Building the Master Midget 2

Practical Wireless
AND PRACTICAL TELEVISION
EDITED BY F.J.CAMM

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The metallised Baseboard that has come to stay. Refuse Substitutes.

Metaplex Baseboards

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BRITISH RADIO GRAMOPHONE CO. LTD.
Pilot House, Church Street, Stoke Newington, London, N.16.
THE FINEST BATTERY SET YET PRODUCED!

5 VALVES

Mains set performance without an Electricity Supply

that do the work of 9

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 phenomenal, 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.

Columbia

"MAGIC NOTES" TRADE-MARK.
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 £21 10s.

B.B.C. Promenade Concerts, 1934

A COORDING 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 forty-fifth 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 Schnydergott 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 Lisbon to Open Shortly

The 20-kilowatt Lisbon (Portugal) transmitter is now testing every other night towards 2000 B.S.T. on 478.9 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

A S it is anticipated that the conversion of the Beromünster (Switzerland) transmitter to a 100-kilowatt may necessitate the closing down of the station during the month of August, the Sottern 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

A NOTHER German station to close down temporarily is that of Langenberg, which is now being converted to a 100-kilowatt. 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?

A S 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. The second type of 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

W ITH a view to a further development of the Czech broadcasting network, plans have been drawn up for the construction of a new 20-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 Bystrians. 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 caktin type of valve, although the glass envelope is retained. As a matter of fact, the caktin 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 of this total one half is occupied by the valve base and valve pins. The initial releases in this series consist of the V.32/K which is a variable-mu H.F. screen tetrode having a 2-volt .15 amp. filament and is designed to operate with 190 volts on the anode and 75 volts on the screen. It 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.E. 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)

IN celebration of Empire Day (May 24th), a broadcast is being built at Muret, near Toulouse, and will be ready to go on the air towards the end of the year.

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, to 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 make 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 will run for two weeks 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 accent 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 Berominster and Sottens.

Berominster, 100 Kilowatts
It is reported from Berne (Switzerland) that the Swiss Telegraph Administration has entrusted the work of increasing the transmission capacity of the Berominster transmitter to the Marconi Company. Possibly during reconstruction the station may close down for approximately a month from the middle of August. When completed, it will reappear on the air as a 100 kilowatt transmitter.

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 accused 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. announce 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.

New Interval Signal
ALTHOUGH of relatively low power, a broadcast transmitter (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 with the Morse letters R.S.R. (- - -), followed by a short excerpt from an old Swiss melody, Charles d'Emmanuel a Rondines, 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).

TELEVISION APPARATUS BEING DESPACHTED 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.

WORLD of WIRELESS

NEW is the call-sign of the latest transmitter to go on the air in the United States; it is situated at Carlyle (New Jersey) with studios in Newark (N.J.) and New York. It operates on 240 metres (1,250 kcs) with a power of 24 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, which 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 wave-length and duties of the Pozzarn station, which, in its turn, would be dismantled and transferred to Pricko. Torun was ceded to Poland by Germany in 1918; it is loosely ninety-two miles from Danzig.

Radio-Lisbon Calling
THE new Lisbon transmitter is on the air; a youth may often 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 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, the Birmingham studio on May 12th, to give Midland Regional listeners some genuine Shropshire dialect plays and episodes drawn from the novels by Mary Webb, "Arming 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.

PRACTICAL WIRELESS

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SOLVE THIS!

PROBLEM No. 86.
Davis built a three-stage L.F. amplifier employing resistance-capacitance coupling for the first part of the system and a push-pull stage for the output. After checking this to the mains he found that it was very unstable, volume having to be kept very low to prevent noise. He increased decoupling components, and spent a lot of time in varying the capacity of the tubes by-pass condensers and tube decoupling resistances, but was unable to prevent the noise. What was wrong? Three books will be awarded for the first three correct solutions offered. 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.
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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 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.I. 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 these 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...
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 6.35 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 licence 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.

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 L1, L2 and L3 should consist of 18, 12 and 8 turns respectively of 16-gauge bare copper wire on paxolin formers, 4 in. in diameter. It is best to mount L1 between the other two, making L2 and L3 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.

THE AMATEUR WANTS 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 circuit, it was decided to maintain both being in circuit continuously whilst the set is working, I made a mechanical device from an old alarm clock, using five 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 of the receiver described in this article.

