

# THE ABC OF TRANSFORMERS — See page 53

# Practical and Amateur Wireless

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EVERY  
WEDNESDAY

Edited by F.J. CAMM

a GEORGE  
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Publication

Vol. 13. No. 315.  
October 1st, 1938.

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# ADD-ON TUNING UNITS—See Page 62.



# Practical and Amateur Wireless

Edited by F. J. CAMM

Technical Staff:  
W. J. Delaney, H. J. Barton Chapple, Wh.Sch.,  
B.Sc., A.M.I.E.E., Frank Preston.

VOL. XIII. No. 315. October 1st, 1938.

## ROUND *the* WORLD of WIRELESS

### Push-button Tuning

MANY constructors still feel uncertain regarding the efficiency of push-button tuning systems, and think that the condensers will require continual adjustment. We recently heard of a case of a shopkeeper who stocked a certain make of receiver in which push-button tuning was incorporated, and every day before he opened his shop he had to readjust the condensers so that the set could stand on the counter to be operated by his customers. Condensers now in use are, however, much more reliable than some which were used in the early sets or which may be included in some imported receivers, and provided that economy is not attempted by obtaining cheap condensers the arrangement may be relied upon. It should be remembered that modern superhets utilise trimmers of a similar type in the I.F. transformers, and one does not have to do much adjusting to these from day to day to keep the set in condition. It is quite true that they may gradually shift due to vibration or climatic changes, but they are sufficiently reliable to warrant the use of unsealed cans, and therefore the push-button tuner can be built with confidence. In response to many requests we give in this issue some brief details of the various forms in which push-button tuning may be added to existing receivers.

### German Licence Figures

THE latest returns of licences issued in Germany shows that the total now runs to 9,514,000, of which 638,000 were issued free. Great Britain is second in the list of totals with 8,650,000, of which 50,000 are free (issued to the blind). Next on the list is France with a total of 4,590,000.

### More Novel Uses

TO add to the number of novel uses to which radio has been put is that of whale location. During night operations some difficulty is sometimes experienced, after a whale has been harpooned, in getting the whale aboard. The first wireless officer of the Norwegian whaler *Kosmos* has built a miniature short-wave transmitter mounted in the harpoon shaft and this transmits a signal which can be located on the whaler and thus the movements of the whale may be followed with

suitable D.F. apparatus and the whale easily landed.

### World's Greatest Showman

BARNUM, an American born in Connecticut, in 1810, was regarded as the world's greatest showman, and a programme in commemoration of his exploits is to be broadcast by the B.B.C. in the Regional programme on October 2nd. The programme has been prepared by Herbert Kendrick and Harold Scott, and will be produced by Laurence Gilliam.

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### Gliding Broadcast

THERE are four principal gliding centres in this country, and from one of these—the Long Mynd in Shropshire—a broadcast will be given in the Midland programme on October 8th. Gliding began in this country in 1930, and there is a Government subsidy continuing until 1940. There are 350 English gliding pilots and gliding is emerging to take an independent place in aeronautics.

### Sir Adrian Boulton

ON October 4th Sir Adrian Boulton will travel North to conduct the B.B.C. Northern Orchestra in the Manchester Studio. This programme will be broadcast in the Northern programme and will include

Schubert's Symphony No. 5 in B flat and the Handel Concerto in B minor for viola and orchestra, with Frank Park as soloist.

### Palace of Radio

A PALACE of Radio is to be built in Milan, and the Italian broadcasting organisation, E.I.A.R., has secured a site of 4,500 square metres at Milan upon which this palace will shortly be erected.

### Beam Radio In Hebrides

THE first of the test transmissions on the new radio telephone installation for the Hebrides should be carried out at the beginning of the month. A station 1,000ft. up on the mountains near Castlebay, Barra, is to work with another station at Tobermory, Mull, whilst the chain will be completed by a station near Oban. The radio installation is intended to replace cables which are often out of action due to the effects of the storms which are experienced in the vicinity.

### Travelling Repairs

AN interesting news item comes from Yugoslavia, where it is stated that a travelling radio repair shop has been touring various towns, and during one recent tour 50 towns were visited and over 300 sets attended to.

### Records from the Stage

MODERN recording systems demand high quality background effects, and recently the Columbia Company have been making popular records of bands on various stages. Debroy Somers was recorded at the Gaiety Theatre, Henry Hall in a Bradford Theatre, and Carrol Gibbons and his Savoy Orpheans in a Nottingham theatre.

### Mains Change-over

THE Elland (Yorks) Council have considered the difficulties met with by listeners when mains supplies are changed from D.C. to A.C., and in lieu of making replacements or fitting rectifiers have decided to offer consumers £4 9s. per set with which they can make the necessary modifications.

### Radio in the Modern Home

AT the Building Exhibition, which closes on Saturday, a flat furnished on the unit system may be seen. This includes a sound-proof air-conditioned radio study, designed to enable the listener to indulge in late or early listening without disturbing his neighbours.

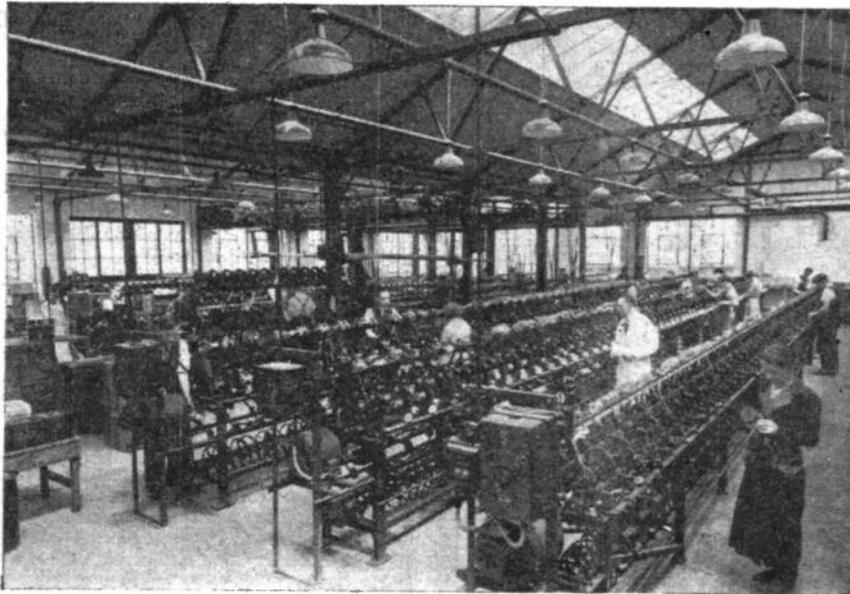
# ROUND the WORLD of WIRELESS (Continued)

## Information in Foreign Languages

**A**N innovation recently introduced in the Budapest telephone system enables foreign visitors to obtain information in English, French, German, Italian, or Esperanto. All they have to do is dial a certain specified number for each language.

## Pitcairn Island

**T**HE new petrol generator provided by American subscribers for Pitcairn Island is evidently in operation, as reception in this country of VR6AY on 20 metres was recently reported.



Rows of covering machines in one of the bays of the Scott Insulated Wire Company's new works at Queensbury, London, N.W.

## T.I.G.B. Coming of Age

**T**HE Technological Institute of Great Britain, to celebrate the twenty-first anniversary of its foundation, has just issued an interesting "Coming-of-Age" souvenir booklet, free copies of which can be obtained by readers on application to the Institute at Temple Bar House, London, E.C.4.

## Programme Music

**T**HE first of a new series entitled "Programme Music," arranged and presented by R. Sterndale Bennett, will be heard on October 8th. Michael Mullinar will be the pianist. Mr. Sterndale Bennett, who last broadcast in "The Musician at the Gramophone" series, has been Director of Music at Uppingham School since 1908, and formerly held a similar position at Fettes College, Edinburgh.

## "Fly by Night"

**T**HE inauguration of the first scheduled night-flying passenger service in the British Isles, from Weston-super-Mare to Cardiff, will be described in "Fly by Night," in the Western Programme on October 2nd, by Pat Beech, at Weston Airport, Vaughan Thomas at Cardiff Airport, and Lealie Bridgmont from the air.

## Agricultural Department Created at Station WLW

**T**HE creation of an agricultural department of WLW and appointment of John F. Merrifield as director has been announced by James D. Shouse, vice-

## INTERESTING and TOPICAL NEWS and NOTES

president of the Crosley Radio Corporation in charge of broadcasting.

Effective on October 1st, the most comprehensive farm service yet attempted by the Nation's station will be offered during every 15-minute unit of the "Top o' the Morning" programme, 6 to 8.15 a.m., E.S.T., daily except Sunday.

## City of Birmingham Orchestra

**T**HE first of the City of Birmingham Orchestra's concerts for the season will be given on October 6th from Birmingham Town Hall, when the first part will be broadcast. This will include Smetana's "Ultava," conducted by Leslie Heward, and "Introduction and Allegro" by Arthur Bliss, conducted by the composer.

## Facilities for Esperanto-speaking Travellers in France

**F**RANCE is now taking up the idea, customary throughout Holland, for the more important railway stations to have a plate in the entrance hall showing the name and address of the local "consul" whose duty it is to help Esperanto-speaking travellers. In France the first two stations to adopt the scheme are in Dunkerque.

## Exhibition Dates

**M**ANCHESTER: *Evening Chronicle* Northern National Radio Exhibition, September 27th to October 8th, City Hall. Scottish Empire Exhibition. Open until October 29th, Bellahouston Park, Glasgow.

## Canada's New Transmitter

**W**ORK has commenced on the third of Canada's 50-kW transmitters, CBA, at Sackville, New Brunswick. This station, which is to cover the three Atlantic coast provinces of New Brunswick, Nova Scotia, and Prince Edward Island, will operate on 1,050 kc/s (285.7 metres).

## Sir Henry J. Wood's Jubilee Concert

**W**E are informed by the B.B.C. that Sir Henry J. Wood, has decided to devote the entire proceeds of his Jubilee concert in the Albert Hall on October 5, to endowing beds for orchestral musicians in London Hospitals.

## SOLVE THIS!

### PROBLEM No. 315

Atkinson's four-valve set was not giving signals sufficiently loud for his full enjoyment. He used an H.F. pentode, S.G. detector, triode first L.F. stage feeding a pentode output stage, with 190 volts H.T. As the set was fairly well-made he decided that the best way of obtaining improved volume was to use transformer coupling between the last two stages instead of B.C. coupling and he accordingly obtained a 5 to 1 L.F. transformer. When he fitted this, however, results were much inferior to those originally obtained and were accompanied by serious distortion. Why was this? Three books will be awarded for the first three correct solutions opened. Address your envelope to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 315 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, October 3rd, 1938.

### Solution to Problem No. 314

As the filaments of the valves remained alight after one had been removed this would indicate that the heater terminals of the valveholder were short-circuited—the valves in an A.C./D.C. set being wired in series. The shorting of the heater of that valve was the cause of his failure to get results. The following three readers successfully solved Problem No. 313 and books have accordingly been forwarded to them: J. H. Marr, 142, South Mid Street, Bathgate, West Lothian; P. Milton, 12, Rampton Road, Sharrow, Sheffield, 7; H. C. Adams, 10, Cannon Road, London, N.7.

Merrifield, whose experience covers many years in the agricultural field, already is on the job, rounding up farm organisations and consulting with extension services throughout the mid-west. The WLW farm service will embrace every phase of the farming industry, with 4-H Club lesson assignments, news of the future farmers of America, and kindred organisations, plus weather, market and farm reports.

## A Paderewski Broadcast

**S**O far the famous Polish pianist has never faced the microphone, but listeners to Sottens (Switzerland) on 443.1 m. (677 kc/s) on September 29th, at B.S.T. 20.00 (8.0 p.m.) will be given an opportunity of hearing one of his pianoforte recitals relayed from Lansanne. It has been organised by the N.B.C., which is broadcasting this programme throughout its entire U.S.A. network.

## Portugal on 100 Kilowatts

**I**T is reported that the Portuguese authorities have decided to increase the power of the Lisbon-Barcarena station to 100 kilowatts.

## Radio for the Eskimos

**A** WIRELESS station has been installed in the Polar circle at the mouth of the Mackenzie river in latitude 69 degrees North, with a view to giving the native population, mainly consisting of Eskimos, a daily radio programme of news bulletins, talks on hygiene, and a concert of gramophone records.



# My New Set

By F. J. Camm

the necessary adjustments, and accordingly the set is not regarded with favour.

## Auto-tuning

On the other hand, a receiver fitted with push-buttons or other devices for tuning may still incorporate all the knobs and controls that delight the heart of the experimenter, but at the same time, by setting one or two of them at a given point, all tuning may be carried out by any inexperienced person—merely by pushing a button. Even the volume control may be dispensed with if A.V.C. is fitted, as most stations will then be received at a level which may be pre-arranged by suitable controls. Wave-change switching may be carried out automatically, and with clear station names above each button the receiver becomes quite automatic. I have therefore followed the modern design and fitted this system to the new receiver, and it should be emphasised that although an automatic tuner of the mechanical type may in some cases be criticised owing to inter-station noise as it passes from one station to another, this does not apply to all receivers, and provided that the mechanism is so chosen that the condenser is moved rapidly the noises as stations are passed are so brief that they cause no inconvenience. Manual control is, however, also arranged for, so that readers can tune to stations other than those indicated on the buttons.

A mechanical system also removes the difficulties of adjusting a series of trimming or tuning condensers, and the initial setting-up of a receiver so fitted is not more difficult than an ordinary manual receiver, and the button mechanism may be adjusted without the aid of any tools. It may be emphasised that the construction of the receiver is no more difficult than that of any of the receivers which have been described in this journal. A fully detailed list of components will be given, and the free blueprint will enable the constructional work to be carried out immediately you have been able to obtain the parts. An important feature of the receiver, which I am sure will appeal to the vast majority of readers, is that it will include the short waves, and I am arranging for a large station-name dial to be supplied by Messrs. Peto-Scott, so that tuning will be reduced to the simplest possible process.

In our issue dated October 15th we shall present a blueprint of my latest receiver. Each year since the publication of this journal I have signalled our birthday in this way, but this year I have purposely delayed an announcement concerning it as I wished first to analyse the readers' views which annually I gather at Radiolympia.

For many years past I have made the subject of our Birthday Blueprint a battery receiver, and I wanted this year to ascertain what percentage of my readers would be interested in a mains set. I have carefully analysed the queries I have received during the past year, and I find that approximately 50 per cent. of my readers are interested in battery sets, and the remainder in mains sets; thus, whatever section of readers I cater for in the matter of a design leaves 50 per cent. of them interested only to the extent of reading about this new set.

I therefore decided to take the opinion of as many readers as possible at Radiolympia. I was able to converse with two or three hundred of them during the show, and although these represent but a very small fraction of our total sales the law of average must apply. I was somewhat astonished at the result, for whilst most of the readers had mains facilities, nearly 60% of them urged me to produce a blueprint for a battery set. Although most of them have been on the mains for many years, they still prefer battery receivers. They are mostly using the mains set for experimental use, but for family use require a battery receiver.

Many of the readers were kind enough to make suggestions regarding the circuit features of the new receiver. For obvious reasons I cannot adopt all of them, but I believe that in the new set, which will be revealed in detail in our issue dated October 15th, but concerning which circuit details will be given next week, together with a list of components, I have produced the set which the majority of my readers will welcome. I can say at once that it will incorporate an ingenious new mechanical system of push-button tuning. This form of tuning, although criticised by some, is of great value to the normal members of the household. The experimenter prefers to have a set with as many controls as possible, and finds that his greatest interest is in obtaining that happy balance of various controls which enables a station to be received clearly and at maximum volume free from interference. The more controls, therefore, the merrier he feels, but whilst this is very good from his point of view, the housewife or other members of the household who wish to listen at various times are unable to make

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Sixty Tested Wireless Circuits, 2/6 (post 2/10)

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# CURING PRE-DETECTOR INSTABILITY

Brief Notes on Some of the Causes of H.F. and I.F. Instability  
and on Methods of Testing For, and Rectifying the Faults

**I**NSTABILITY in the H.F., frequency-changer or I.F. stages can be due to bad design, but for the purposes of these notes it will be assumed that the receiver is not a newly-made one, and that it has previously operated satisfactorily. The first difficulty is in recognising the instability and in isolating it, so that tests can be made with a view to its cure. Sometimes, of course, instability is clearly evident due to the fact that reception is accompanied by a high-pitched whistle or screech; alternatively, a much lower-pitched noise might be heard at certain wavelength settings or when receiving particular transmissions. This particular indication, by the way, is often mistaken for low-frequency instability with the result that initial tests might be misleading.

## Lack of Sensitivity

But there are other indications of lack of stability in the pre-detector (or pre-first-detector) stages. For example, it might be found that the receiver is almost "dead" toward the lower or upper end of one waveband or that, when tuning in some transmissions, the signal strength gradually increases as the exact tuning point is approached, and then suddenly falls off. Instead, a whistle might be heard when tuning, despite the fact that the reaction control, when provided, is set full back. Should the set burst into inaudible oscillation at certain condenser settings, this will probably be suggested by a "popping" or "clicking" noise as the tuning control is operated.

## Screen and Earth Connections

By no means an unusual cause of the trouble is the breaking away of an earth-return connection to a screen—which might be a sheet of aluminium or a length of braid used to shield a connecting lead. It is wise, therefore, to make a careful check for this trouble, tightening any earthing bolts that appear to have worked loose. It is also worth while in many instances to try the effect of making additional earth connections from screening materials, also ascertaining that the earth lead itself, as well as its connection within the receiver, is perfectly sound. A point that can easily be overlooked when making this preliminary examination is a loose screening can on a coil or condenser; see that any such screens are pressed well into their bases and that they fit tightly. If it appears desirable, scrape clean the parts which are intended to be in contact. It is sometimes a good plan to wind a strip of tinfoil round the base of a screening can used for a coil to ensure that the contact is good and that the joint is "sealed."

In testing for good earth connections, do not overlook those from the lower ends of the coils, testing the coils for continuity between pairs of terminals if necessary. If the suppressor grid is brought out to a separate socket on the valveholder, see

that this is suitably earth-connected, or joined to the cathode pin, according to the method employed by the maker of the set.

## Meter Tests

If it is thought that the set is bursting into oscillation at certain tuning points, a

*by The Experimenters*

check can be made by inserting a milliammeter in the anode leads of the valves, at the points shown in the accompanying diagram. Notice that the meter is connected on the "H.T." side of the coupling components; if it were joined directly to the anode it might cause additional trouble, or introduce an apparent fault which was otherwise absent. A .5-mfd. tubular condenser should be joined in parallel with the meter to act as a by-pass.

If the meter shows a drop in current at certain condenser settings it will be a fairly

removed. It is, in fact, often desirable to disconnect the aerial before making the test. It might be argued that a receiver which is stable when the aerial is attached could well become unstable when it is removed. That is so, but any modern set should remain stable without the slight additional damping provided by the aerial.

## Faulty Decoupling Components

When the valve concerned has been traced the anode decoupling resistor and condenser may be suspected and tested by replacement. If the resistor has developed a short-circuit or the condenser an open circuit the decoupling will no longer be effective. The same checks should then be made for the screen grid components, which can produce similar effects. If a new valve has been fitted it might be found that additional decoupling is required, although this will generally apply only when an old-type valve has been changed for a more efficient modern counterpart.

Next check the bias resistor or resistors if the set is mains operated. If one of these

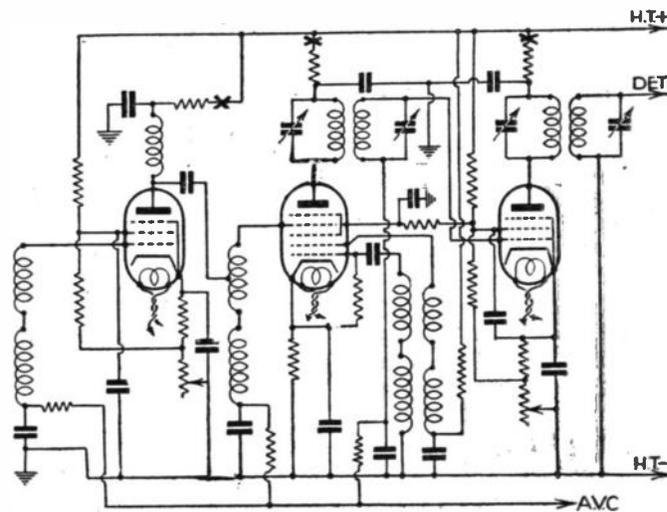
is short-circuited, the valve can easily become unstable since the bias would be reduced appreciably if not removed entirely. In the same way, a bias-resistor by-pass condenser which had developed a short-circuit could produce the same result. Substitution is usually the simplest method of testing. It will be appreciated, however, that if the bias circuit were shorted the reading obtained on an anode-circuit milliammeter would be higher than normal for the particular valve in use, so that the initial

tests would probably give a "lead" in this direction.

## Coil or Grid Circuit "Open"

In the case of a frequency-changer serious instability is sometimes traced to a break in the grid circuit of the first-detector portion; the fault might be in the leads from the coil to the valveholder and earth or A.V.C. line, or in the grid winding itself. After checking externally, therefore, test the coil for continuity. Trouble in this direction would generally be suggested by flattened tuning and lack of sensitivity.

*Continued on page 63*



This skeleton diagram of a hypothetical H.F., F.C., I.F. circuit shows the condensers and resistors referred to in the text. Crosses indicate suitable points at which a milliammeter may be inserted to test for self-oscillation.

sure sign that the valve is falling into self-oscillation. By this means it will generally be possible to find which of the valves is at the root of the trouble, so that the corresponding circuit can be tested more thoroughly. When making the test it will be best to turn the variable-mu volume control, when fitted, to its maximum position, although tests can be repeated with the control at different settings. It will be appreciated, of course, that the current reading will be lower at lower settings; it should, nevertheless, remain steady over the tuning range. This assumes that A.V.C. is not provided or, alternatively, that the aerial lead has been

# The ABC of Transformers

*A Practical Article Explaining the Whys and Wherefores of Transformation*

It has been said of the electrical epoch that it is the "Age of Wasted Energy," and the statement has considerable justification. The efficiency of any power generating plant, expressed as a ratio of input to output, is sufficiently appalling to give all but the most hardened engineers occasional twinges of conscience.

In the present scheme of things generation losses are accepted as part of the price we pay for power. Distribution losses, on the other hand, constitute a waste factor and are to be avoided. It is here that alternating current has the advantage over direct current, for the transformation losses are negligible with the former, a large transformer being probably the most efficient machine ever made.

## Comparative Efficiency

The smaller types used in radio receivers have an efficiency of 60 to 80 per cent., while power transformers handling over 5 kilowatts can be rated as high as 95 to 98 per cent. efficient. Compared with the 45/50 per cent. efficiency of a motor-generator the improvement is evident.

But efficiency alone is not the factor which interests the designer of wireless equipment. He is more concerned with the ease with which the domestic main supply of 240 volts can be safely reduced to 4 volts for valve heaters, or stepped up to 8,000 volts or so for cathode-ray equipment.

The theory underlying the principles of electro-magnetic induction is too involved for discussion in an article of this nature. We are all familiar with induced magnetism, and from there to induced electro-motive force is but a step. We have got into the way of taking things for granted. We may, however, digress for a moment to consider the major points of inductive action.

## Inductive Action

A transformer consists in essentials of two insulated windings which are wound over a closed magnetic circuit, generally of iron. Alternating current is fed to one winding, usually termed the primary, and from the other or secondary winding an alternating current may be taken at a higher or lower pressure than the applied voltage. The voltage applied to the primary causes an alternating current to flow in the winding which induces by electro-magnetic action an alternating flux in the iron circuit.

If we take the elementary transformer (Fig. 1) and plot the voltage and current values against a basis of time, we get a series of curves showing the relationships of the two quantities.

Curve 1 (Fig. 2) represents the voltage wave applied to the primary. Curve 2 is the current wave, lagging on the voltage by 90°, the common phenomena of inductive circuits. The magnetic flux induced by the current is in phase with it, and is shown by curve 3.

This alternating flux induces a voltage in the windings that is lagging by 90°, shown by curve 4. This back-voltage, lagging by 180° on the applied primary voltage, is known as the counter E.M.F., or back E.M.F., of self-induction.

It will be seen, therefore, that the initial

primary voltage has to perform two functions—to force a current through the D.C. resistance of the windings and to balance the counter E.M.F. produced by that current.

With a well-designed transformer the primary inductance is high, being of the order of several henries. The reactance at the excitation frequency is given by  $2\pi fLp$ , so that the effect of D.C. resistance of the order of 10 ohms is negligible.

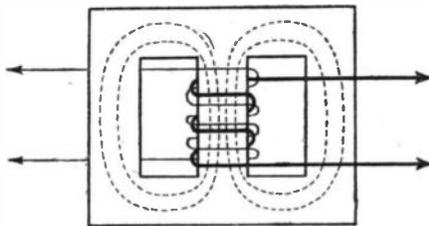


Fig. 1.—Diagrammatic sketch of an elementary transformer, indicating the magnetic flux.

The primary current with the secondary open circuited is determined by

$$I_p = \sqrt{R^2 + (2\pi fLp)^2}$$

and has been seen to be lagging 90° on the primary voltage. It will be seen that the power absorbed by the primary over the period 0° to 180° is given back to the alternator over the period 180° to 360°. Hence over the whole cycle of alternation no power has been absorbed, and the primary magnetising current is said to be "idle" or "wattless."

In dealing with the theoretical case, no allowance is made for losses incurred with magnetisation or resistance. Actually, small losses do occur, and will be dealt with at a later stage.

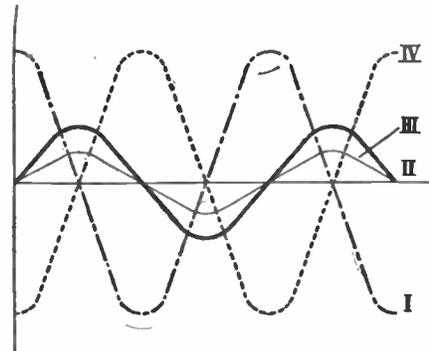


Fig. 2.—Voltage, current and flux curves in a mains transformer. I=Applied primary volts: II=Magnetising current: III=Flux: IV=Back E.M.F. of self-induction.

If the transformer is soundly designed, practically all the magnetic flux induced by the magnetising current will cut all the turns of both primary and secondary windings as it changes direction.

Thus it follows that the voltage induced in each turn of the secondary is equal to that induced in each turn of the primary. Therefore, on open circuit, the ratio of primary to secondary E.M.F. is equal to the ratio of primary to secondary turns, and is known as the transformation ratio.

Also, since the secondary E.M.F. lags by 90° on the flux producing it, it is 180° out of phase with the voltage applied to the primary winding.

Before passing on to the consideration of the secondary circuit under load, it should be noted that a transformer should never be used on a frequency lower than that for which it was designed.

## Counter E.M.F.

The counter E.M.F. of self-induction, which as we have seen, limits the magnetising current, is determined by the equation  $V = 2\pi fLp \times I_p$

Therefore, since  $f$  is lower, the primary current must be greater to increase the counter E.M.F. The increased value of primary current in turn reduces the inductance of the primary, and hence the current is again increased. The effect of a lower frequency is therefore to increase the heat losses in the primary, and in the iron circuit, due to the increased flux density. A higher frequency of excitation is permissible.

The previous discussion has dealt with transformers with open-circuited secondaries. When the secondary circuit is closed by a resistance, such as a valve heater circuit, the secondary E.M.F. gives rise to secondary current in phase with the voltage.

This secondary current will in turn set up an alternating flux in the transformer core proportional to itself and the turns of the winding. Furthermore this secondary flux is in opposition to the flux produced by the primary current. Part of the latter is therefore cancelled and the primary inductance decreased.

## "Load Component"

An increased current will flow through the primary winding to restore the flux to its original level and so preserve the balance of the applied voltage and counter E.M.F. of self-induction. This additional current is termed the "load component" of the total primary current.

The complications involved when part of the secondary load is reactive—as in the case of the H.T. secondary winding, are of technical rather than general interest, and will not be discussed at this point.

In a future article, transformers under test conditions will be dealt with, and a design for a power transformer for home construction will also be given.

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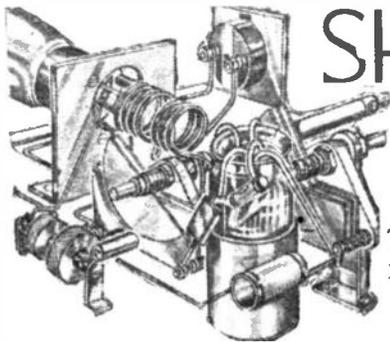
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# SHORT-WAVE SECTION

THE BANDSPREAD S.W. THREE  
Main Details of the Circuit Described on  
Blueprint PW68

IN 1936 we described a very efficient three-valver for short-wave use, in which the bandspread system of tuning was employed. The circuit is given below, from which it will be seen that an H.F. stage is employed, with the bandspread tuning in the detector stage. R.C. coupling is employed between the detector and output valve, and pentodes are employed in all three stages.

The wiring is so simple that no difficulty whatever should be experienced, but care should be taken to keep the under-chassis components clear of the metal surface. Resistances R1 and R3 have long connecting leads and therefore if there is a tendency for them to touch the metal chassis it will be advisable to place a piece of insulating material, such as empire cloth, underneath these components. Alternatively, their free ends may be secured to the nearest M.C. bolt by means of insulated wire. The only other point that needs mentioning is the volume control. The spindle of the specified control is insulated from the centre tag, and therefore it will not be necessary to use an insulating bush. If a non-specified control is used, however, it will be advisable to insulate the spindle from the metal panel.

### Battery Leads

After the wiring has been carefully inspected, the battery leads may be joined up. H.T.3 should be plugged into the 120-volt socket of the H.T. battery, H.T.2 into a socket between 90 and 120 volts;

greater volume should be obtained when this lead is plugged into the 120-volt socket, but the H.T. consumption will be greater than with the 90 socket in use. The voltage applicable to H.T.1 is governed by that applied to H.T.3. With 120 volts on the latter, H.T.1 should have approxi-

mately 36 volts, but the best socket can only be found by experiment. The H.T.±± lead should, of course, be plugged into the ± socket of the H.T. battery and the G.B.± lead into the ± socket of the G.B. battery, with the L.T.± and L.T.±± leads connected to the ± and ±± terminals of the accumulator respectively. G.B.2± lead must be plugged into the ±9 socket of the G.B. battery, and G.B.±1 into the ±4± or ±6 socket. As the H.T. battery is running down, it will be necessary gradually to lower the setting of G.B.±1, however. When the battery voltage has dropped to 80 volts, about ±3 volts bias will be sufficient.

### Aerial Series Condenser

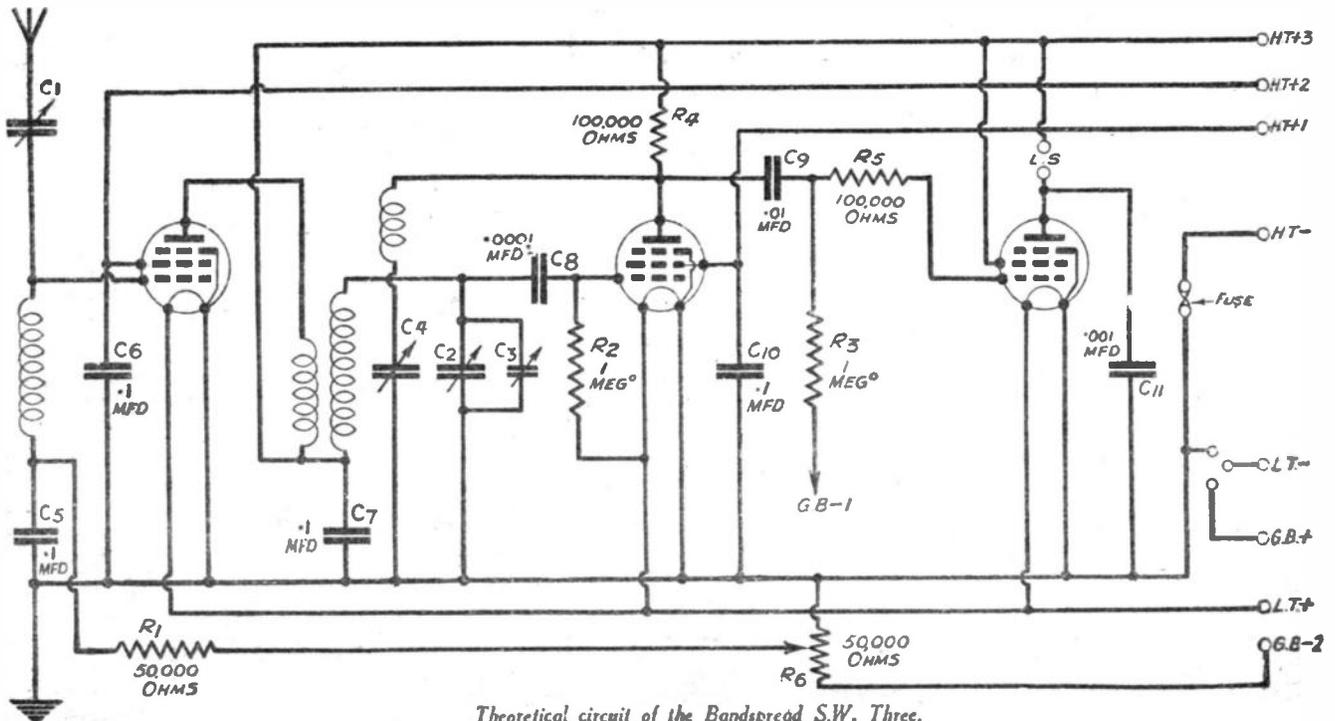
When the battery leads have been correctly wired, the aerial-earth and loud-speaker leads may be joined to their respective sockets and the set switched on by means of the three-point on-off switch. If a very long aerial is used the aerial series condenser C1 should be adjusted so that the moving vanes are nearly out of mesh. Reducing the setting of this condenser has the effect of reducing the effective length of the aerial. In most cases it will be found the best results will be obtained by keeping the volume control at maximum.

### Tank Unit

As some constructors may not have used the Eddystone tank unit, a few notes will be given concerning this. Condenser C3 is the tank, having a maximum capacity of 140 mμfd., variable in ten steps by means of the control knob. Condenser C2 has a maximum capacity of approximately 20 mμfd., and is connected in parallel with the tank C3, thereby enabling the operator to increase the effective capacity across the coil by this value. The specified coil has a wave-range of 24.6 to 51 metres when tuned by means of a .00016 mfd. condenser, and therefore when stations between 24.6 and approximately 27 metres are to be tuned in, the tank condenser control should be set at the first stop. If, on the other hand, stations between 40 and approximately 43 metres are to be picked up, stop 5 should be used.

### LIST OF COMPONENTS FOR THE BANDSPREAD S.-W. THREE

- One short-wave coil, Type B (Wearite).
- One bandspread tuning outfit C2, C3 (Eddystone).
- One 50,000 ohm potentiometer R6 (B.T.S.).
- One air-dielectric pre-set condenser, Type SW.87 C1 (Bulgin).
- Five fixed resistances (1 watt type) (Erie). 50,000—1 R1 (Erie). 100,000—2 R4, R5 (Erie). 1 megohm—2 R2, R3 (Erie).
- Seven fixed condensers: One .0001, Type 665 C8 (Dubilier). One .001, Type 4501 C11 (Dubilier). One .01, Type 4501 C9 (Dubilier). Four .1, Type 4503 C5, C6, C7, C10 (Dubilier). One 3-point on/off switch (B.T.S.).
- Four chassis-type valve-holders, 3 four-pin 1 five-pin (Clix).
- Two terminal strips, Aerial and earth and loudspeaker (Belling-Lee).
- Seven wander plugs, H.T.±, H.T.1, H.T.2, H.T.3, G.B.±, G.B.1, G.B.2 (Belling-Lee).
- Two spade connectors, L.T.± and L.T.±± (Belling-Lee).
- One S.W. H.F. choke, Type H.F. 3 (Bulgin).
- One Type RC32 reaction condenser (B.T.S.).
- One loudspeaker, Type 37M. (W.B.).
- One pair headphones (Ericsson).
- One microfuse with holder (100 m.A.).
- One Bandspread Three cabinet (Peto-Scott).
- One metal chassis 10in. by 7½in. by 2½in. (Peto-Scott).
- Three valves, Types HP211, HP210 (4-pin), PP222 (5-pin) (Tungsram).



Theoretical circuit of the Bandspread S.W. Three.

# ON YOUR WAVELENGTH



## The Radio and War

WITH war clouds hanging over Europe we have had a foretaste of the service which radio would yield should war break out. I trust, however, that this calamity will not happen, and that by the time you read these notes, which must necessarily be written some days before you read them, the world has reverted to normality.

During the last war we had to rely upon the newspapers, for broadcasting had not started. To-day it is being used more and more by foreign Governments as an instrument of propaganda to further political interests and to foster national hates. In the event of war we should rely upon the radio for accurate news, for it would be the mouthpiece of the Government. During the last war such wireless telegraphy receiving and transmitting sets as were in existence were confiscated, and I have no doubt that in the event of another war amateur transmitting sets would be similarly confiscated. I do not think, however, that receiving sets will be interfered with.