Wiring for the switch.

TO SET TO HEATERS

the mercury cups and closes the circuit between the eliminator and the set; by this time the spring has come to rest again.

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, to the number which 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 successives 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 thin 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 U is fixed to arm D by sealing-wax to form the bridge across the mercury cups.

The contacts across the frame a piece of thin ebonite is fixed, for holding contacts E, and by drilling two thin holes about 0.5 mm. 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, while providing some interesting work for the mechanically inclined amateur — G. HODGSON (Lancaster).
PRACTICAL MOTORIST is the paper for the modern motorist. It explains in an interesting and easily understood manner how to get the best out of your car; how to run it economically; how to get that extra touch of speed; those extra miles per gallon; how to trace squeaks and rattles—in fact, how to enjoy economical, efficient and trouble-free motoring.

PRACTICAL MOTORIST will keep you guided on the latest news, legislation, and technical information relating to new cars. Its Free Advice Bureau will help you out of your difficulties and its legal section will advise you on all matters relating to technical offences. Travel-tempting illustrations, enjoyable articles on touring, and informative diagrams make Practical Motorist a paper which will be eagerly read by every owner-driver.

On sale at all Newsagents and Bookstalls, or by post 4½d. from George Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.
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 I.C.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.

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 may be 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 11- 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.
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, capacitively, or conductively, so that one has to rely on the electron stream in the valve 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 the electron stream in the valve, on the same principle as that of the pentagrid converter, recently introduced for superheterodynes. The tuning of the circuit can better be explained with the aid of Fig. 1, which shows a practical arrangement using a mains screen 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 C6. 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 C6. The result of this is that the oscillator is less likely to be at hand. Most component values are the same in both circuits, but depend to some extent on the wavelength.

By-pass capacitors C2 and C3 should be used on ordinary broadcast waves, the band to be covered, if the last ounce of accuracy is desired.

The wavemeter should be built in a screen box of aluminium at least half an inch thick, although metalized wire would probably do. Only a very reliable, rigid variable condenser should be used for C6, with a 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 best 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. 1—Theoretical and pictorial diagrams of an electron-coupled oscillator.

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

ALTERNATIVE COIL CONNECTIONS (SEE FIGS)
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 second part of the tuning coil is wound in the usual way but the plate part \( L_3 \) has interwound with it a second coil \( L_2 \), which forms one filament lead, the other connection being made through \( L_4 \). Otherwise, the circuit values are the same as in the previous figure. A coil for the 45 to 100-metre band requires twelve turns for \( L_4 \) and three turns each for \( L_2 \) and \( L_3 \), wound with twenty-two enamelled or d.c.e. wire on a 2 in. former. With from 30 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 20 m/A. total H.T. current, depending on the valve used. Even mains valves only take a total current of under a milliamper with the meter in the H.T. circuit.

The baffle itself, the cone, the lower part of the tuning coil, and a small gap between the two being mounted, they must next each be affixed to their respective cones. Screw the apex of the larger cone just so far down the reel of the unit that the cone is neither quite 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

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 reel of the unit that the cone is neither quite 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.

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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 loudspeaker 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 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 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.

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. posi-

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

fig. 11.-A permanent-magnet moving-coil speaker.

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.

All-mains Receivers

Up to about 1934 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. Th-
general form of construction of the indirectly-heated valve was shown in Fig. 6, from which it will be seen that the filament (or more correctly, heater) is used only to heat 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 receivers. I scarcely need add that from that time the moving coil has come to be recognized as the par excellence in the loud-speecher 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 permanently-magnetized type which is so popular at the present time was evolved.

Band-pass Tuning
By about 1920 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 wave-length, 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.

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.

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 S.G." types of receiver have been struggling for pride of place, and 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 supplied 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. valves is that it can be used as a perfectly distortionless pre-detector volume control by varying its grid-bias voltage. Due to the latter fact it is possible to control to the exact point of 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.
May 12th, 1934

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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 the scrap box, and consist of one four-point switch, two grid-leaf 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-leaf 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 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.—F. Morcox (Penarth).

A Novel Safety Switch Lock

A simple sensitive relay.

A Sensitive Relay

A Sensitive Relay 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 that 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).

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, or 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).