During the recent crisis many announcements of the latest position were made by radio, but the one which seemed to have given rise to the greatest consternation was the announcement that the Premier was flying to see Herr Hitler. Never has my post bag bulged so much with a mixture of letters of appreciation and contumely. The letters vary from extreme shame that a British Premier should humiliate the British race and destroy what shreds of British prestige were left, to extreme approval that he should have the courage to have sought a solution by personal contact. Most of the letters state that the writers feel that such a meeting should have been kept secret, and nearly all of them ask for my views on the announcement. Sorry that I cannot oblige, for this is a non-political journal, and as I do not possess any particular brand of politics, preferring to believe that all parties are right and wrong sometimes, and to pin my particular belief on the particular party which I think to be right on a particular occasion, nothing I could say could add anything to the discussion. I will

## By Thermion

however, express the opinion which I have so often given that I think the wireless should be used solely for entertainment purposes.

### Dealers' Replies

I PUBLISHED a reader's letter the other week which quoted the foolish reply of a radio dealer who, when asked why television was radiated on such short wavelengths, said that the pictures won't stretch more than 5 or 6 metres! A trade paper commenting on this says: "If Thermion is the fair-minded bloke I expect, Editor F. J. Camm will not object to a lively radio dealer coming back with some of the foolish things that customers say. Or are these so frequent that they are not news?"

The paragraphist who wrote this serves a trade paper, and if he is the alert bloke I have the right to expect him to be, he ought to know by this time that the customers who buy wireless sets and components, in 90 per cent. of the cases, know far more about radio than the dealer ever will. I have not a very high opinion of wireless dealers, and most of the comic stories which come to me have their genesis on the dealer's side of the counter. I fairly publish most of the stories I receive, and if you search through the files you will find that the funniest stories have been at the dealer's expense. I have no doubt that when some of the "lively" radio dealers "come back with some of the foolish things that customers say" those statements will have originated from letters which I have published in these columns. It thus will definitely not be news.

### Great Increase in Wireless Licences

THE Post Office issued 374,002 wireless receiving licences during August, 1938. This figure represents

a net increase of 32,147 in the number of licence-holders during the month after making allowance for expired licences and renewals. This is 65 per cent. greater than the increase established in July.

The total number of licences in force at the end of August, 1938, was 8,689,850, as compared with 8,295,950 at the end of August, 1937, an increase during the year of 383,900.

During the month there were 491 successful wireless prosecutions.

### French Television

I HEAR that television transmission characteristics which will not be changed before July 1st, 1941, have been announced by the French radio minister, M. Julien. They include:

Vision wavelength... 6.52 m. (46 mc/s).

Sound wavelength... 7.14 m. (42 mc/s).

Polarity of transmission... Positive.

Number of pictures... 50 interlaced per sec.

Number of lines... Between 440 and 445.

Picture proportion... 5.4 (width/height).

Duration of line

synch. signals... 18 per cent.

Duration of frame

synch. signals... 15 lines per interlaced section (about 7 per cent.).

### More About Crooners

SIR EDWARD BAIRSTOW, who presided at the Glasgow Congress of the Incorporated Association of Organists, ran his eye down the Agenda to be discussed. He came to crooning, and I understand that his face contorted and his nostrils distended like a Heath Robinson cartoon of a crab-apple. This is what he said: "There is no necessity to discuss crooning, it is a damned ugly thing."

### Television at 5s. a Week

I AM informed by the G.E.C. that two important additions to their range of popular-price television sets have just been announced.

The first of these is a vision-unit giving the standard picture of 7½ in. by 5½ in. at 23 guineas. The other is a sound and vision console model priced at 37 guineas which gives almost double the picture size with a 10 in. by 8 in. screen.

Other G.E.C. models announced include a combined television and all-wave radio floor model with mirror viewing at 60 guineas which

also gives a 10in. by 8in. picture, and a de luxe model of the same set at 70 guineas with a 13½in. by 11in. picture—the largest screen obtainable to-day without the use of projection technique. All these models are available on hire-purchase terms, from 5s. a week.

#### Inventors

HERE is another letter from K. T. H., of Birkenhead, on the vexed question of inventors and their ways:

"As one of the army of crank inventors who are so dear (?) to the heart of Mr. Camm, I suppose it is too bad of me to poke fun at a brother genius, but I can't wonder at Mr. Camm's excitement when the word inventor is mentioned in his hearing after reading the letter of Mr. McC. about his diamagnetic high-tensioned, spring-adjusted indoor aerial, which he has now boiled down so that it can be put on the market at 3s. 6d. to 4s. 6d.

"Something will be boiled down, I have no doubt. What a shame it is that no one at the Patent Office, or anywhere else, will point out the obvious snags in this keen reader's idea, if only for his own sake. He seems to have got all mixed up very badly. Since he keeps his diamagnetic wires in a state of high tension by means of spring adjusters, obviously the tension will vary constantly as temperature varies, and at no time will all the various wires be under the same degree of tension, since no two springs ever made are exactly alike. I think myself that he would be well advised to ask a slightly higher price so that he could include a tuning fork to get all his wires on the same note. Or are they tuned on a musical scale? If the B.B.C. Military Band is broadcasting something written in A flat minor, what happens to reception if the aerial is tuned to D sharp? Does the tuning of the aerial automatically adjust itself, or is some form of manual tuning provided, all for 3s. 6d.? Who knows what this may lead to? No doubt the day will arrive when we shall need no 'push buttons' or other tuning arrangements in the set itself. In place of these we shall have some form of remote control, one end of which will be connected to the adjustable diamagnetic spring-controlled aerial, and the other to a small dial showing all the different wavelengths, and all we shall need to do is make the aerial tighten up or slacken off till it will only respond to the wavelength of the particular station we wish to listen to. Of course, I can't say what that will

## Notes from the Test Bench

#### A Bridge Tester

WHEN testing condensers and resistors it is often valuable to be able to ascertain the value as well as being able to check for breakdown. The bridge is the simplest method of testing such components and with the aid of standard accessories, a scale may be provided so that values may instantly be read off. The only parts needed are a transformer, a neon lamp and 'phones. The neon is included in series with a high-voltage source on the primary side of the step-down transformer, and on the other side a volume control, 'phones and terminals are included. When energised, the arm of the control is rotated until all sound disappears from the 'phones, when the bridge is "balanced" and the value may be read off from the scale. There are, of course, many variations of the simple scheme outlined, which forms the basis of practically all such testers.

#### Series Heaters

WHEN using the "Universal" type of valve with heaters wired in series it is important to remember that the various valves should be included in a given order so that hum or similar troubles are avoided. With a simple set it may be taken as a general rule that the detector valve should be last in the chain (that is, with one side of the heater connected direct to earth), whilst in a superhet it is generally found that the first detector is best when connected as the last link. In some superhets, however, the second detector may be connected last.

#### Ideal Coils

WHEN winding coils for experimental use it is necessary to remember that efficiency is not always the most desirable factor. For instance, a coil which is wound to give the greatest signal voltage may be found to possess such a wide field that it will be impossible to include it in a modern receiver without screening, in which case the efficiency will be reduced. The general principles of good coil design are low H.F. resistance (obtained by using thick or stranded wire), low self-capacity, and high inductance. In general, the main aim should be to make the diameter of the coil as large as possible compared with the length of the winding, best results from the efficiency point of view being obtained when the diameter is greater than the length. Very high efficiency is not called for on the long waves, but on the medium waves it is possible to obtain greatly improved results in most receivers merely by substituting high-efficiency coils.

'boil down' to. Or even if it will make anything actually 'boil over'—Editors, for instance! I used to think Mr. Camm was a little hard on we poor mutts. Now I can see how much I misjudged him. I appreciate what good reasons he has for looking on inventors as just a pain in the neck. Taking we inventors as a whole, the only valuable service we render to the world at large is to add to its gaiety and amusement. We are the funniest ever. The god we worship is, definitely, Heath Robinson!

Inventor McC—tuned his aerial to G

Then transmission is made on A flat.

Says Inventor McC—that don't matter to me,

My tension springs soon alter that. When sopranos would sing—you just tighten a string

Then their top notes come through like a bell,

And for Rachmaninoff—you just slacken off,

And for basso profundo as well.

So with wires "out" or "in" this invention must win,

It is easy and simple to fix.

You'll never be lost—to provide its small cost,

When "boiled down" it's just three-and-six.

"From which you will easily see that I am a particularly vile specimen myself—I am not only an inventor, I am also a poet???? And I don't think even Mr. Camm could survive that combination of evils for any considerable period without giving up the ghost.

"Best respects and good wishes. Keep your page bright and snappy with the latest information about all these new and wonderful inventions."

#### Woman's Fair at Olympia

THE Marconiphone Company inform me that they have secured the contract for the Public Address installation at the Woman's Fair and Exhibition which is to be held at Olympia from November 2nd to 26th. The equipment to be employed will consist of a series of high-fidelity high-power amplifiers operating several giant 4-unit loudspeakers in the Main Hall and the National Hall, besides a large number of units of smaller power in other parts of the building. The music will be provided from gramophone records and also from the band, and S O S's and announcements of importance will be made throughout the system and when required.

# The Amateur Transmitter

Planning and Building the Station : Operating Procedure : The Log-book and QSL Cards  
By L. O. SPARKS

**S**TATION layout is a very important matter. Nothing is more detrimental to good work than a collection of apparatus piled haphazardly together without any thought of efficiency, system or ease of working.

A slipshod layout does not indicate great care of equipment; every amateur worthy of the name is not only rather particular about his apparatus but also takes a pride in its appearance and the overall efficiency of his station. To achieve and maintain a reasonable standard it is absolutely essential to adopt some system of layout and working, but as these requirements are governed by individual conditions it is impossible to give hard and fast details. However, here are the main points to be observed.

When the question of the location of the station is being discussed, bear in mind aerial and earth arrangements. It is both annoying and troublesome to select an ideal spot as regards space and other facilities and then to find that it is practically

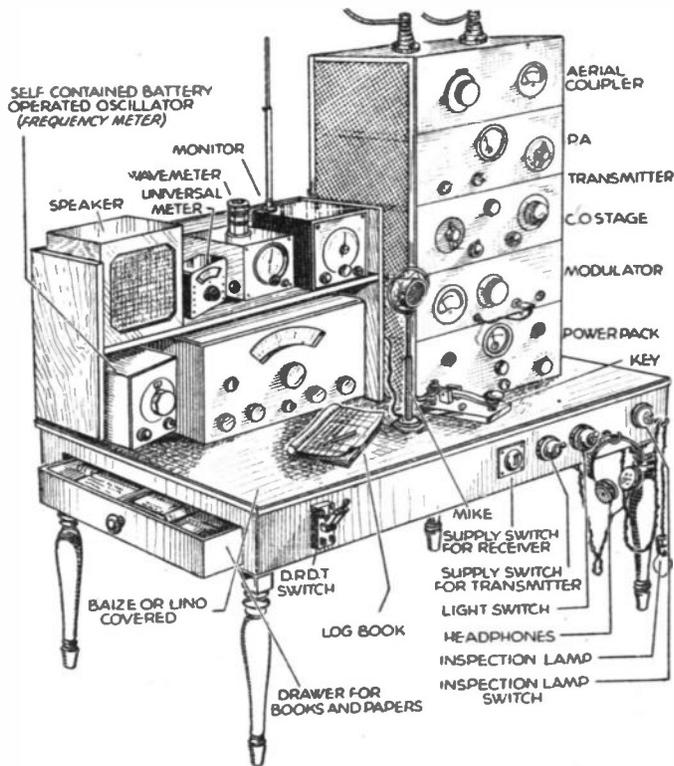


Fig. 1.—A suggested layout for a table; note the additional shelf to increase useful area.

control during operation of the station. If the bench is long, it is a good idea to use half or more of it for the apparatus and the remainder as a working bench over which can be fitted a neat tool rack, etc.

It is not always possible to alter the height of a bench once it is built, so if one has to be constructed for the purposes in question, see that its height is just right for the elbows to rest on when sitting down. Many hours will be spent at the receiver and/or transmitter, and items which will reduce strain and add to the comfort must be considered.

### Racks

Racks can be divided into three classes, as shown in Figs. 2 to 4. They provide

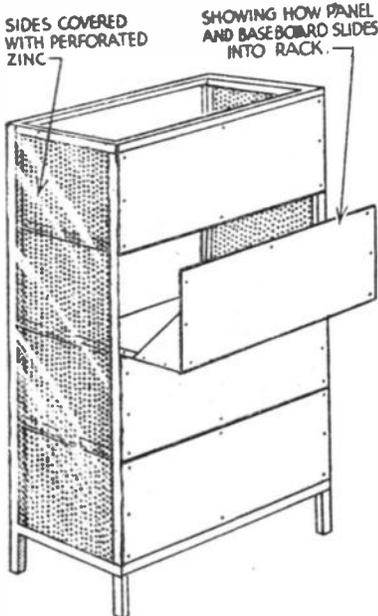


Fig. 2.—A box rack structure. With this method complete protection is given to all apparatus.

or lino, and hooks, screws, switches and any other requirements can be fitted to the sides or leg tops without the feeling of damaging a good piece of furniture. It is usually possible to pick up a table of this type for a very reasonable figure at a second-hand dealer's or a furniture sale.

• With a table, however, it is often difficult to lay out all the gear in a satisfactory manner. The set or transmitter might be placed in an ideal position for operation, but, it is then found that the monitor, wavemeter or other meters are awkwardly placed for easy manipulation or, on the other hand, no space is available for speaker, batteries or mains unit, or the jotting down of observations in the log-book.

The suggestion outlined in Fig. 1 is the result of using a table for some time and getting fed-up with balancing one item on top of another during moments of check testing. The shelves, fittings and placing of the items can be varied to suit own requirements. One item calls for special mention: see that adequate lighting is provided, and that it is so arranged that inspection of the interior of the set or transmitter can be easily carried out. The small inspection lamp shown is operated off an old bell transformer, i.e., low voltage.

### Bench

This method of accommodating the gear calls for similar treatment to that mentioned above, except that with a bench it is usually possible to fix a shelf underneath to carry such items as batteries, mains units and other items which don't call for constant

an ideal method of construction when  
(Continued overleaf)

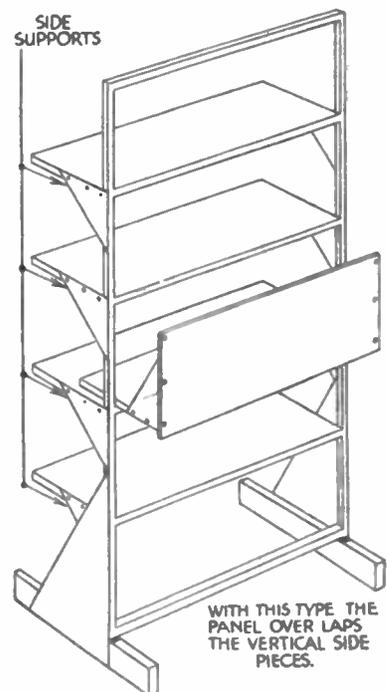


Fig. 3.—An open rack. Very handy for experimenting and quick tests. Parts not protected.

impossible to make contact with the aerial and an efficient earth. If a choice has to be made, select the site most favourably placed for the last two items.

### Planning the Layout

Once again space will rule over ideas and plans. Whether a table, bench, rack or shelves is to be used depends on local conditions; therefore suggestions are given below for all of these.

A table to carry all the gear is very satisfactory, provided it is such that fixtures can be screwed to it and, if the necessity arises, additions made without the fear of spoiling its appearance. A good stout kitchen table, with drawer, is ideal, as its top can be covered with baize

**THE AMATEUR TRANSMITTER**

(Continued from previous page)

space is limited or when a compact assembly is required.

The box type is the most rigid and protected of the three arrangements; the open type (Fig. 3) allows quick observation and testing, but provision *must* be made for covering all parts at high potential, to prevent the possibility of shocks to the operator and any other member of the household who *might* come in contact with it. Domestic pets must not be overlooked. The third method (Fig. 4) is very similar to Fig. 3 with the exception of the shelves being reversed and no panels used, the controls being mounted on brackets. This system was devised for use in a narrow recess and for experimental purposes, but it could be adapted to satisfy many requirements.

For home construction, wood is the best material to use for the racks shown, although, if the workshop is equipped for simple metal work, some very neat and strong racks can be made by anyone with a little experience.

**Station Operation**

Casual listening is no way to gain the true amateur status; it does not follow that one has to become a slave to a receiver or ignore all other subjects, but to gain a thorough knowledge of short-wave communications the whole matter must be treated with a certain seriousness prompted by genuine enthusiasm and interest in the subject.

Worth-while records should be kept, and for this purpose a log-book should be maintained and used during listening periods. Suitable books can be purchased or made from stiff-covered exercise books, the pages being ruled off in the manner indicated by Fig. 5 which, incidentally, is a copy of the log sheets obtainable by members of the B.L.D.L.C.

Stations operating under an A.A. or full transmitting licence are bound, by the P.M.G.'s regulations, to keep an accurate log-book in which has to be recorded full details of all operating periods.

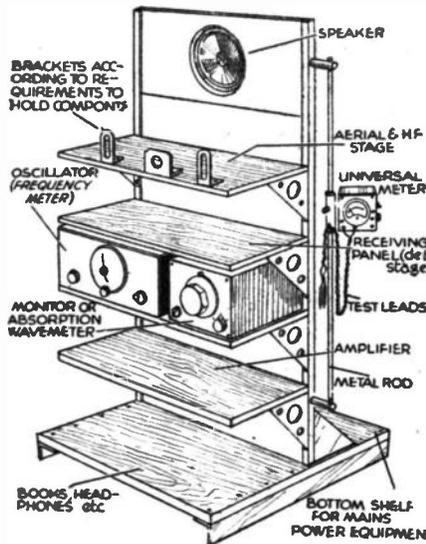


Fig. 4.—Another form of experimental rack, useful where space is limited.

The reception log-sheet is practically self-explanatory, and it will be seen that if intelligent use is made of the various columns, valuable data will be compiled concerning individual stations, best listening

Date	Time (G.M.T. or E.S.T.)	Items and Announcements	Volume (R.)	Fading	Static	Interferences	REMARKS

Fig. 5.—How the log book sheets should be ruled off.

periods for different frequencies, and geographical positions, static, interference and fading.

A check will be kept on reports sent and verifications received, and in this direction discretion must be used, otherwise much valuable time and money can be wasted by both owner of receiving and transmitting station.

Reports on reception are useless to the transmitter unless they convey accurate information and tell him something he

does not already know. For instance, it is no use sending in a report to a transmitter in, say, Scotland when he is normally working contacts all over the British Isles with perfect ease. Similarly, Continental operators know that they can work our stations without claiming any great achievements, so unless a station within such limits asks for reports, it is really a waste of time sending in reports on their reception.

After all, there is very little satisfaction in collecting QSL cards from what can be considered as local stations, so far as receiver efficiency and manipulation is concerned. When reports are sent in, be sure and enclose Imperial Reply or International Reply Coupons, to cover the return postage of the QSL card. These are intended for use in the Colonies and other nations respectively, and can be obtained from any main Post Office, their price being 3d. and 6d. It is useless to send stamps.

**Listening Time and Frequency**

The amateur transmitting stations will be heard on the following bands: 5 to 5.3 metres, 10 to 10.71 metres, 20.83 to 21.43 metres, 41.12 to 42.83 metres and 150.4 to 174.4 metres approximately.

The beginner will do well to start off on the 40-metre band as this does not require the same fine touch as the higher frequencies, and there is usually someone on the air during most of the day. During the week-ends they are easily picked up.

The next band, 20 metres, will usually provide the best bag of distant stations during late afternoon

and evening, but when sitting in on a listening period it is advisable to explore all the bands in turn and then settle down on one section, according to prevailing conditions.

Time and weather play peculiar pranks with the reception of S.W. signals, and it will soon be found that one band may become more or less useless after a certain hour, while another band will start coming in at a strength far beyond that which it was received, say, two or three hours earlier.

**Old-time Minstrels Revived from WLW**

"GENTLEMEN, be seated!" It's the old-time minstrel show interspersed with pleasant memories of the late Al. G. Fields, Lou Dockstader, McIntyre and Heath, and, in more recent years, Lasses White, Neil O'Brien and others of burnt cork fame, that one hears over WLW, 9.30 to 10 p.m., EST, on Mondays.

When Owen Vinson, WLW programme director, sought to revamp "The Minstrel Man," he drew from the staff some veterans of the old minstrels. Charles Lammers of the production staff, himself an old minstrel man, is in charge of production. Harold Carr is featured as Colonel Merryweather, the interlocutor.

Hink and Dink, first starred on the air in the old WLW "Cotton Queen" minstrels, are featured end men, as are Ray Shannon and Charlie Dameron. Shannon's stage career began more than a quarter of a century ago as a blackface comedian, and Dameron did his time with Lasses White before entering radio.

Joe Lugar and His Dixieland Dandies,

**ITEMS OF INTEREST**

the band that made the "Cotton Queen" famous for its old-time minstrel tunes, provide the music interludes and background for the new "Colonel Merryweather's Minstrels" over the Nation's Station on Monday nights.

**THE WIRELESS CONSTRUCTOR'S ENCYCLOPEDIA**

By **F. J. CAMM** 6th Edition

(Editor of "Practical and Amateur Wireless") **5/- Net**

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**South African Music Scholarship**

THE musical composition scholarship offered by the Performing Right Society to South African composers to enable them to study in this country has been awarded by the Selection Committee in Cape Town to Mr. Arnold Van der Wyk, a 22-year-old student at the Stellenbosch University, who has written the music for the forthcoming Voortrekkers Centenary Celebrations at Pretoria. The scholarship, which has a value of £200 per annum, is available for a minimum period of two years. Mr. Van der Wyk is expected to take up his studies shortly at the Royal Academy of Music in London.

The offer of the scholarship by the Performing Right Society was made at the beginning of this year, following a visit to South Africa by the General Manager, Mr. C. F. James. He discussed the project with General Smuts and other prominent South Africans during his visit, and it was held unanimously that it would help very materially in encouraging the latent talent among the composers of South Africa. Wide interest was attracted throughout the Union by the competition, and a considerable number of entries were received.

# A PAGE OF PRACTICAL HINTS

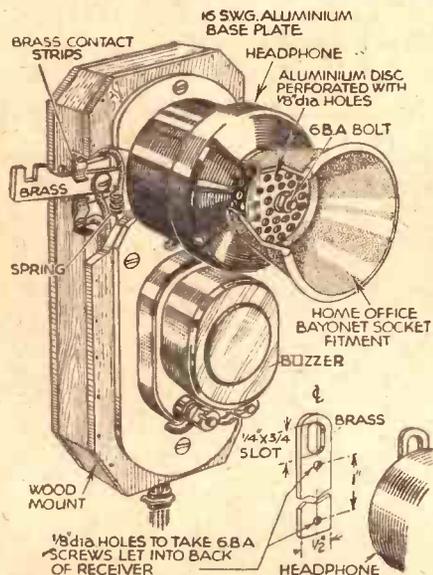
**SUBMIT YOUR IDEA**

# READERS WRINKLES

**THE HALF-GUINEA PAGE**

### An Inter-house 'Phone System

I CARRY out my experiments in a shed at the end of my garden, and when anybody wants me they invariably have to come down to the shed, as when the door is closed I cannot hear them when they



A novel inter-house 'phone system.

call; consequently, I decided to install a simple inter-house 'phone system using parts from the junk box. As will be seen from the sketches, the use of standard Home Office bayonet socket protection fittings enabled me to improve the use

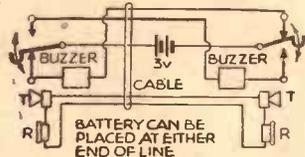


Diagram of connections.

of an ordinary earphone for the transmitter, whilst giving each unit a distinguished appearance. It will be noticed from the circuit diagram that there is no battery boosting in the 'phone circuit, the reproduction with the simple series circuit being ample as there is seldom any noise to drown the speech.

The H.O. fitment is secured to the earphone by an aluminium disc, a 6 B.A. bolt passing through the centre and clamping the "mouthpiece" against its internal ridge, and with a spring washer on the underside of the 'phone cap. It was, of course, necessary to drill a number of 1/8 in. holes not only in the disc, but in the 'phone cap itself, as shown.—L. G. HEDGECROFT (Ashford).

### THAT DODGE OF YOURS!

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

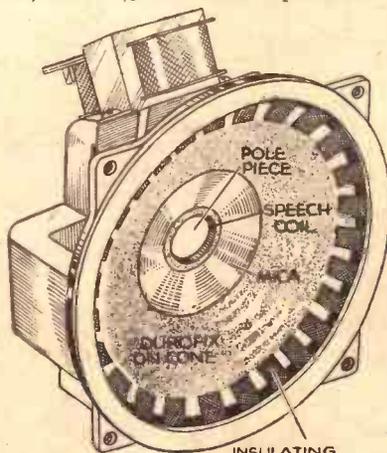
### SPECIAL NOTICE

All wrinkles in future must be accompanied by the coupon cut from page 69.

### Improving a Moving-coil Speaker

THE accompanying sketch illustrates an idea for improving the tone of the cheaper type of moving-coil speaker.

I have a paraphase push-pull amplifier, and I decided to try and improve my 1937 loudspeaker. I smeared the whole cone with Durofix, and glued a piece of mica 1/1000in. thick cut in the shape of the cone, about 1/8in. from the speech-coil to



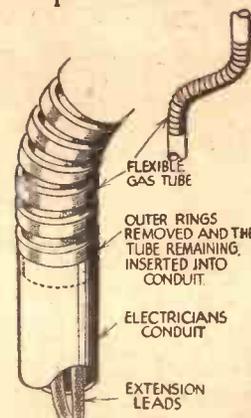
Method of improving the tone of a moving-coil speaker.

about 2in. from the edge of the cone. I then cut away that part of the cone which acts as a hinge for the cone to the chassis, and suspended the cone by means of pieces of insulating tape, stuck one end to the edge of the cone and the other to the chassis, thus allowing for free movement of the cone. I have since substituted this by felt. The resulting change in tone after this modification is remarkable. The bass response is completely free from bass resonance, and also responds to the lower bass frequencies much better. The high note response is much better and is free from annoying resonance and there does not appear to be any loss in transient

response. Reproduction as a whole is more forward and clearer.—J. ROGERS (Erith).

### Simple Conduit for Extension Leads

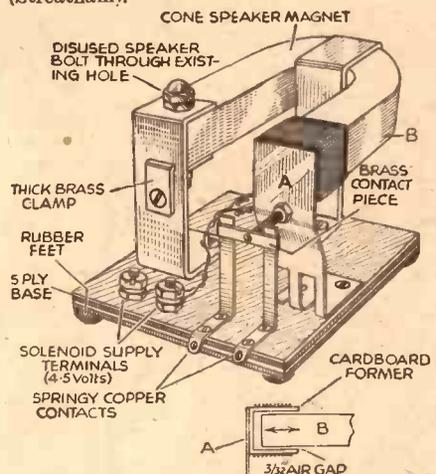
IN this simple method of neatly carrying an extension to a room awkwardly placed, the tubing saves the trouble and necessity of bending conduit, and can be a permanent, or temporary, fitting. The gas tubing fits snugly into the conduit, there being no need for soldering or fixing in any way.—B. RICKETS (Hull).



A simple conduit for loud-speaker extension leads.

### A Solenoid-operated Relay

I HAVE just made very good use of two old cone speaker magnets, and the accompanying sketch shows the method I have adopted for the novel construction of two low-voltage relays working on the solenoid principle. These magnets already had clamping holes in each pole piece, and by shaping a stout brass clamping bracket as illustrated, and with the aid of a further support at the rear, a rigid fixture was simply attained. The armature "A" comprises a piece of thin springy copper, about 20 S.W.G., and by fitting a long 6 B.A. screw, and soldering this to the commoning contact piece, the circuit for the two copper contacts was kept independent. For the solenoid coil I wound 50 turns of No. 30 S.W.G. enamelled wire round a cardboard former, and in constructing this former I left an air gap of 3/32in., thus permitting a reasonable clearance.—F. G. LETWOOD (Streatham).



An improvised low-voltage relay.

**I**n our issue dated September 10th we gave the main picture sizes of the majority of television receivers now available. We have now had an opportunity of examining the various types of receiver which

# TELEVISION: LATEST

Details of Some of the New Season's Receivers



A typical television unit providing only the television, sound and picture.

are on sale, and it is interesting to note that considerable changes have been made in some of the receivers which were formerly on the market. At one time there was only one, for instance, which utilised magnetic

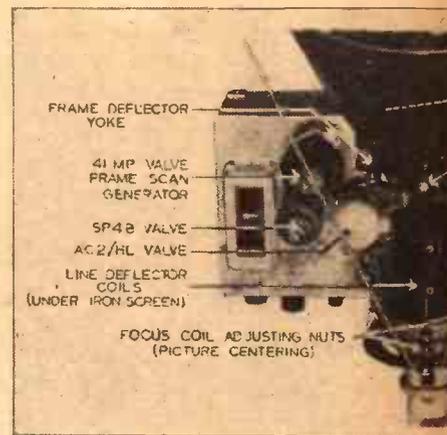
employ the magnetic system. The illustrations on this page show the interior of two well-known television receivers, one a Bush and the other an H.M.V. receiver, and the Bush illustration clearly shows the magnetic coils round the cathode-ray tube. These illustrations serve to show the general method of building the modern television receiver, where each section is built up separately on its own chassis, although in one or two cases the entire apparatus has been built on a single chassis. A good instance of this is the new Marconiphone and H.M.V. table receivers, where the makers have succeeded in crowding on to a single small chassis a 6-valve radio chassis and the 10-valve cathode-ray tube apparatus, whilst the small cabinet also houses the speaker and cathode-ray tube.

### Circuit Design

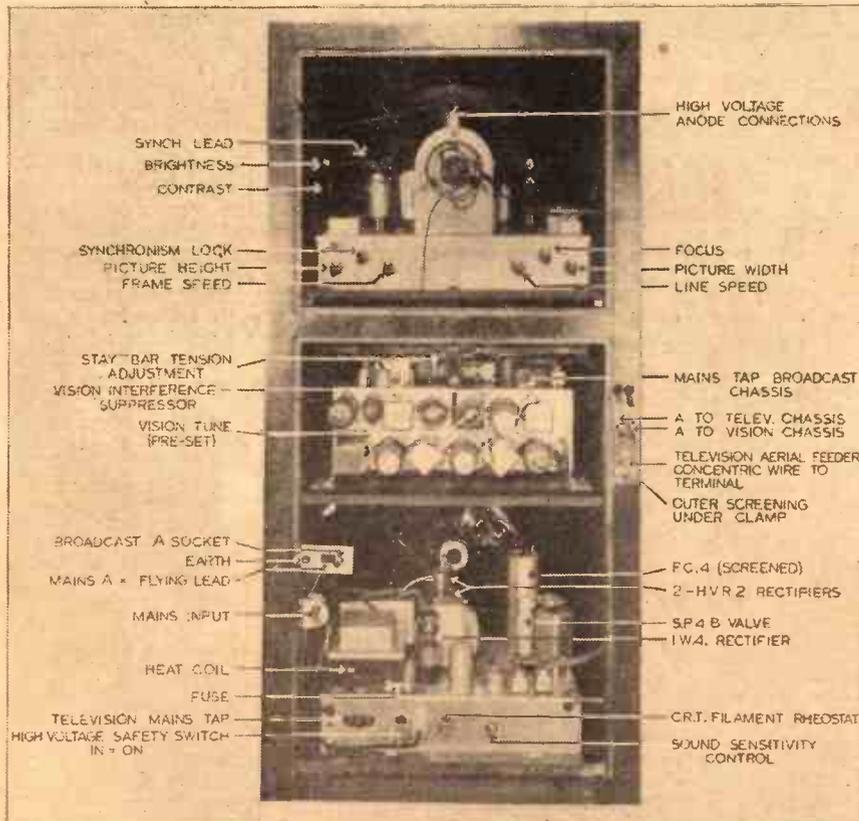
The radio side of most modern television sets is of the superhet type, the separate vision and sound signals being picked off by suitably adjusted circuits from a single frequency-changing stage, but in the Marconiphone and H.M.V. receivers the straight (T.R.F.) circuit is retained. The intermediate-frequency adopted in the superhet types of receivers varies and some value

picture detail. The band-width varies in the different models from 2 to 6 mc/s, whilst in some receivers single-sideband reception is adopted.

Apart from these main features there are several special details which are adopted by individual manufacturers. For instance, one maker at least has adopted an audible warning to show that the vision section is left on—it being understood that when the transmission has finished the screen will darken and it will not be possible to see that the set is left on unless some strong local interference is experienced, when flashes of



The Bush television chassis



This diagram of one of the Bush receivers indicates the various separate parts.

deflection, all the remainder incorporating electro-static systems. The position has now been reversed, and the majority

between 5 and 13 mc/s is generally adopted, the tuning generally being flattened to give a wide frequency response so as to retain

light might be seen on the screen. In the receiver mentioned, which is a Tannoy set, a whistle starts up when the transmitter switches off and thus the user knows that the set should be switched off.

Another point of interest is that the standard resistance-capacity method of coupling, which has hitherto been thought to be the only satisfactory system for the

# TELEVISION

### Special Electrodes

**O**RIGINALLY, the cathode-ray tube electrode system consisted of a directly-heated cathode surrounded by a Wehnelt cylinder, while in front of this combination was a simple orificed disc. This arrangement served to meet the needs of early experimental work, but the demands of television brought about radical changes. It was noted that at this year's Radiolympia the majority of the cathode-ray tubes used in the television receivers were operated electro-magnetically, and from the point of view of the tube manufacture itself this has simplified matters very considerably. On the other hand, the design of the actual electrodes themselves has been the subject of very important research. The cathode is usually of the indirectly-heated type, and according to both make and purpose, the control grid and anode are shaped in a

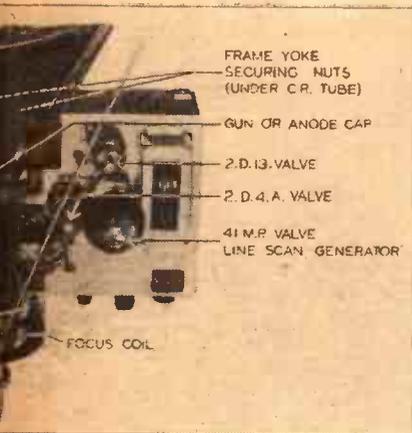
# T DEVELOPMENTS

vers and the Circuits which are Adopted

time-base circuit, has been dispensed with in one or two sets, and standard transformer coupling employed with every satisfaction.

## Tube Sizes

There is still considerable controversy regarding the size of picture which should be adopted for normal domestic purposes. A 5in. tube is employed on a number of sets, and the picture size varies according to the particular mask employed. In some makes the maximum area is utilised in spite



indicating essential points.

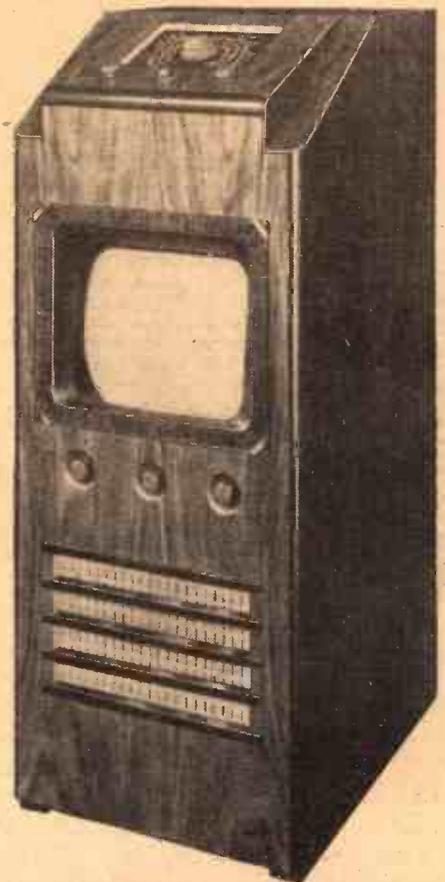
of the curvature of the tube end, whilst in others the mask has been reduced so that a more or less flat picture is obtained. Sixteen inches is the size of the largest tube employed in the domestic receivers, and, again, this is masked to provide slight variations in size by different makers. The practice of utilising a lens to magnify the size of the picture appears to have

fallen out of favour, although several receivers are still available with the cathode-ray tube in a vertical position and the picture viewed by reflection in a mirror. Glass protecting screens, either of plain or safety material, are also incorporated in some receivers, whilst others have the tube end directly exposed.

The very small type of tube, providing a picture about 2ins. or so in length, is employed in the projection model receivers, such as are supplied by H.M.V., Philips, Baird, Pye and other firms. In these the tube is placed at the lower end of the cabinet, directed upwards, and a lens is used to project the picture on to a mirror from which it is thrown on to a screen. In the Baird receiver two screen sizes are adopted, and it is possible to change the screens in a very short space of time so that the desired size of picture may be obtained. The two screens measure 18in. by 15in. and 24in. by 19in., and fold inside the lid of the cabinet when not in use. The usual trouble with the projection type of receiver is that the picture must be viewed from a position as near as possible directly in front of the screen, and as the angle of vision increases the brilliancy of the picture rapidly falls off.