Automatic Switching Stand for a Soldering Iron

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 1½in. 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 1½in. diameter holes cut in them are then glued to the top of the former, and 200 turns of 24-gauge copper wire are wound on the bobbin thus formed. The two strips of iron 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 journaled in these holes. A lin. length of 1in. wrought iron rod is soldered to the lower end of the pointer, and another 1in. length is glued or fastened along the outside 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.

A Handy Home-Made Ammeter.
REARDEN'S WRINKLES

(Continued from previous page)

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 3 in. 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 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 required is obtained. The A.C. voltage to be measured is substituted for the cells, and the resistance 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. CRAMS (Liverpool).

A Handy Screwdriver

THE screwdriver illustrated is handy for thoseheaded screws in awkward positions. The piece of tube used is slightly larger than the head of the screw. A pin is rivetted 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. GAYLING (Cambridge).

Simple Polarity Indicator

A GOOD way to find the polarity of wires is to clip the end of a piece of blotting paper in ordinary blue ink, apply the ends of the wires to the paper and the negative 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 it 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 useful place to keep the wav-length chart. —ARTHUR TAYLOR (Knutsford).

A useful aerial hint.

Two clips of springy brass hold the iron in the desired position by engaging with pins fixed in the handle, one clip being rivetted 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 it 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 useful place to keep the wavelength chart. —ARTHUR TAYLOR (Knutsford).
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FOR A YEAR
10/- A WEEK
FOR A YEAR
£10 CASH
or one of 25 other Prizes

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FREE! CASH PRIZE
COMPETITION

THE MOST INTERESTING COMPETITION
YOU'VE EVER SEEN!!

As a radio man, could you do with some free, unmortgaged extra cash? Here is a rare chance of tuning in to a welcome windfall by simply being a radio man—by being sufficiently interested in radio to win an easy prize.

Not only easily but very enjoyably, too, you can win £1 a week for a year, 10/- a week for a year, £10 cash, or one of twenty-five other useful prizes. You have only to be interested in the performance of your set. Not technically; just spend a pleasant evening or two as a true radio man, and win a prize in this easy, free competition.

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As long as you know the rudiments of radio, you can win a prize—without any difficulty or cost, without being technical, intellectual, clever or lucky. Ask at your nearest radio dealer's for particulars and free Entry Forms for the novel AvoMinor competition.

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Address

P.W.1
THE MASTER MIDGET

Full Constructional

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

When wiring is completed as far as, and including, the panel and baseboard, move to another position, so as not to damage wires when the panel is handled.

The wires to the speaker diaphragm are tied with rubber tapes which will serve the purpose quite well. The holes for the panel bracket bolts are most easily made by using the brackets themselves as templates. Place the panel and bracket temporarily in position, with the brackets in place, and mark through the holes with a pencil.

Having completed the panel glue a sheet of thin balsa, approximately 4 in. by 4 in. on the back to cover the four control spindle holes. A keyhole saw will answer the purpose quite well.

This is one of the reasons why the few readers who demand a receiver that is small and inconspicuous in everything but performance may be satisfied.

MIDGET MOVING-COIL SPEAKER

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

If components or parts are not provided.

It is small (little larger than two standard 100-volt H.T. batteries), of refined appearance, entirely self-contained, and gives excellent speaker volume, far greater than two standard 100-volt H.T. batteries, in the accommodation of batteries of adequate capacity. It is small (little larger than two standard 100-volt H.T. batteries), of refined appearance, entirely self-contained, and gives excellent speaker volume, far greater than two standard 100-volt H.T. batteries, in the accommodation of batteries of adequate capacity.

The only soldered connections necessary are the two connections to the speaker and to the little 0.001 mfd. grid condenser.

For the initial test the knob on the pre-set condenser inside the receiver should be screwed down to the maximum sensitivity but least selectivity. If increased selectivity is found necessary—one, if several are installed to overlay—the receiver should be mastered slightly with the

LIST OF PARTS FOR THE "MASTER MIDGET"