## Controls

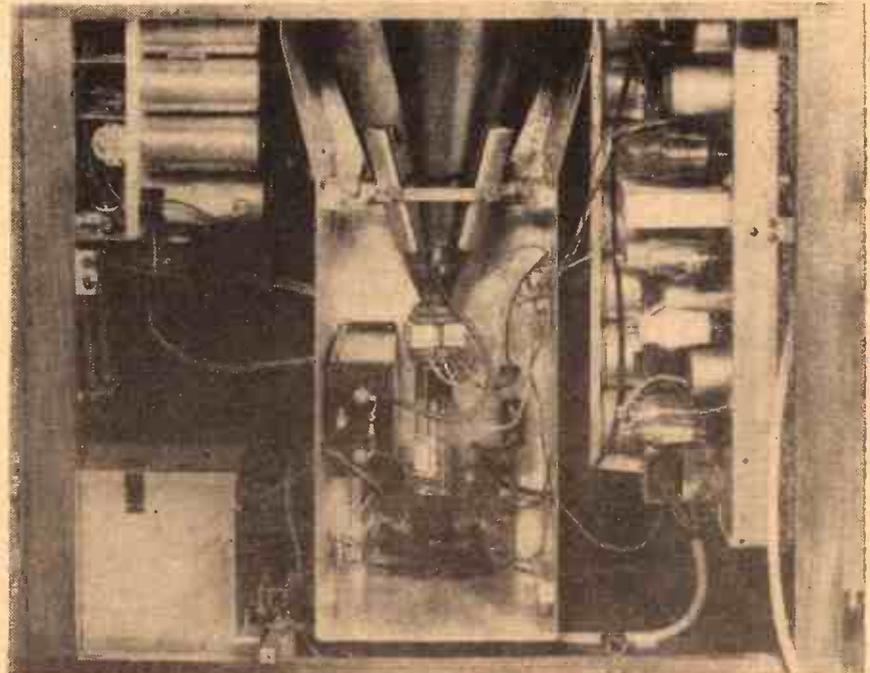
In some receivers a single control is adopted for contrast and a single one for volume on the sound programme, whilst in others it is possible to control from the panel the brilliancy, contrast, frame and other



A modern console television and radio receiver. a sub-panel out of sight and only retain one or two for normal use. The modern apparatus is so reliable that picture shift,

## ON NEWS

special manner. This has been done with a view to securing the best possible control of the electron stream in its passage to the front fluorescent screen. In one case the control grid itself is shaped as a hollow cone with its apex close to the cathode and wide end facing the anode. It is claimed that in this way the distribution of the electrostatic lines of force between the cone mouth and the anode is such that the electron stream is constrained to keep to the centre axis and this increases the number of electrons passing through the anode aperture on the way to the screen. Furthermore, the signals applied to the control electrode, when shaped in this manner, exercise a more decisive action in modulating the stream intensity because the electric field inside the cone with reference to the anode is almost zero.



An internal view of one of the H.M.V. receivers, showing how the various chassis and tube are arranged.

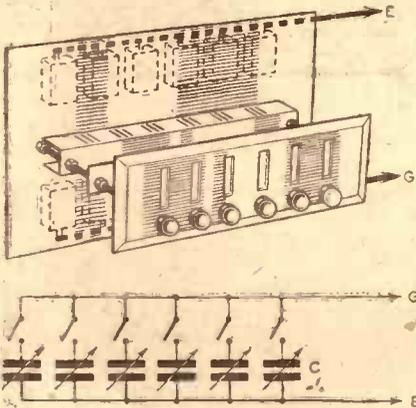
movements of the picture. It appears, however, that the general trend of design is to place all but the essential controls on

sync., focus and other controls will hold for a considerable time without the necessity for readjustment.

# Add-on Tuning Units

How Push-button Tuning may be Incorporated in Any Existing Type of Receiver - - By W. J. DELANEY

**M**ANY listeners are anxious to fit push-button tuning but do not wish to alter their existing receiver. It is, fortunately, quite a simple matter to add this form of tuning, and the only difficulty which presents itself is what form the additional unit shall take.



Figs. 1 and 2 show the theoretical and a practical layout of the switch-condenser assembly.

You can build a simple push-button unit with condensers which may be inserted into the receiver cabinet and wired to the existing circuit; you may build a complete separate tuner with valve or valves to add before the receiver, or in an advanced form may build a complete remote-control unit which will enable push-button tuning for a number of stations to be carried out from a distance.

In Figs. 1 and 2 are shown the elements of a simple add-on unit, and all that is required for this is the necessary push-button mechanism, a strip of paxolin and a set of condensers. As reliability is important the latter must be of a type which will retain their capacity under all conditions met with in the normal home and good quality components should be obtained. The push-

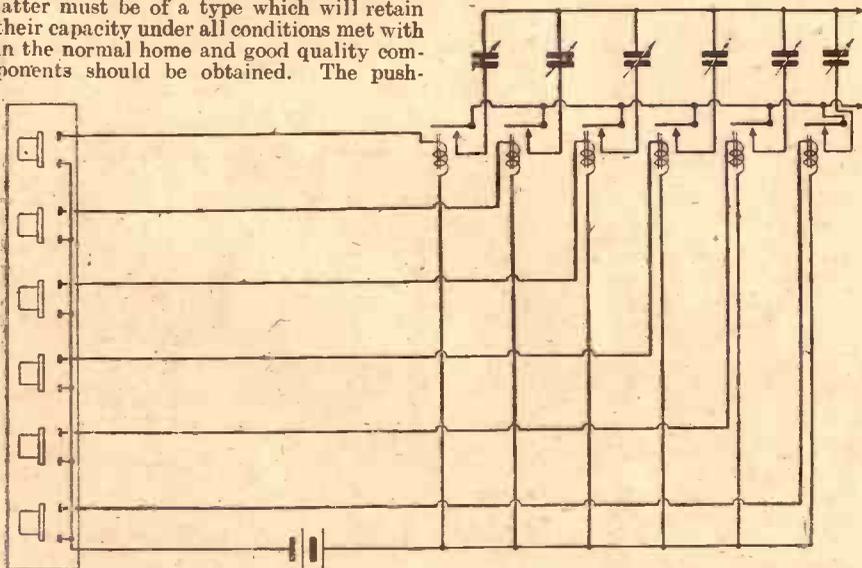


Fig. 5.—A remote control push-button unit, with relays for each station.

button mechanism may be obtained for a single circuit, two circuits or three circuits, and the number of condensers needed will thus depend upon the circuit with which the unit is to be employed. The complete assembly will be very compact, and may be included in most receivers without altering the layout or otherwise modifying the receiver.

### Simple Units

It will probably be found in most cases that the most convenient position is immediately above the ganged condenser, the valves or coils generally calling for a

receiver. With a very simple single-valve detector, the reaction condenser should be retained and automatic reaction by means of the push-buttons should not be attempted. The simple idea just described is, of course, applicable even to a superhet, provided that the suitable condenser values are selected for the trimmers. The capacities depend upon the coils in use and the stations which have to be obtained automatically, and some idea of the required capacities may be obtained by remembering that the normal condenser used for tuning has a maximum capacity of .0005 mfd. and thus by noting the

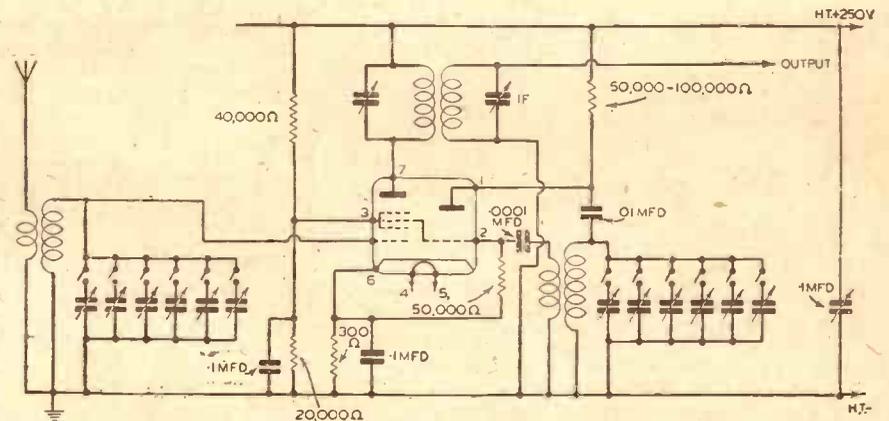


Fig. 3.—A superhet unit with push-button tuning in both circuits.

rather higher panel than is needed for the condenser alone. This is the best place for the unit as it should be wired to the condenser so that in the "manual" position the condenser is brought into circuit for tuning in the normal way. There will thus be a single lead for connection to earth, and one lead for each grid circuit in the

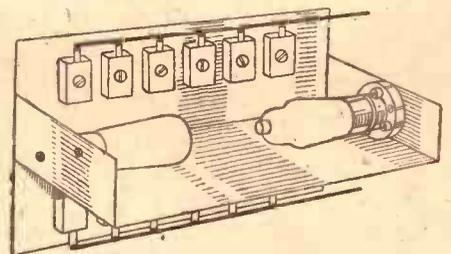


Fig. 4.—How to make up the units shown in Fig. 3.

position on the dial of the various stations a reasonable idea of the capacity required may be obtained.

### Superhet Unit

A more useful add-on unit is that wherein a complete superhet converter is employed, and this may be of the mains or battery type. If a mains unit is used, it is desirable to include an ordinary mains unit with it for the supply of the necessary L.T. and H.T. The circuit may utilise the modern triode-hexode or similar combination valve to reduce the over-all size, and by mounting this and the rectifier on their sides the overall dimensions of the unit may be kept down considerably. When a unit of this type is employed the receiver must, of course, be used as an I.F. amplifier with subsequent stages, and thus the output from

(Continued on following page)

ADD-ON TUNING UNITS

(Continued from previous page)

the unit is connected to the aerial terminal of the receiver and the latter is tuned to a long-wave setting—according to the I.F. which is desired. With this scheme, therefore, only one connecting lead need be employed, although for the sake of efficiency it is desirable to use an earth link between the unit and the receiver.

The unit may be assembled on sheets of paxolin bolted to the framework of the push-button unit and a general idea of the scheme is shown in Figs. 3 and 4. Modern small iron-core coils should be used and there is a wide range from which these may be selected. Care should be taken, if the coils or the unit are not screened, that interaction does not take place with coils or wiring in the receiver.

Remote Controls

A more ambitious and interesting scheme is to use the push-button tuning unit as a remote control device so that any number of stations may be selected from a distant point without having to go to the receiver to change the station. There are various ideas which may be adopted to enable this to be done, but probably the simplest is to use ordinary relays. Each condenser is joined to a contact as in the case of the push-button arrangement, but the circuits are made and broken by small relays—modified bell-magnets, or built-up head-phone magnets may be used. Each magnet is wired to a contact so that a lead may be connected for distant operation, and thus the extension lead will consist of a number of cables, one for each push-button, plus a return lead. One battery or voltage source will suffice, and many schemes offer themselves for the automatic resetting of each relay when a new station is required. The main idea is outlined in Fig. 5, and variations will present themselves to the keen experimenter. At the present time there are on the market a number of very good relays and associated contact apparatus which are in the nature of Government surplus—being dismantled from manual telephone exchanges and gear upon the changeover to automatic. These may be put to good use in the making of equipment such as that above indicated, but owing to the variations in apparatus and in individual preferences it is not possible to give any particular constructional details. It should be noted that the schemes mentioned are all of the trimmer condenser type of automatic tuning as this lends itself most readily to the modification, but systems in which the main tuning condenser is moved for each station may also be utilised, provided that means of carrying out the condenser movement may easily be added to an existing set. In most cases it will be found that this is not possible without considerable modification to the receiver design.

WIRELESS COILS, CHOKES AND TRANSFORMERS, AND HOW TO MAKE THEM.

Edited by F. J. CAMM.

2/6, or 2/10 by post from Geo. Neugebauer, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

RADIO CLUBS & SOCIETIES

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

DOLLIS HILL RADIO COMMUNICATION SOCIETY

THE following programme has been drawn up: October 4th.—Mr. A. Turner, M.I.R.E. (G2XO): Lecture on short-wave transmitters and receivers.

October 18th.—Mr. J. H. Walters, of Belling and Lee: Lecture and demonstration on the causes of interference, suppression at the source and receiver end, and proposed legislation.

November 1st.—Mr. D. N. Corfield (G5CD): Lecture on the alignment of superhetero.

All of these meetings commence at 8.15 p.m., and we shall be happy to meet any readers who would care to visit us, the place of meeting being Braintree Croft Schools, Warren Road, N.W.2. Membership fee is 2s. 6d. per year from the date of joining, and any further details will gladly be sent on request. Hon. Sec.: Mr. E. Eldridge, 79, Oxgate Gardens, N.W.2.

LONDON TRANSMITTING SOCIETY

THE winter season of this society began on Sunday, September 11th. Membership is open to all holders of A.A. or full transmitting licences, and application for membership must be made on QSL card.

A junk sale of transmitting gear will be held on Thursday, October 6th, at 8 p.m. Our new "Ham Shack" has a collection of all the latest amateur receivers, transmitters and test gear. We are centrally situated, and would be delighted to meet any readers of PRACTICAL AND AMATEUR WIRELESS and discuss their problems at club evenings. Meetings are held at the Secretary's QRA every Sunday at 11 a.m. and Thursdays at 8 p.m. A welcome is extended to all enthusiasts to come and see us, and our gear. Our QRA is 40, Eacburn Road, Edgware. Hon. Sec., G. Yale.

WORTHING AND DISTRICT SHORT WAVE CLUB

THE outdoor listening test, which should have been held on Sunday, September 18th, had to be cancelled owing to bad weather. Out of the 20 odd members of the club, six have A.A. licences, and one has his full licence. Morse classes are held every Monday at Alpine Nurseries, Harrington Lane, Durrington, Worthing, at 7.30 p.m. Beginners are welcome. All inquiries should be addressed to the Hon. Sec., D. Boxall, "Braeside," Greenlands Road, Durrington, Worthing.

ROMFORD AND DISTRICT AMATEUR RADIO SOCIETY

THIS Club has been very active lately concerning I.F. receivers.

G3FT is being pirated on 7mc CW. The pirate gives his QRA as Aston, near Birmingham, and is on about 7.145 kc/s. Club meetings are held every Tuesday evening at the Red Triangle Club, North Street, Romford, and anyone interested in radio is sure of a welcome at 8.30 p.m. The members include nine full G's, 15 A.A.'s and several SWL's. Morse practice is given to all who desire it by the members holding G calls. Sec., R. Bearlow (G3FT), 3, Geneva Gardens, Chadwell Heath, Romford.

B.B.C. MUSIC PROGRAMMES, AUTUMN, 1938

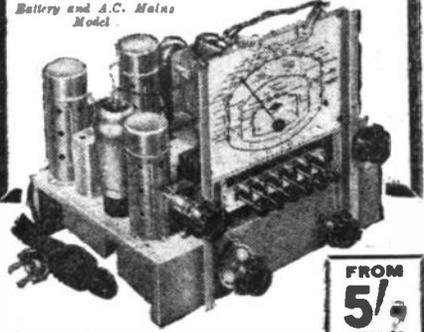
A NEW issue of the B.B.C. Music Programmes Pamphlet contains details of advance music programmes and other general information concerning music to be broadcast during the fourth quarter of 1938. The pamphlet includes details of the new series of Symphony Concerts; the Sunday Evening Concerts which will be devoted to orchestral and chamber music; and the most important "outside broadcasts," such as those of the Royal Philharmonic Society, the City of Birmingham Orchestra and the Hallé Society.

"B.B.C. Music Programmes, Autumn, 1938," may be obtained for 2jd., post free, on application by post to the B.B.C. Publications Department, 35, High Street, Marylebone, London, W.1, or for 2d. on personal application to Broadcasting House, Portland Place, London, W.1, or any B.B.C. Regional Office. Envelopes and postcards should be marked "Pamphlets" in the top left-hand corner.

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6-STAGE A.C. ALL-WAVE MODEL 909. Advanced 6-valve 6-stage A.C. superhet with built-in light-visibility output, 4 wave-ranges, 18-2,000 metres. A.V.C. Illuminated station-named calibrated dial. 6-tube station Press-button tuning. Manual tuning, 36:1 ratio, combined on-off switch and volume control. Tone control. Size 1 1/2 in. w., 9 1/2 in. h., 8 1/2 in. deep. Guaranteed, fully tested. Cash or C.O.D. Terms, 7/6 down and 18 monthly payments of 11/3. Matched speaker transformer, type 5274, 27/6 extra. £8.19.6

7-STAGE A.C. ALL-WAVE MODEL 908. Modern 8-valve 7-stage A.C. superhet with 3 wave-ranges, 18-2,000 metres. 6-tube station Press-button and manual (50:1) tuning. Illuminated station-named calibrated dial. Tone control. 4-position switch for 3 wave-bands and frame. 3 watts output. Guaranteed, fully tested. Cash or C.O.D. Terms, 7/6 down and 18 monthly payments of 10/-. Matched energised speaker, complete with transformer, £7.19.6 20/3 extra.

4-VALVE A.C. MODEL 905. 3 wave-ranges 18-2,000 metres. Station-named dial. 4-valve 5-stage superhet circuit. A.V.C. 3 watts output. 6-tube station Press-button and manual tuning. Volume and tone controls. Chassis size 1 1/2 in. w., 9 1/2 in. h., 7 1/2 in. deep. Guaranteed, fully tested. Cash or C.O.D. Terms, 5/- down and 18 monthly payments of 8/10. Matched speaker, complete with transformer, £6.19.6 19/6 extra.

7-STAGE BATTERY 4-VALVE MODEL 903. Wave-ranges and chassis size as A.C. model 905. 6-tube station Press-button and manual tuning. Station-named dial. Low H.T. consumption. Guaranteed, fully tested. Cash or C.O.D. Terms, 5/- down and 18 monthly payments of 7/-. Matched P.M. moving coil speaker, complete with transformer, 21/- extra. £5.12.6

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Easy-to-read station-name dial and general appearance similar to model illustrated. No push-button movement, but all-world reception provided by manual tuning. Easily fitted to existing cabinet at a fraction of the cost of a new complete receiver.

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7-STAGE A.C. MODEL 906. A powerful all-wave superhet. Radio gram chassis. A.V.C. Tone and volume controls. Output 3-watts. Complete with all valves. 6 gns. Yours for only 5/- down and 18 monthly payments of 7.11.