One Wheatstone pre-set condenser, 0.000 mfd.
One metal F.E. transformer, 3:5:1.
One companion 10-pole condenser holder, baseboard, 10 in. by 5 in.
One metal 10-pole condenser holder, 10 in. by 5 in.
Two Hellesen fixed condensers, type "000," 0.0005 mfd.
One Bulgin on-off switch, type S 85.
One Bulgin 5-pin valve-holder.
One Exide accumulator, type PY 4.
One Metaplex baseboard, 101 in. by 51 in.
One Hellesen variable condenser, 3:5:1.
One Metaplex variable condenser, 3:5:1.
One 0.001 mfd. coupling condenser.
One O.S.O.R. pentode type, and 220 PT.
One O.S.O.R. pentode type, and 220 PT.
One Hellesen variable condenser, 3:5:1.
One A.C.E. pentode type.
One Midget L.F. transformer.
One Midget L.F. transformer.
One O.S.O.R. pentode type.
One Hellesen fixed condenser, type 0.001 mfd.
One Hellesen moving-coil speaker.
One Hellesen condenser, type 0.0005 mfd.
One O.S.O.R. pentode type.
One Hellesen variable condenser, 3:5:1.
One Hellesen pentode type.
One Hellesen pentode type.
One O.S.O.R. pentode type.
One Hellesen condenser, type 0.0005 mfd.
One O.S.O.R. pentode type.
One Hellesen variable condenser, 3:5:1.
One Hellesen pentode type.
One Hellesen pentode type.
THE MASTER MIDGET

Full Constructional

Easy to Build

It is best to start construction by making a tentative layout on paper, cutting out and drilling the panel according to the measurements given in the diagram. If components other than those specified are employed, it is necessary to modify the dimensions given. The most practical method of cutting the holes is to use a cold chisel, or 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 bracket 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-connection, and it acts as a shield, thus preventing any chance of contact between the tuning coil. It is purposed that 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 glassine or similar insulated connecting wire, with the exception of the battery leads for which ordinary wire is used.

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

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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 12 ft. 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 25 ft. 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 50 ft. long and 20 ft. 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 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


Long Waves


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 Husband. The Band and the Male Voice Choir, which is to sing, consist almost entirely of Warwickshire men. For a hundred and sixty-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 Dangerefield, in the 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 Callenford 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. Mount 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 the Narrator.
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.

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

Most modern receivers incorporate at least one "band-pass" circuit. This is a device in which two tuned circuits 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 L1, L3, and partly capacitative through the small condenser C1. The resistance R1, usually of 1,000 ohms, is necessary for completing the grid circuit of the variable-mu H.F. valve.

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

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

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. 5.—Circuit diagram of the Fury Four Super.
Turning to the output stage of this set, for which a pentode valve V₄ is indicated, it will be observed that the auxiliary grid of this valve is decoupled by a 5,000 ohms resistance R₈ by-passed to earth by a 1 mfd condenser C₈. 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 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, R₄ and R₅, the former being of fixed value and calculated to provide the minimum bias required by the valve when operated at maximum sensitivity, while R₅ 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 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.
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 scanner, etc.) overshooting the marks of the original image and the forcing motion exerted by the synchronizing mechanism for the purpose of correcting the tendency of 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 element 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 support holding 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.

Television in France

There have been many television transmitters in operation in France. 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 vertical framing; this acts as an adjustable mask allowing the field of scan 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 of which is "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, one to be more or less 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 base. The top may be one and a half inches larger than 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, suspend the motor at the back on a shelf as shown. This shelf will serve to accommodate the fitter lamp-holder holding the neon lamp (beehive 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 in vacuo zone may be observed through the holes of the scanning disc when it is made to rotate.

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

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 first 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 enclose the disc, however, and so protect it from damage, as well as removing the possibility of dust clogging the screening 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 1/2 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 intensity and definition. A certain amount of confusion seems to exist amongst readers, however, as to the way in which the electron beam scans the fluorescent screen at the front of the tube. This is modulated in order to produce the resultant image. Electrical time base pulses circulate the correct movements to trace out the field of horizontal or vertical scanning lines, but the momentary intensity and these are known respectively as horizontal or vertical scanning lines, but the momentary intensity to which the ray is deflected depends on its velocity. This consists essentially of two synchronizing potentials, the momentary intensity of the spot remains constant but varies continuously, and the light and dark sections of the image built up. With 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 impenetrable of the ray and depth depends on its velocity. This was overcome in one series of experiments by superimposing the picture signal on the scanning potential and 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 Gear

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 possible faults and they can be remedied very readily.

The first criterion is to see that an adequate steady polarizing currents is fed through the two synchronizing coils in series. The current should have a value of about 25 milliamperes, and if a meter is connected to the condenser and test this current being correct (the synchronizing signal 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 extinctions 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 become partially or entirely 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 neat new one if it is found to be even slightly defective.

Continuing the possible cause 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. 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 and the concavity of each tooth facet. If not, correct this with a very fine jeweller's file. Incidentally, the same file will remove any burrs that may have been produced by 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 the smoothness of the framework holding the coils to the bearing surface and clean up the sliding surfaces. Replace, tighten up the toothed wheel, 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 modern television, 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's 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 hand being the fluorescent screen.

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 surface 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
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 our readers' interest. We have not previously described the advantages of the Ultra-S.W. waveband. We have been focused upon the use of ultra short wavelengths for a very long time to say 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 50,000 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 aggregating 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 wavelengths gained rather differently to a set made for broadcast reception, but to say that the mode of operation in different stations 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 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.

**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 it is 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 “cycles.”

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.

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- Class “B” Output, 6/400, 50/90, 25/55, 15/25, 5/8, £6.60.
- Class “B” Output, 6/400, 50/90, 25/55, 15/25, 5/8, £6.60.

**PETO-SCOTT 1094 WALNUT ADAPTADOR** converts your 12'2" to a magnificent Radiogram. Recent tested walnut, with beautiful design, ready to take your set, speaker and power equipment. **OUR PRICE,** £17/12/0. Cash or C.O.D., £17/12/0.

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Points to Bear in Mind When Purchasing Radio Components

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 labels, but quite often the case is that of 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! Probably coiled-hoilily for swinging-coil reaction, transformers, coils of all kinds, and sometimes in the background, a regiment of soldiers, but often more than not they 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 shop 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 "hazard" which you incurred? 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. The components must have been bought in the same box? Why do we all persist in deluding ourselves that we can either get something for practically nothing or a 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 simple offer to sell or 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 and ask the price of the 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 legitimate phraseology. The dealer is offering for sale, in consideration of the sum of ten shillings, to anyone who cares to accept it. (To accept means to pay (say, 10s. a hour) a certain radio component. You accept his offer by asking for the component and placing your money on the counter. 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, then any offer made, whether 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 fore one of a definite offer (no ifs or buts), and it must be accepted as it stands. Of course, if the shopkeeper can prove that the offer 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 seller 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 any component except on permission in question, there is implied a condition that they are reasonably fit for the intended purpose.

To take an example: You wish to buy a line filter transformer of some type, the manufacturer's name and type number ? No. It refuses to function.

It is simply useless asking your dealer to give you a transformer, say, a pair of band-pass coils and you ask the dealer for them. It appears that he would have at liberty to say, "I have no band-pass coils of any make and also either inductive capacity or any other type of coupling, and you would have very little chance if they agreed to sell it. Also, ask for the article by name, and be sure of getting satisfaction.

Taking 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 broadcasts. He had heard a receiver of this type, but could give no further details. Actually, what the customer required was a sensitive superheterodyne receiver. The dealer sells him, say, a two-valve receiver and, in his ignorance, they are entitled to deliver it. 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 on permission in question.

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

Components 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 buyers 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 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 reverts to the original owner or any intermediate dealing in them. You may be an innocent purchaser of goods which may not have been stolen, through legitimate channels, and if the rightful owner proves that they have been stolen you lose the goods and property in them. So remember the injunction — caveat emptor.

No one would think of calling on a motor agent and asking for a car, saying, ‘I'll pay you £500 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 legal embarrassments. The simple truth is that the usual buyer will always put matters right for you. Take your copy of the Practical Wireless before purchase, as very often disputes are obviated by a little thought. It is easy for you. Take your copy of the Practical Wireless before purchase, as very often disputes are obviated by a little thought.

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 deceived by invectives, and they are well acquainted with the psychology of this type of person. A brief, tactful letter is more likely to bear prompt attention than one containing a lot of irrelevant matter.

Now to sum up:

1. On the article you wish to purchase, ascertain its price, code number, and name of manufacturer.
2. If you find the price too high, you then have a remedy, and the manufacturer will always put matters right for you.
Do You Know What
This Graph Means?

The man who can analyse these curves and understand what they indicate knows his job. But if they do not convey to him perfectly definite information, it would appear that he needs more training than he has had. He is not competent to fill a responsible position in wireless.