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# TelevIEWS

## Electron Microscope Improvements

THE usual form taken by an electron microscope is familiar to most readers of PRACTICAL AND AMATEUR WIRELESS. An image of the object to be magnified is focused on to a photo-electric cathode, and the electron image so formed is focused electron-optically on to a fluorescent screen, and the circuits employed enable the resultant image to be enlarged several diameters. This is satisfactory for many purposes, but occasions arise when the degree of illumination is insufficient, this being particularly so when very high magnification is essential. To meet this, the electron microscope has its fluorescent screen replaced by a mosaic screen very similar in character to an Iconoscope. The electron image directed on to this brings about the normal dis-

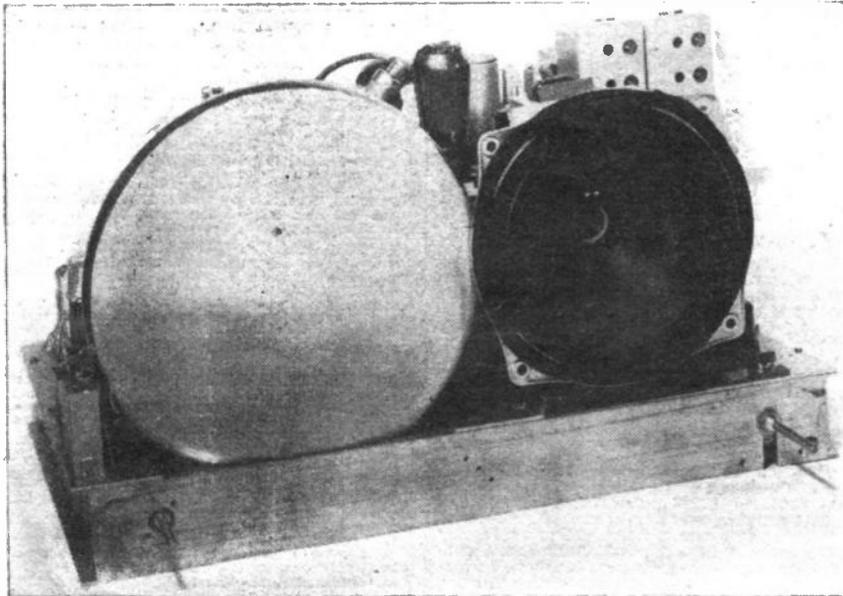
tributed condenser charge effect. This screen is then scanned by an electron beam, and the resultant signal output produced is fed to the control electrode of a standard cathode-ray tube. This produces a picture of the object under examination, and since the scanning beams are deflected by pulses generated by a single time-base, there are no synchronising difficulties.

## Compact Sets

The desire to make television receivers as compact as possible has manifested itself on the Continent as well as in this country. Many of the new British designs are astounding

possible to secure signals of adequate strength in that district from the present London station. This is to be regretted, for any work in this connection must inevitably bring about a close study of

base give control of sound volume and picture contrast. The brightness control is coupled with the contrast control, and is individually adjusted for each receiver, while the modulation control is quite automatic. There is a good measure of amplification provided, and it is claimed that an input voltage of half a millivolt from the television signal is ample to produce a satisfactory picture measuring 9in. by 8in. The output stage coupled to the control electrode of the cathode-ray tube is so designed that it is always possible to work the set at maximum brightness, and yet secure an adequate range of contrast in the picture tones. In spite of the short length of the C.R. tube, focus is good, and although the radio tuning is fixed for the broadcast band, it is possible to change the tuning coils. When used for sound only, the consumption is 100 watts, this being increased to 160 watts for combined sound and vision.



A modern Continental television receiver chassis giving radio, as well as television, in a compact form with only a single vision control.

ing when comparison is made with their two-year-old prototypes. Much of this compactness can be attributed to the new short type cathode-ray tubes which enable the tube to be mounted horizontally without an excess of cabinet depth. With this type of tube, operated magnetically in nearly every case, the deflection angle traced out by the scanning beam is very much greater than with the longer type tube. This means that the output of the time-base generator must be larger than before, but even so manufacturers have felt it worth while to make these changes. One very interesting Continental chassis design is shown in the accompanying illustration. Actually, this set is smaller than many standard wireless receivers being 23in. long, 14in. high and 14in. deep. In addition to television a radio receiver provides reception from the local medium-wave station, and the long-wave National station, a single switch with four positions giving this choice in addition to television and ultra-short-wave sound. Two further knobs seen at the two ends of the chassis

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## Provincial Requirements

Addressing a gathering of various representatives of the radio trade in Nottingham recently, a well-known television engineer, as a result of the questions he was asked, formed a fairly accurate idea of the requirements of the provinces in so far as television is concerned. Although looking forward anxiously to the day when the promised chain of provincial stations is opened, the general feeling of the meeting was that they were glad that London and the home counties had had all the teething troubles associated with the initiation of the B.B.C. service. On the other hand, little effort had been made to ascertain whether it was

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## GOODMANS LOUDSPEAKERS

The new booklet issued by Goodmans Industries, Ltd., is more than a catalogue, as it gives in detail the various processes involved in the production of a high-class speaker. The title of the booklet is "The Attainment of an Ideal," and it explains many of the mysteries of the modern speaker from the point of view of response and production. Several of the firm's model speakers are listed, and a set of curves is included showing the performance of speakers and

receivers. A copy of the booklet will be forwarded to readers on receipt of 1/6d. to cover cost of postage. The address is Laucelot Road, Wembley, Middlesex.

## BULGIN SERVICE MANUAL

THE 1938 edition of the Radio Service Manual has now been received, and may be obtained by readers price 1s. This has 79 pages devoted to all aspects of modern radio practice and includes 250 circuits and diagrams. The first two pages are devoted to useful tables and formulae, and the remainder of the book has each pair of pages devoted to a separate subject, one page of text and one of illustrations. The subjects covered range from adapters to test equipment and are all dealt with in alphabetical order. Fuses, decoupling, extension speakers, ganging, meters, switches and similar details are fully covered and every keen experimenter should obtain a copy of this interesting manual.

## VARLEY

THERE are 23 pages in the new Varley catalogue, and in addition to many existing components one or two new items may be noted. Among these may be mentioned the Permeability Tuned I.F. transformers designed for 465 kc/s and available in three patterns at 8s. and 8s. 6d. each. The catalogue gives details of coils, filters, power potentiometers, H.F. and I.F. chokes, power resistances, volume controls, L.F. and mains transformers.

## CURING PRE-DETECTOR INSTABILITY

(Continued from page 52)

Instability in an I.F. stage can, similarly, be caused by unsatisfactory connections between the windings and the associated circuits, so similar tests should be instituted. Pay particular attention, however, to the screening cans on the I.F. coils, since perfect shielding is often especially important in this part of the circuit. It might occasionally be found that the windings have slipped, or become damaged, so that the coupling between primary and secondary windings is too tight; that will produce serious instability in an otherwise perfectly stable receiver.

## Alignment

Should it be suspected that the trimming of an H.F.-detector receiver has been altered, careful re-setting should be carried out. In some cases the alignment should not be perfectly accurate on all of the tuning circuits, a slight discrepancy in one of them being intentionally allowed. Thus, it will often be found that stability can be completely restored, without loss of quality or sensitivity, by the simple process of moving one trimming screw—preferably that for the aerial coil when this proves effective—through a small angle.

With a superhet, instability in the I.F. circuits might indicate that the I.F. transformers are out of alignment. They should be checked carefully, and preferably with the aid of a tuned modulated oscillator. Another useful and comparatively inexpensive instrument for this purpose is the Bulgin I.F. liner, which consists of a neon oscillator fed from the A.C. mains and designed to give a steady signal which can be fed into the primary of the first I.F. transformer. Alignment is carried out in the usual manner, preferably with the aid of a visual tuning indicator or output meter.

## A.V.C. Line

When A.V.C. is provided, the feed resistors and by-pass condensers should be tested, whilst the action of the automatic volume control circuit can be checked by means of the visual tuning indicator where fitted, or by a milliammeter connected in the anode circuit of one of the controlled valves. In this case, the aerial should be connected and the receiver tuned to a few of the more powerful transmissions to see that the anode current actually does drop as a signal is tuned. If an A.V.C. feed resistor were open circuited it would generally mean that the grid circuit of the corresponding controlled

valve would be isolated from earth and therefore that the bias provided by the cathode resistor would not be applied to the valve. The result would be identical with that caused by a short-circuited bias resistor or condenser.

## TELEVISION IN THE U.S.A.

ACCORDING to the latest reports from the United States it seems quite certain that the television picture standard which will be adopted for the initial service in that country will be a line definition of 441 lines, 60 frames per second interlaced to give 30 complete pictures per second. The radio set manufacturers have not yet gone into production until certain improvements in the experimental transmissions have been carried out, but the engineers concerned are now busily engaged on this task. The new series of tests being undertaken by the National Broadcasting Co. at New York are expected to produce satisfactory reception within a 40- to 60-mile radius, but there seems little hope of going beyond this because of the very nature of the New York buildings themselves, and the configuration of the surrounding country. In addition to the work of the N.B.C. the Columbia system has announced its plans to install an ultra-short wave radio transmitter in the Chrysler Building tower of New York, with studios in another part of the city. If this materialises, the inhabitants of New York will have the choice of an alternative television program, and this should make a material difference in the market for home sets.

## "AND NOW"

THE B.B.C. recently issued a pictorial booklet of 32 pages dealing with television in a way it has never been dealt with before. The book is full of interesting pictures which tell the story, with a racy commentary, of all that television means to the viewers to-day.

"Television is obviously impossible"—runs the foreword, "but it is happening every day," and in the spirit of this lively statement, "And Now" shows page after page of exciting pictures taken at the camera man's elbow. We see the King and Queen as viewers saw them in the Coronation Procession; famous stage and screen personalities in the studio; television plays with the cameras in action.

The booklet is obtainable, price 8d. post free, from B.B.C. Publications, 35, Marylebone High Street, London, W.1. It can also be obtained at local B.B.C. offices.

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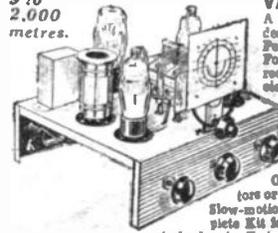
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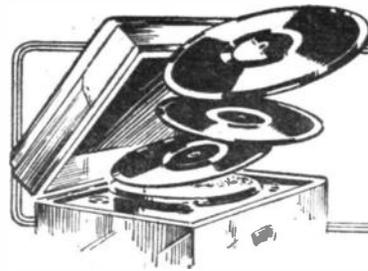
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# Impressions on the Wax

## A REVIEW OF THE LATEST GRAMOPHONE RECORDS

### H.M.V.

THE first complete recording of Schubert's Impromptus has this month been made by Edwin Fischer, who shares with Artur Schnabel the distinction of being a first-class interpreter of this composer's music—*H.M.V. BD 3484-9*. There is another delightful record by Kreisler of his famous "Liebeslied," coupled with another of his compositions, "La Gitana," on *H.M.V. DA 1629*.

A record that without doubt will be very popular is that by Anton and the Paramount Theatre Orchestra playing two famous waltzes, "The Skaters' Waltz" and "Over the Waves"—*H.M.V. BD 580*. Barnabas Von Geczy, one of the finest light orchestras on the continent, plays a tango, "The Wind has Told Me a Story" and "Kiss Serenade"—*H.M.V. B 8780*.

The film selection chosen by Louis Levy this month is that of "Joy of Living"—*H.M.V. BD 582*.

The name of H.M. Coldstream Guards Band will be welcomed by many. They play "Under the Double Eagle" and "Hands Across the Sea"—*H.M.V. B 8782*. The great American "swing" pianist, "Fats" Waller, who has just paid a visit to this country, "shows off" his pianistic ability in two of his own compositions, "Alligator Crawl" and "Vipers Drag"—*H.M.V. B 8784*, whilst Vivian Ellis, the pianist composer, has recorded selections from two new musical shows, "The Fleet's Lit Up" and "Running Riot," on *H.M.V. BD 584*. Reginald Foort's contribution to the list this month are two popular titles, Handel's "Largo" and the "Minuet" from "Berenice" on *H.M.V. BD 578*.

### Vocal Records

BENIAMINO GIGLI turns his attention to lighter music this month with "L'Ultima Canzone" and "Occhi di Fata," on *H.M.V. DB 3551*, and Elizabeth Schumann has made a most delightful record of the famous "Grinning" song by Benatsky, coupled with "Im Chambre Separee" from "Der Opernball," by Heuberger. Both songs are in Viennese style and the result is entirely charming—*H.M.V. DA 1651*. Paul Robeson's powerful voice is shown to great advantage in his record of "No More," a negro folk song, with a Portuguese song, "En can ta dora Maria" on the reverse side—*H.M.V. B 8781*.

Peter Dawson sings in very fine style what is often referred to as the only Australian folk-song, "Waltzing Matilda." With it is coupled a New Zealand song, "Waiatu Poi"—*H.M.V. B 8771*.

Noel Coward has chosen for his new record a number from the film "Joy of Living," entitled "Just-Let Me Look at You," whilst on the reverse side he has revived his own "Poor Little Rich Girl"—*H.M.V. B 8772*. The American variety star, Harry Richman, sings two numbers in characteristic style, "Say Good-night to your Old-fashioned Mother" and "You're

What's the Matter with Me"—*H.M.V. B 8774*. "The Girls who Work where I Work" and "Happy School Days" are the titles with which Max Miller continues his series of riotous records—*H.M.V. BD 583*. The Comedy Harmonists, whose records have so much appeal, have recorded two attractive light German numbers, "Now we'll Drink just one More" and "Die Der finusik" (The Village Band), the latter being very popular in Germany—*H.M.V. B 8779*.

### Brunswick

THIS month the Brunswick Company introduce a rather unusual type of disc known as Calypso records. Calypso singing is a feature of the West Indies and can perhaps be explained by likening the singers to the old Elizabethan Troubadours. The lyrics are based on everyday occurrences, and improvised to a simple melody, more or less impromptu. Thus a visit of a notability, the winning of a Test Match, a record-breaking flight will form inspiration for a new Calypso record. The first record is now issued—*Brunswick O 2624*—with the Caribbean Serenaders supplying the orchestra accompaniment. At first hearing you will find these Calypso records a little strange and perhaps uncouth, but they leave a lasting impression and eventually you will be entirely captivated by their originality.

### Decca

TWO albums are supplied by the Decca Company in their "Permanent Music" series, the first being the recording of the Britten Variations on a Theme of Frank Bridge, played by the Boyd Neel String Orchestra on *Decca X 226 to 228*. These three records are supplied in an album with a note by Henry Boys. The same band also play Handel's Concerti Grossi Nos. 7, 8 and 9 on *Decca X 132 to 137*, contained in an album with a note by Walter Yeomans.

The big hit tune of the moment, "The Lambeth Walk," which is a hilarious item in the stage show "Me and My Girl," has been recorded by Eddie Cantor with Ambrose and his Orchestra on *Decca F 6741*. On the reverse side are two popular tunes, "Little Lady Make Believe" and "Says My Heart." Eddie Cantor has also recorded "Making the Best of Each Day" and "That's the Kind of Baby for Me" on *Decca F 6748*.

On the vocal side we have "The Street Singer" singing "Somebody's Thinking of You To-night" coupled with "My Heaven in the Pines," on *Decca F 6730*. "So Little Time" (So Much to Do) and "You Leave Me Breathless," from the film "Coconut Grove," sung by Greta Keller with orchestral accompaniment, on *Decca F 6750* and finally that popular radio comedienne, Tessie O'Shea, singing two humorous numbers, "Don't Kiss Her in the Daylight" and "U-ra-li-a-tee-ay," on *Decca F 6758*.

# Leaves from a Short-wave Log

## The Maxim Memorial Station

TO commemorate the memory of Hiram P. Maxim, first President of the American Radio Relay League, a station has been opened at Newington (Conn.) which comprises five separate radio transmitters on short waves. Its cost, defrayed by voluntary donations and grants, has been roughly 18,000 dollars. It is to be used as the official mouthpiece of the A.R.R.L. for communications with all members of this association.

## More Spanish Stations in 40-Metre Band

F.E.T. No. 5 is the call of a Nationalist transmitter at Burgos (Spain) working nightly on 40.8 m. (7.353 mc/s) from G.M.T. 18.00. A news bulletin in the English language is given towards G.M.T. 19.00. At 21.00 a relay is carried out regularly of the programme broadcast by the Radio Nacional studio at Salamanca, but the station does not close down before midnight. The address announced for reception reports is: 52, Avenue de la Grande Armée, Paris (17), France. On 41.15 m. (7.295 mc/s) a station with the

call-sign EA3F1, styling itself *Radio Republicana Español*, works nightly between G.M.T. 18.30-19.30, and occasionally at other times during the evening.

## Madrid Again on Two Channels

IN addition to the regular programme broadcast through EAQ, on 30.43 m. (9.86 mc/s) through the Aranjuez transmitter, a programme may also now again be picked up on 31.65 m. (9.48 mc/s) emanating from the Vallecas station EAR, in the neighbourhood of the old Spanish capital. Nightly news bulletins given in various European languages are interspersed with a musical broadcast composed of gramophone records.

## Paris and Algiers

FOR the relay of radio programmes from the Radio Alger (Algiers) studio to the French state broadcasting stations TPZ and TPZ2, two transmitters situated at Alger-Eucalyptus are used; they operate on 24.75 m. (12.12 mc/s) and 33.48 m. (8.96 mc/s) respectively. On the other hand, broadcasts of the Paris P.T.T. news bulletins made to Algerian listeners through the local medium-wave station are transmitted through TPA2, Paris, on 33.19 m. (9.04 mc/s).

## English Talks from Prague

FOR news bulletins in the English language broadcast from Prague (Czechoslovakia), turn to the Podebrady transmitters, OLR4A, on 25.34 m. (11.84 mc/s) and OLR4B, 25.51 m. (11.76 m.). Special transmissions are made at G.M.T. 20.20 and 21.30 nightly.

# NOTES FROM THE TRADE

## Hum-Metrohm Tester

A NEW type of test instrument has been produced by Messrs. Everett, Edgumbe and Co., for insulation testing without the need of turning a handle. This is based on the vibratory-generator, utilising a small battery feeding an interrupter and transformer, whereby an output of 500 volts is obtained. This is rectified and smoothed, and a 3in. scale meter gives suitable indications of insulation and resistance, with a neon lamp as an indicator that the apparatus is functioning properly. The price is £7, and a special leather carrying case is available at 18s. The instrument weighs 3½lb. and measures 7in. by 5½in. by 3½in.

## New Car Aerials

THE Ward under-chassis and roof type car aerials are now available in improved forms at 10s. 6d. each. The new models have been designed to avoid troubles which might arise from vibration, and a high degree of signal input is claimed for the new under-chassis type. These are supplied by Microphone Equipment, Ltd., of 8, Charing Cross Road, London, W.C.2.

A series of aerials is also now available from R. Shipper and Co., of 18, Corporation Street, Manchester. 4, one being of the telescopic type for clipping on a bumper, and one of the under-chassis type. A further model is of the roof type, kept in position by suction cups. The telescopic type is chrome plated and can be extended from 3ft. 3in. to 5ft. 9in., and an 8ft. screened lead is supplied at the inclusive price of 22s. 6d. The under-chassis model is built into a pocket provided with straps and buckles for clipping on to the chassis, and this costs 17s. 6d. The roof model is also finished in chrome, and costs 22s. 6d.