Radio has developed so rapidly throughout the last ten years that it has now greatly outgrown the supply of technically qualified men required for the better posts. Moreover, it continues to develop with such speed that only by knowing the basic principles can pace be kept with it.

The I.C.S. Radio Courses cover every phase of radio work. Our Instruction includes American broadcasting as well as British wireless practice. It is a modern education, covering every department of the industry.

OUR COURSES

Included in the I.C.S. range are Courses dealing with the Installing of Radio sets and, in particular, with their Servicing, which to-day intimately concerns every wireless dealer and his employees. The Operating Course is vital to mastery of operating and transmitting.

There is also a Course for the Wireless Salesman. This, in addition to intensifying the art of salesman’ship, provides that knowledge which enables the salesman to hold his own with the most technical of his customers.

We will be pleased to send you details of any or all of these subjects. Just fill in, and post the coupon, or write in any other way, stating which branch of Wireless interests you — the information you require will be forwarded at once.

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Name..................................................Address...........................................

PRACTICAL WIRELESS

May 12th, 1934

PRACTICAL TELEVISION

(Continued from page 210, Television Supplement.)

adjusted for the particular value of accelerating potential existing on the anode, and 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-millionths 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 certain 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, and thus is made substantially parallel instead of becoming divergent. The number of ionizations per second, and hence the ion 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 fascination 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 magnitude of the potential of this electrode in the assembly of the tube is indicated in Fig. 2.

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.

INCREASED VOLUME REDUCED H.T. CONSUMPTION

The Varley Power Puncher is easily inserted with only three connections into any existing battery-operated circuit. No alterations needed, no new transformers or valves. Incorporate one of these economiser units into your set — you will be amazed at the saving of your H.T. current. Write to-day for our free catalogue.

Varley

Proprietors: Oliver Pell
Corporation, Ltd.

Advertisements of Oliver Pell
Corporation, Ltd., Kingsway House,
Telephone: Hol. 8080.
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. Batchelor and Son, of 119, Buxhill Row, London, W.C.I, 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 specially made F.P. choke. The valve holder is of the 2-pin type, and is wired in such a manner that it may be employed for a battery operated or a rectifier-heated A.C. grid. The grid leak is internally wound so that when the battery type 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 base is fitted with the various terminals, which forms an exciting coil, when certain alterations are made to the switch circuit. The switch is changed to conserve its use from long-wave to short-wave reception. The cell of ingenious design, incorporating two separate windings on the one former.

The Eeles short-wave converter chassis.

The Eeles short-wave coil and base.

Obtain a copy of the Eeles catalogue in which full descriptions and connections are given. The Duplex chassis, complete with coil, costs £1 1s. 0d., and the coil with base as shown in the upper illustration costs 12s. 6d.

NEW TUNGSRAM UNIVERSAL VALVES

The popular range of Tungsram Universal valves and has now been augmented by two new types, one a single diode (D418) and one double diode (D419B). 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 2½in., and a bulb diameter of only 1½ in.; 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

This one of the combined detector oscillator, or type of valve, is becoming increasingly popular, and the following characteristics of the Osram M.X. 40 heptode class will, no doubt, be of great interest to readers who are desirous of experimenting with this type of circuit. The valve is of the standard 5-pin base and has, in addition, a connecting lead brought out to the top of the glass bulb. This latter connection is the control grid. The seven pins are joined to the oscillator grid, the anode, the oscillator cathode and the heater.

The Osram hexode valve.

The latter is of the 4-volt type, and the normal voltage for the anode is 200. Outer and inner screens are designed to screen all valve heating current, with 100 volts (maximum) whilst the heater voltage anode should receive a potential of 100 volts maximum. It is immaterial the oscillator section is comparatively low, so that the reaction coil will be provided with a fairly high value of reactance. The valve makers recommend the heptode to the amateur to be employed in the oscillating or detector section of the receiver. The heptode can be connected as a three-stage detector or a super-regenerative detector. 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 WIRELESS CONSTRUCTOR’S ENCYCLOPAEDIA

(2nd Edition)

By F. J. CAMM

(Editor of "Practical Wireless")

This invaluable encyclopedia is written in plain language by one of the most accomplished designers and writers on wireless construction.