**"GOOD AND BAD SETS**

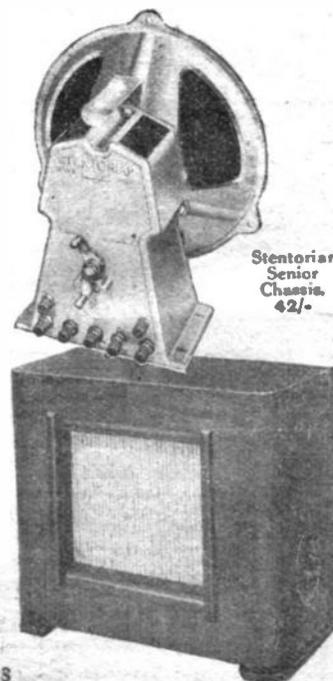
**WILL BE IMPROVED BY IT,"** says

**MR. F. J. CAMM**

Whether used as a rejuvenator of receivers, or just for extension speaker purposes, the current Stentorians will be a joy to their proud new owners for many years to come.

Even if only as a matter of interest, hear one at your local dealer's. You will agree with Mr. Camm that "listeners are fortunate in having at their command a speaker so sensitively responsive."

Chassis from 17/6. Cabinet models from 24/6, complete. "Long Arm" extension remote control, 15/6.



Stentorian Senior Chassis. 42/-

Stentorian Cadet Cabinet. 39/6 with constant impedance V/C



**Stentorian**

PERMANENT MAGNET MOVING-COIL SPEAKERS

WHITELEY ELECTRICAL RADIO CO., LTD., MANSFIELD, NOTTS

# IMPORTANT BROADCASTS OF THE WEEK

## NATIONAL (261.1 m. and 1,500 m.)

Wednesday, September 28th.—Band concert.

Thursday, September 29th.—Promenade Concert, from Queen's Hall, London.

Friday, September 30th.—No. 47398. Airman Harry Swift, feature programme.

Saturday, October 1st.—Sing Song, variety programme.

## REGIONAL (342.1 m.)

Wednesday, September 28th.—The Golden Wedding, a variety programme.

Thursday, September 29th.—Insurance Money: a comedy by George Shiels, from Northern Ireland.

Friday, September 30th.—Royalty Racquet, variety programme.

Saturday, October 1st.—Promenade Concert (Last Night of the Forty-Fourth Season), from Queen's Hall, London.

## MIDLAND (297.2 m.)

Wednesday, September 28th.—Landmarks in English Music: 3—John Fields, 1794.

Thursday, September 29th.—Music from the Gilbert and Sullivan Operas: orchestral programme.

Friday, September 30th.—Sociable Songs.

Saturday, October 1st.—Ploughing competitions at Moreton-in-the-Marsh: recorded commentaries.

## WEST OF ENGLAND (285.7 m.)

Wednesday, September 28th.—Agricultural Bee: Glos. v. Wilts.

Thursday, September 29th.—Melody Out of the Sky: dance band programme, from Regional.

Friday, September 30th.—Dance Cabaret from the Grand Hotel, Torquay.

Saturday, October 1st.—Eastward Ho!: a talk.

## WELSH (373.1 m.)

Wednesday, September 28th.—Our Very Own: The Humour of the Welsh, a talk.

## TELEVISION PROGRAMMES

### "London Wall"

A CROSS section of life in a solicitor's office, together with the hopes and fears of those who work there, will be portrayed in the presentation of "London Wall" to be televised in the evening of October 8th and the afternoon of October 12th. Production is by Michael Barry.

The play chiefly centres on Pat Milligan, the "baby" of the solicitor's firm, whose boy friend "Hec" Hammond works with the shipping agents on the floor above. Trouble arises for "Hec" in the person of Eric Brewer, the managing clerk who has set his cap at Pat Milligan. The presiding genius of the play is Birkenshaw, the office boy, a type whose neck is dirty, but whose outlook on life is Rabelaisian and to the point.

### Crystal Palace—Motor Racing

CRYSTAL PALACE will again provide a thrilling outside feature for viewers on October 8th.

On that Saturday afternoon a stern struggle will be fought out between the well-known motor racing "aces," Arthur Dobson and B. Bira, who is, of course, Prince Birabongse of Siam, while the Imperial Trophy Race will also be staged for British and Continental drivers. In both these events cameras will follow the progress of the cars as they hurtle round the track, and an effects microphone will be placed at each camera position to pick up the roar of the cars and convey the exciting atmosphere of such contests.

Thursday, September 29th.—Welsh International Golf Championship: a summary of the day's play from the North Wales Golf Club, Llandudno.

Friday, September 30th.—The Key to High Farming, a talk.

Saturday, October 1st.—Covered Court Tennis: Welsh Championships, a commentary on the Final of the Men's Singles from the Craigside Hotel Hydro, Llandudno.

## NORTHERN (449.1 m.)

Wednesday, September 28th.—An excerpt from the Arcadian Follies, from the South Pier, Blackpool.

Thursday, September 29th.—Between Houses, a variety programme.

Friday, September 30th.—Variety from the Manchester Evening Chronicle Radio Exhibition.

Saturday, October 1st.—Water Polo: an eye-witness account of the English Final at Rochdale.

## SCOTTISH (391.1 m.)

Wednesday, September 28th.—My Old Shako, 1888-1938, feature programme.

Thursday, September 29th.—The National Mod of the Highland Association, from Clachan Concert Hall, Glasgow.

Friday, September 30th.—An orchestral concert.

Saturday, October 1st.—Folk-songs of the North-East.

## NORTHERN IRELAND (307.1 m.)

Wednesday, September 28th.—Variety from the Grand Opera House, Belfast.

Thursday, September 29th.—Insurance Money, a comedy by George Shiels.

Friday, September 30th.—Irish Dance Music.

Saturday, October 1st.—The autumn programmes, a talk.

## NOTES AND NEWS

### Launching of the Giant Cunarder Queen Elizabeth.

AS with the Queen Mary, the speeches of Their Majesties the King and Queen were amplified to all the assembled crowds in Messrs. John Brown's Shipyard at Dumbarton on September 27th. This work was entrusted to the Marconiphone Company, principally on account of the outstanding success of their apparatus and work on the previous occasion. As before, His Majesty the King's Marconi microphone was available, as was also the special Marconi microphone reserved exclusively for the use of Her Majesty Queen Elizabeth.

## EVERYMAN'S WIRELESS BOOK

By F. J. CAMM

Wireless Principles and Fault Tracking simply explained.

3/6 or 4/- by post from Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2

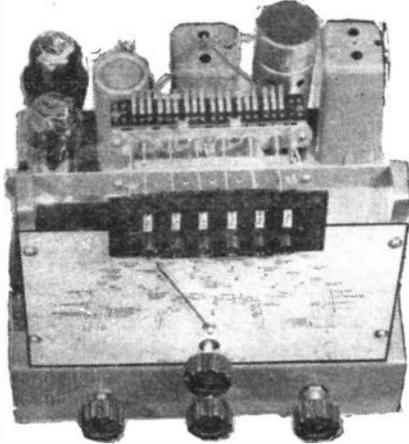


Mr. Neville Chamberlain, the Prime Minister, on his arrival at Heston Airport, after his historic flight to Germany for his talk with Herr Hitler at Berchtesgaden. Mr. Chamberlain is here seen addressing the crowd at the Airport. Note the television camera on the right recording the scene, and the operator, near the centre of the illustration, manipulating the microphone.

## ARMSTRONG 7-STAGE

All-Wave Radiogram Chassis incorporating Push-button and Manual Tuning, supplied complete with Bin. Matched Moving-Coil Speaker, model A.W.3PB. Price £7 18s. 6d. complete. Call at our Showrooms and hear this latest chassis.

Specification: New method of Push-button Tuning incorporating genuine Silver Mica Condensers to obviate station drift, principal Medium Wave Stations and Luxembourg can be obtained by the Push-button method. All latest refinements, including large Tuning Scale calibrated in degrees and station-names on all wavebands. Short-wave covers all principal bands from 15.9 to 50 metres. Volume and Tone Controls work on Gramophone as well as Radio. Pick-up Leads may be permanently connected. Moving-coil speaker made especially for chassis.



Packing and Carriage Free. 7 Days Trial. Carriage Paid. Armstrong 12 months guarantee. The above is only one of many attractive models and full details will be sent on application. 8 New Models, send for Catalogue. **ARMSTRONG MANUFACTURING Co.** 100, ST. PANCRAS WAY (Formerly King's Road), GARDEN TOWN, N.W.1 'Phone: GULLiver 3105.

## Engineers' Guide To Success

Write TO-DAY for this great Guide, containing world's widest choice of home-study courses in engineering covering all branches, including Radio, Television, Sound Reproduction, etc., and which alone gives the Regulations for Qualifications such as A.M.I.E.E., A.M.I.R.E., A.M.I.W.T., C. & G., etc. Training until Successful/Guaranteed.

**THE TECHNOLOGICAL INSTITUTE OF GREAT BRITAIN,** 42, Temple Bar House, London, E.C.4. (Founded 1917.) 20,000 Successes.

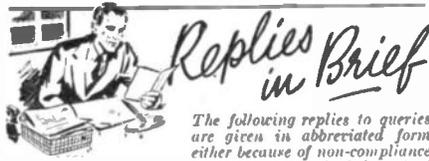


### FREE ADVICE BUREAU COUPON

This coupon is available until October 8th, 1938, and must accompany all Queries and Wrinkles. PRACTICAL AND AMATEUR WIRELESS, 1, 10, 38.

## Read all about the CIVIL AIR GUARD IN THIS WEEK'S FLYING

The New Popular Air Weekly Of all Newsagents and Bookstalls 3d. EVERY FRIDAY



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

**G. C. (N.7).** It would be desirable to decouple the screens, inserting a 1,000 ohms resistor in each screen lead, with a .1 mfd. condenser to earth. A 5,000 ohms decoupling resistance and a 1 mfd. condenser should also be included in the H.F. anode circuit.

**C. N. (West Wickham).** Resistances are shunted across the meter to increase the range of reading, and resistances are included in series so that voltage readings may be taken. The values depend upon the resistance of the meter, and a 1 milliamperage is generally taken. Full details have been given in past issues.

**F. S. (Leeds, 10).** We have no blueprints, but our latest book, "Transmitting for Amateurs," gives circuits and full details.

**G. W. J. (Amesbury).** As you can hear car interference it is obvious that the set is working fairly well and perhaps all your troubles are due to an inefficient aerial or earth system. We advise you to try and improve these.

**M. V. (Northolt).** The set is quite in order and the results already obtained prove that it is working. You are probably listening at the wrong times on the other wavebands or are not tuning carefully enough. A good aerial and earth is essential.

**St. G. (Bristol).** A .25 megohm potentiometer should be quite suitable, although if the transformer is a very good one a higher value could be employed.

**E. S. (Poole).** The firms in question issue their catalogues free.

**F. H. M. (E.17).** The switch in question could be used, and for the dial light a 6 volt bulb could be included in the heater supply. Alternatively a low-consumption mains bulb could be wired to the primary or input side of the set.

**A. G. O. (Ewell).** We regret that we do not publish any books on the subject. We suggest you write to Messrs. Foyles, who may be able to supply you.

**F. G. B. (Queenborough).** We could not solve the difficulty without a circuit or details of the wiring of the extension speaker. The trouble may not exist in the receiver, but in the extension speaker wiring.

**J. C. (Glasgow).** Use the Bulgin L.F. 10 as the original component is no longer on the market.

**P. S. W. (Coventry).** We have no particular blueprint or diagram we could recommend and can only suggest that you endeavour to follow one of the various articles we have published on the subject.

**G. T. (Chard).** If you examine the Blueprint or wiring diagram you will find that the three-point switch takes care of the point in question. The theoretical diagram shows the main principles only.

**F. W. S. (Carlisle).** We regret that we have not used one of the units in question and thus cannot supply a blueprint.

**M. C. (Filton).** We have no blueprint of the amplifier in question.

**G. L. (Little Hulton) and J. E. B. (Stoke-on-Trent).** We are sorry that we cannot publish your request as we should be inundated with similar requests and would need the whole of one issue for the purpose. A small advertisement would be your best plan.

**J. D. (Chelmsford).** If your diagram is correct you are short-circuiting your G.B. supply. The lead from the H.F. choke should be H.T. positive, not G.B. positive.

**J. D. B. (Aberdeen).** We have no blueprint, but the 2 1/2 watt amplifier published in our issue dated June 18th last should be suitable for your purpose.

**O. R. (nr. Hornsea).** We do not advise you to attempt to make do under the conditions mentioned. It would be better to wait and obtain a mains set.

**W. J. H. (Kenilworth).** We regret that we have no receiver using the coils in question and are thus unable to assist you in this particular case.

**A. E. W. (Leith).** The coils were not used in any of our receivers and the makers are now unable to supply details of connections.

**W. J. (Rushden).** The makers can supply details of the coils. Our Encyclopedia should be of interest to you.

**N. B. (Hull).** Without a maker's reference we cannot identify the coil. There are many different types and no standardisation of terminal disposition or numbering.

## BEFORE DECIDING ON YOUR 1938/9 RECEIVER OR KIT OF PARTS,

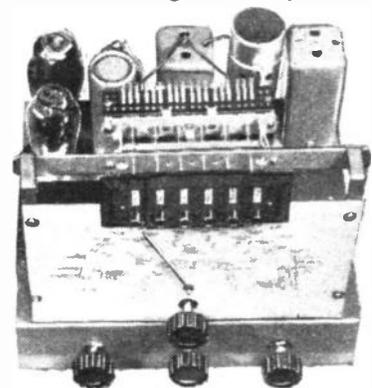


let us send Full Specifications & Price Lists of new 1938/9 Armstrong Models. Many refinements are incorporated in these Chassis, usually only found in more expensive sets.

**L.R.S.** EVERY offer carries this symbol in: (1) Fully Guaranteed (2) Sent Carriage Paid (3) Available for Immediate Delivery (4) On the Best and Lowest Terms

## WE ARE GIVING DAILY DEMONSTRATIONS OF THE NEW ARMSTRONG CHASSIS

from 10 a.m. to 5 p.m. It's well worth a visit—no obligation to purchase.



**ARMSTRONG PRESS-BUTTON CHASSIS** Model A.W.3PB, 7-stage A.I.F. WAVE Chassis. Manual and instantaneous Press-Button Tuning. Short waves from 15.9 to 50 m. Complete with Bin. Matched M.C. Speaker. CASH PRICE 12/6 with order and 12 monthly payments of 12/4.

**New ARMSTRONG 9-Valve All-Wave RADIOGRAM Chassis** Model A.W.9BPP, having Radio frequency Pre-Amplifier and 8-Watt resistance capacity coupled Triode push-pull output. CASH PRICE 18/- with order and 12 monthly payments of 17/3.

As above but including ROLA G.12 Loud-speaker, a combination which gives quality reproduction unsurpassed even by very high-priced receivers. CASH PRICE 34/- with order, and 12 monthly payments of £1.0.

**AVO-MINOR TEST METER**—the equivalent of 13 testing instruments in one. Measures Current, Voltage and Resistance with ease and accuracy. CASH PRICE 45/- or 5/- with order and 10 monthly payments of 4/6.

WE CAN SUPPLY or the most favourable terms available—all "PRACTICAL WIRELESS" Kits, all well-known sets, Radiograms, Speakers, Valves, Components, etc. Electric Clocks, Mires, Lamps, Cleaners and all domestic Electrical Equipment.

**CASH or C.O.D.** ORDERS DELIVERED BY RETURN OF POST. We can guarantee such prompt delivery only because we carry large stocks and, being placed so favourably, we are able to secure anything Radio or Electrical immediately.



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You'll get it QUICKER and on BETTER TERMS from L.R.S.

## PRACTICAL WIRELESS SERVICE MANUAL

By F. J. CAMM. From all Booksellers 5/- net, or by post 5/6 direct from the Publishers, George Newnes, Ltd. (Book Dept.), Tower House, Southampton Street, London, W.C.2.