Obtainable at all Booksellers, or by post 5½d from Geo, Newnes, Ltd., 8–11, Southampton Street, Strand, London, W.C.2.
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 3in. long, and a slabber 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 down the scale, probably one of the London stations, North Regional, and National, one foreign station of about 300 metres, at Athens and Stuttgart, all at good strength and beautifully clear, and one or two others that were too low for me to pick up. 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 joined another half-hour with this crystal set, and found five stations that were very good, two German, that closed down at 11.30, one English station 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 good make with a three-gang condenser and other midget components, a set of extremely small dimensions can be designed.—J. WESTGOTT (Dunkfield).

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.C.V. and, perhaps, tone control, etc., at a price that compares with other commercial sets.

When we look at the range of well-known commercial sets and see the splendid value offered in A.C. superhets, it is obvious that a leader of this type must be welcomed by many. I hope that Practical Wireless will design a superhet that will compete with any on the market, both for price and quality.—J. L. CHALIS (Hendon).

Low-tension Supply

Sir,—PRACTICAL WIRELESS in the April 14th issue, by A. E. Gaskley, is extremely interesting and useful to many of us who are led 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 lamp 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 the cost of 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, and at the present time in the U.S.A., are welcomed a good receiver of 4 to 5 valves, not including rectifiers.—C. L. JOHNSTONE (Longhyr, India).

"Made like a Gun"

Sir,—I beg to acknowledge with many thanks, the receipt of the pocket tool. I suppose I am only repeating the statements that thousands of people have already sent: it 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 deically ingenious. With the "Encyclopedia of Practical Mechanics," the "Home Constructors' Encyclopedia," I think many 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.

A Correction

Sir,—The Editor kindly notes the receipt of the tool-kit. Please don't forget that listeners in India, and at the present time in the U.S.A., are welcomed a good receiver of 4 to 5 valves, not including rectifiers.—C. L. JOHNSTONE (Longhyr, India).

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Wavelengths 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. SCHRUM (Claremont, nr. Cape Town, S. Africa).

A Bournemouth Reader's Thanks

Sir,—With reference to the letter of Mr. Barnes (Faversham), re the schedule of W3XAL. Whilst this is a very useful schedule, I wish to point out that the schedule given by me was in operation at the time of writing, the time of schedule being 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 have not been forwarded for publication. In point of accuracy it is required no correction during the period mentioned. The microphones announcement of new schedule heard by your correspondent automatically cancels the original schedule.—A. W. MANN (Middlesbrough).

Schedule of W3XAL

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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 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. STU (Morpeth).
30,000 Recordings a Year

A conservative estimate of 30,000 new records 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 by Elgar's Caractacus, H.M.V. DB 2145. Caractacus was one of Elgar's earlier works, and it is said to be expressed in a way that wishes 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. At 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. 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.

Light Orchestral Discs

Among the new light-orchestral discs are Madeleine Caplet's version of the operatic March from "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 nationalistic feeling has shown itself in the master of his Largo. John Barbirolli, the English conductor, who has been making such a name for himself in Britain recently, has directed the 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 "nifty" dance tune of the moment, and Ray Noble's orchestra have made a really good recording of it, coupled with The oars round the canoe 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 give their records a quality, which makes each instrument stand out from the others.

Popular Melodies by Star Artists

In addition to the records of Madeleine Caplet, 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. The latter, while both on H.M.V. DB 2117. Casals plays not quite such well-known compositions; Valentini's Gavotte, De Laserna's Tomatillo, 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 1390 he sings the old film hit, Smokey Through, from the film of the same name, and one of the popular dance tunes of the day, in a manner that is universally appreciated. My vote 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 Jack Oldham's contribution with two famous ballads, Fleurette and Mairi, my girl, on H.M.V. B 9121. 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 are Madeleine Caplet's version of the operatic March from "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 nationalistic feeling has shown itself in the master of his Largo. John Barbirolli, the English conductor, who has been making such a name for himself in Britain recently, has directed the 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 "nifty" dance tune of the moment, and Ray Noble's orchestra have made a really good recording of it, coupled with The oars round the canoe 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 give their records a quality, which makes each instrument stand out from the others.

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The hum may be caused owing to lack of de-coupling of the receiver. In this case of course, it will be necessary to insert de-coupling arrangements in the audio circuits of the various valves to stabilize the set. On the other hand, the hum may be due to the fact that you are overloading the eliminator, and it will, therefore, be necessary to fit a larger-capacity valve. Without precise details and figures, I cannot suggest anything more definite.

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