# Practical and Amateur Wireless BLUEPRINT SERVICE

PRACTICAL WIRELESS		No. of	F. J. Camm's "Vitesse" All-	
CRYSTAL SETS.		Blueprints	Waver (5-valver) .. 27.2.37 PW75	
Blueprints, 6d. each.	Date of Issue		Mains Sets: Blueprints, 1s. each.	
1927 (Crystal Receiver) ..	9.1.37	PW71	A.C. £5 Superhet (Three-valve) .. 1.12.34 PW42	
The "Junior" Crystal Set ..	27.8.38	PW94	Universal £5 Superhet (Three-valve) .. 31.7.37 PW59	
<b>STRAIGHT SETS. Battery Operated.</b>				
<b>One-valve: Blueprints, 1s. each.</b>				
All-wave Unison (Pentode) ..	—	PW31A	"Qualitone" Universal Four .. 16.1.37 PW73	
Beginner's One-valver ..	19.2.38	PW85	<b>SHORT-WAVE SETS.</b>	
The "Pyramid" One-valver (HF Pen) ..	27.8.38	PW93	<b>One-valve: Blueprint, 1s.</b>	
<b>Two-valve: Blueprints, 1s. each.</b>				
Four-range Super Mag Two (D, Pen) ..	—	PW36B	Simple S.W. One-valver .. 9.4.38 PW88	
The Signet Two (D & LF) ..	24.9.38	PW76	<b>Two-valve: Blueprints, 1s. each.</b>	
<b>Three-valve: Blueprints, 1s. each.</b>				
The Long-range Express Three (SG, D, Pen) ..	24.4.37	PW2	Midget Short-wave Two (D, Pen) .. 27.8.38 PW91	
Selectone Battery Three (D, 2 LF Trans) ..	—	PW10	The "Fleet" Short-wave Two (D (HF Pen), Pen) .. 27.8.38 PW91	
Sixty Shilling Three (D, 2 LF (RC & Trans)) ..	—	PW34A	<b>Three-valve: Blueprints, 1s. each.</b>	
Leader Three (SG, D, Pow) ..	22.5.37	PW35	Experimenter's Short-wave Three (SG, D, Pow) .. 30.7.38 PW30A	
Summit Three (HF Pen, D, Pen) ..	—	PW37	The Perfect 3 (D, 2 LF (RC and Trans)) .. 7.8.37 PW63	
All Pentode Three (HF Pen, D (Pen), Pen) ..	29.5.37	PW39	The Band-Spread S.W. Three (HF Pen, D (Pen), Pen) .. — PW63	
Hall-Mark Three (SG, D, Pow) ..	12.6.37	PW41	<b>PORTABLES.</b>	
Hall-Mark Cadet (D, LF, Pen (RC)) ..	16.3.35	PW43	<b>Three-valve: Blueprints, 1s. each.</b>	
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-wave Three) ..	13.4.35	PW49	F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen) .. — PW65	
Genet Midget (D, 2 LF Trans) ..	June '35	PW1	Jarvo Flywheel Midget Portable (SG, D, Pen) .. 19.6.37 PW77	
Genet Midget Three (D, 2 LF Trans) ..	8.6.35	PW51	<b>Four-valve: Blueprint, 1s.</b>	
1926 Sonotone Three-Four (HF Pen, HF Pen, Westcoater, Pen) ..	—	PW53	"Imp" Portable 4 (D, LF, LF, Pen) .. 19.3.38 PW86	
Battery All-Wave Three (D, 2 LF (RC)) ..	—	PW55	<b>MISCELLANEOUS.</b>	
The Monitor (HF Pen, D, Pen) ..	—	PW61	S.W. Converter-Adapter (1 valve) .. — PW48A	
The Tutor Three (HF Pen, D, Pen) ..	21.3.36	PW62	<b>AMATEUR WIRELESS AND WIRELESS MAGAZINE</b>	
The Centaur Three (SG, D, P) ..	14.8.37	PW61	<b>CRYSTAL SETS.</b>	
The Gladiator All-Wave Three (HF Pen, D (Pen), Pen) ..	29.8.36	PW69	<b>Blueprints, 6d. each.</b>	
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen) ..	31.10.36	PW63	Four-station Crystal Set .. 23.7.38 AW127	
The "Oolt" All-Wave Three (D, 2 LF (RC & Trans)) ..	5.12.36	PW72	1934 Crystal Set .. — AW444	
The "Rapid" Straight 3 (D, 2 LF (RC & Trans)) ..	4.12.37	PW82	150-mile Crystal Set .. — AW450	
F. J. Camm's Oracle All-Wave Three (HF, Det, Pen) ..	28.8.37	PW78	<b>STRAIGHT SETS. Battery Operated.</b>	
1926 "Tri-band" All-Wave Three (HF Pen, D, Pen) ..	22.1.38	PW84	<b>One-valve: Blueprints, 1s. each.</b>	
F. J. Camm's "Sprito" Three (HF Pen, D, Det) ..	26.3.38	PW87	J.B.C. Special One-valver .. — AW387	
The "Hurricane" All-Wave Three (SG, D (Pen), Pen) ..	30.4.38	PW89	Twenty-station Loudspeaker One-valver (Class B) .. — AW449	
<b>Four-valve: Blueprints, 1s. each.</b>				
Sonotone Four (SG, D, LF, P) ..	1.5.37	PW4	<b>Two-valve: Blueprints, 1s. each.</b>	
Fury Four (2 SG, D, Pen) ..	8.5.37	PW11	Melody Ranger Two (D, Trans) .. — AW388	
Beta Universal Four (SG, D, LF, A, B) ..	—	PW17	Full-volume Two (SG det., Pen) .. — AW392	
Nickson Class B Four (SG, D (SG), LF, C, B) ..	6.1.34	PW34B	B.B.C. National Two with Lucerne Coil (D, Trans) .. — AW377A	
Fury Four Super (SG, SG, D, Pen) ..	—	PW34C	Big-power Melody Two with Lucerne Coil (SG, Trans) .. — AW388A	
Battery Hall-Mark 4 (HF, Pen, D, Push-Pull) ..	—	PW46	Lucerne Minor (D, Pen) .. — AW426	
F. J. Camm's "Lull" All-Wave Four (HF Pen, D, LF, P) ..	26.9.36	PW67	A Modern Two-valver .. — WM409	
All-Wave "Corona" 4 (HF Pen, D, LF, Pow) ..	9.10.37	PW79	<b>Three-valve: Blueprints, 1s. each.</b>	
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, C, B) ..	12.2.38	PW83	Class B Three (D, Trans, Class B) .. — AW386	
<b>Mains Operated.</b>				
<b>Two-valve: Blueprints, 1s. each.</b>				
A.C. Twin (D (Pen), Pen) ..	—	PW14	New Britain's Favourite Three (D, Trans, Class B) .. 15.7.33 AW394	
A.C.-D.C. Two (SG, Pow) ..	—	PW31	Home-built Coil Three (SG, D, Trans) .. — AW404	
Selectone A.C. Radiogram Two (D, Pow) ..	—	PW19	Fan and Family Three (D, Trans, Class B) .. 25.11.33 AW410	
<b>Three-valve: Blueprints, 1s. each.</b>				
Double-Diode-Triode Three (HF Pen, D, LF, Pen) ..	—	PW23	£5 5s. B.G.3 (SG, D, Trans) .. 2.12.33 AW412	
D.C. Ace (SG, D, Pen) ..	—	PW25	1934 Ether Searcher; Baseboard Model (SG, D, Pen) .. — AW417	
A.C. Three (SG, D, Pen) ..	—	PW29	1934 Ether Searcher; Chassis Model (SG, D, Pen) .. — AW419	
A.G. Leader (HF Pen, D, Pow) ..	—	PW35C	Lucerne Ranger (SG, D, Trans) .. — AW422	
D.C. Premier (HF Pen, D, Pen) ..	31.2.34	PW35B	Cosor Melody Maker with Lucerne Coils .. — AW423	
Ubique (HF Pen, D (Pen), Pen) ..	28.7.34	PW36A	Mullard Master Three with Lucerne Coils .. — AW424	
Aranda Mains Three (HF Pen, D, Pen) ..	—	PW38	£5 5s. Three; De Luxe Version (SG, D, Trans) .. 19.5.34 AW435	
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen) ..	11.5.35	PW50	Lucerne Straight Three (D, RC, Trans) .. — AW437	
"All-Wave" A.C. Three (D, 2 LF (RC)) ..	—	PW54	All-Britain Three (HF Pen, D, Pen) .. — AW448	
A.C. 1936 Sonotone (HF Pen, HF Pen, Westcoater, Pen) ..	—	PW56	"Wireless League" Three (HF Pen, D, Pen) .. 3.11.34 AW451	
Mains Record All-Wave 3 (HF Pen, D, Pen) ..	5.12.36	PW70	Transportable Three (SG, D, Pen) .. — WM271	
All-World Aco (HF Pen, D, Pen) ..	28.8.37	PW80	Single-tune Three (SG, D, Pen) .. — WM327	
<b>Four-valve: Blueprints, 1s. each.</b>				
A.C. Fury Four (SG, SG, D, Pen) ..	—	PW20	Economy-Pentode Three (SG, D, Pen) .. — Oct. '33 WM337	
A.C. Fury Four Super (SG, SG, D, Pen) ..	—	PW34D	"W.M." 1934 Standard Three (SG, D, Pen) .. — WM351	
A.C. Hall-Mark (HF Pen, D, Push-Pull) ..	24.7.37	PW45	£3 3s. Three (SG, D, Trans) .. — Mar. '34 WM354	
Universal Hall-Mark (HF Pen, D, Push-Pull) ..	9.2.35	PW47	PTP Three (Pen, D, Pen) .. — WM371	
A.C. All-Wave Corona Four ..	6.11.37	PW81	Certainty Three (SG, D, Pen) .. — WM389	
<b>SUPERNETS.</b>				
<b>Blueprints: 1s. each.</b>				
£5 Superhet (Three-valve) ..	5.6.37	PW40	Minutube Three (SG, D, Trans) .. — Oct. '35 WM393	
F. J. Camm's 2-valve Superhet ..	13.7.35	PW52	All-wave Winning Three (SG, D, Pen) .. — WM400	
F. J. Camm's £4 Superhet ..	—	PW58	<b>Four-valve: Blueprints, 1s. 6d. each.</b>	

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

Issues of Practical Wireless .. 6d. Post Paid.  
Amateur Wireless .. 6d. ..  
Practical Mechanic .. 7d. ..  
Wireless Magazine .. 1/3 ..

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Send (preferably) a postal order to cover the cost of the Blueprint and the issue (stamp over 6d. unacceptably) to PRACTICAL AND AMATEUR WIRELESS Blueprint Dept., George Newman, Ltd., Tower House, Southampton Street, Strand, W.1.C.

Class B Quadradyne (2 SG, D, LF, Class B) ..	—	WM344
New Class B Five (2 SG, D, LF, Class B) ..	—	WM340
<b>Mains Operated.</b>		
<b>Two-valve: Blueprints, 1s. each.</b>		
Consoelectric Two (D, Pen) A.C. ..	—	AW402
Economy A.C. Two (D, Trans) A.C. ..	—	WM28C
Unicorn A.C.-D.C. Two (D, Pen) ..	—	WM394
<b>Three-valve: Blueprints, 1s. each.</b>		
Home Lover's New All-electric Three (SG, D, Trans) A.C. ..	—	AW383
S.G. Three (SG, D, Pen) A.C. ..	—	AW390C
A.C. Pentaquester (HF Pen, D, Pen) ..	23.6.34	AW436
Shantovani A.C. Three (HF Pen, D, Pen) ..	—	WM374
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All Metal Four (2 SG, D, Pen) ..	July, '33	WM329
Harris' Jubilee Radiogram (HF Pen, D, LF, P) ..	May '35	WM388
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<b>Battery Sets: Blueprints, 1s. 6d. each.</b>		
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<b>Mains Sets: Blueprints, 1s. 6d. each.</b>		
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"W.M." Radiogram Super A.C. ..	—	WM386
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<b>SHORT-WAVE SETS—Battery Operated.</b>		
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<b>Three-valve: Blueprints, 1s. each.</b>		
World-ranger Short-wave 3 (D, RC, Trans) ..	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen) ..	30.6.34	AW438
Experimenter's Short-waver (SG, D, Pen) ..	Jan. 19. '35	AW463
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# LETTERS FROM READERS

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

## Received on the "Simplest" Short-wave Two

SIR,—I recently constructed your "Simplest" Short-wave Two, and when I tried it out I could not have wished for better results, as you will see by the accompanying 14 mc/s log.

Americans received were: W1BKY, W1AIQ, W1AVK, W1HAY, W2KDD, W2FJ, W2GK, W2DA, W3CNY, W3EWW, W3FAM, W3FJU, W4EPZ, W4ALD, W4ALP, W5JT, W6OI, W6OAH, W8KML, W8QUL, W8REY, W9FEY, W9NGZ, W9TOO.

Others were: VE1FG, VE1NU, VE1BA, VE2GK, VE2BO, VE3MD, VE3NF, VE3QJ, VE5ACN (Canadians). PY1BJ, PY1GK, PY2BA, PY2LM, PY4TT, PY3CG (Brazil). COGJJ, COTWD (Cuba). SU1KG (Egypt). VQ4KT, VQ4JB (Kenya). LU8AB (Argentina). KA7EF (Philippine Is.). All these amateurs were received at very good 'phone strength, and several were received on the speaker. These have all been logged in the last two or three weeks, and I have also heard commercial stations from most of the European countries, including Japan, Cuba, and South America. I think this is a wonderful set and I am very pleased with the results obtained.—FREDERICK HARWOOD (Bathampton, Somerset).

## A Good 20-metre Log

SIR,—Conditions on 20 metres have improved so much lately that I append some of the best 'phone transmissions logged here. The receiver is a battery one-valve, using a triode detector, and a half-wave antenna pointing east and west.

K6OQE, K6NZQ, K6BNR, VR6AY, VE5ACN, VE5JK, VE5OT, VE5EF, VE5ABD, VE5NY, W7BVO, W7FEZ, W7EOI, W7EQY, HR5C, TG9AA, NY2AE, TI3AV, K4EMG, VP5IS, CO2LY, YV5ABY, HC1JW, HC1FG, PY4BT, PY2CK, PY1GU, LU4BC, LU8AB, LU4AW, CX2AK, HI3N, OQ5AQ (Belgian Congo), VQ4KTZ, ZE1JA, VQ2HC (Northern Rhodesia), ZS1AN, ZS6AJ, ZS6FB, ZS6S, PK1MX, PK2WL, PK4DG, PK1ZZ, VU2CQ, VK2AXA, VK2YG, VK2IQ, VK2NS, VK3KX, VK3WA, VK3PE, VK3BM, VK3HG,

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

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VK3ZL, VK6MW, TF3C (Iceland). Also W6NYD (portable in Honolulu). A QSL card was received in July from VR6AY (Pitcairn Island), giving a brief description

of the island, a miniature map of the Pacific giving its position, and a small photograph of the operator's equipment donated to him by American radio manufacturers. Best wishes to your paper.—P. YEATES (Bedford).

## Correspondent Wanted

SIR.—I wish to get in touch with any reader of PRACTICAL AND AMATEUR WIRELESS, about 17 years old, who is interested in amateur reception. My receiver is a B.T.S. Trophy 5, used with a 20ft. indoor antenna, and listening is done both on headphones and on the built-in speaker. All the amateur bands from 1.7 to 28 mc/s are covered, and I hope soon to operate a receiver on 56 mc/s.—S. W. SALT, 4, Chumleigh Walk, Surbiton, Surrey.

**LET ME HELP YOU INTO A KEY POSITION**

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# QUERIES and ENQUIRIES

Perhaps you could give me some idea of the best lines to adopt."—R. C. (Dublin).

If two pick-ups or mikes are to be used, and it is only desired to fade out any one and bring in another, a centre-tapped potentiometer control may be employed. The centre-tap is earthed, and the separate mikes or other instruments are joined across each half of the control. The arm is joined to the grid and thus each input may be faded and brought in as desired. For true mixing, two separate controls will have to be used, and the lower end of one should be joined to the arm of the second. If the mike or pick-up is then joined across each control the inputs may both be reproduced together in any desired strength and this gives true mixing. It is also possible to obtain this effect merely by connecting the

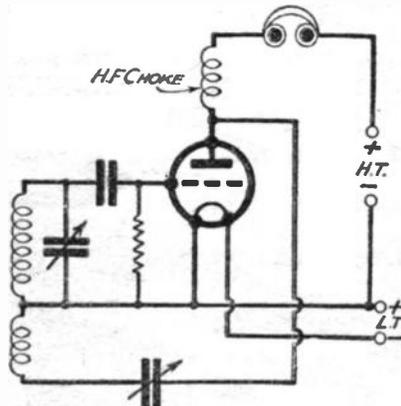
## Sprite Three

"I have been looking through some back numbers for a circuit to build, and am rather puzzled regarding the Sprite receiver. In this you use an aerial and an H.F. transformer, and in both cases primary and secondary are switched for wavechanging. The switching appears to be carried out with a single multi-contact switch, with an earthed spindle or shorting bar, and it would appear on the face of it that this will short-circuit the H.T. through the primary of the H.F. transformer. Perhaps you could explain this point to me."—H. R. E. (Crewe).

If the switch had a single contact or a shorting bar your remarks would be correct. However, the type of switch which was employed has the spindle divided into two sections, so that each is isolated. Therefore, it is possible to switch H.T. and other circuits without introducing short circuits, but if an alternative switch is employed you will have to take care of this point.

## Short-wave Receiver

"I wish to start short-wave listening and wonder if it is possible to say what is the most simple and reliable set for use down to 10 metres. I have had no previous experience



The simplest circuit for a beginner in short-wave reception.

in set building but now wish to take up set making and experimental work."—G. J. (Croydon).

In view of the fact that you have no experience, we think the most reliable set would be the simple one-valve reacting detector. A super-regenerative or other circuit would probably be found difficult to make and adjust to get maximum results, whilst the simple detector stage does not call for any particular skill in building or in operating.

## Pick-up Mixing

"In the amplifier I am building I want to be able to mix the outputs from two mikes. I have seen many different suggestions but am not clear what is the best scheme to adopt. The amplifier is to be used with gramophone pick-up as well as mikes.

## RULES

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

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

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

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

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two instruments and volume controls in parallel, but the former method is to be preferred.

## A.V.C. Circuit

"I have added A.V.C. to my receiver with not very successful results. I attach a circuit showing how I have effected the change and should be glad if you could indicate why this fails to work properly."—R. B. A. (Queenborough).

The circuit shows that the A.V.C. line is fed to all valves without any decoupling. You will find it desirable to decouple each circuit on this side, connecting the by-pass condenser direct to the lower end of each coil and transformer and to the nearest earth point. The decoupling resistance should also be joined direct to the coil or transformer and then the lead taken to the A.V.C. circuit. We think this will cure the trouble you are experiencing.

## Pyramid One-valver

"Could you please let me know the price of the components or the complete kit for the Pyramid One-valver, less the headphones and batteries, but including the chassis and panel?"—A. H. (Heybridge, Nr. Maldon).

Kit "A" for the receiver in question costs 47s. cash, or 4s. 6d. down and 11 monthly payments of 4s. 6d. Messrs.

Peto-Scott include in the Kit "A" the chassis and all specified parts with connecting wire, screws, etc. The valve, 'phones and batteries are separate.

## Checking Ganging

"I am in doubt concerning the accuracy of the ganging in my four-valver and wonder if you can suggest any simple method of testing without going to the trouble of obtaining an oscillator or output meter. Surely there is some simple little dodge which may have originated in your pages and which could be used by others like myself who wish to check their receiver."—A. F. R. (Bolton).

A GOOD suggestion is to use a differential condenser, the moving plates of which are joined to earth and the fixed plates of which are joined to each section of the condenser. Then, if both sections are accurately trimmed or matched all stations should be received with the moving vanes of the differential condenser in a central position. If on any station a readjustment of the extra condenser is required, it will indicate that the two sections are not balanced. If more than two circuits are in use a single condenser may be used as the test unit, and it may be joined to each section of the gang condenser in turn to see if any readjustment is needed.

## H.F. Stages

"I am not in favour of the superhet circuit and am thinking of building a straight receiver with two H.F. stages. I believe these are rather tricky to build and get operating properly, and wonder if you have any designs or can give me any information to enable me to design a really efficient set. I have built many sets before, but this is the first time I have thought of trying two really good H.F.'s."—L. W. (Watford).

WE could not give all of the main points in the form of a reply, but think the best plan is to advise you to read the article on the subject which was published in our issue dated July 16th, last. You could, of course, follow the design of the Admiral 4-valver, recently published, but if you wish to build to your own ideas the various principles underlying the design of efficient H.F. stages should be studied in the article in question.

## H.F. Gain Control

"I am contemplating adding another H.F. stage to my H.F., Det., L.F. mains set and would like advice on how to arrange the H.F. gain control. At present this is a 5,000-ohm variable resistor in the cathode lead of the variable-mu H.F. pentode. In the new arrangement should this control the first H.F. stage or both?"—K. M. (Leicester).

THEORETICALLY it should only be necessary to control the first valve as this will then prevent troubles due to overloading. In practice, however, it is often desirable in a case such as this to link the two cathodes (with suitable decoupling components) and control them together. It is also possible to leave the control on the second valve and use an aperiodic first stage, but the exact arrangement will depend upon the results you desire from the receiver.

The coupon on page 69 must be attached to every query.

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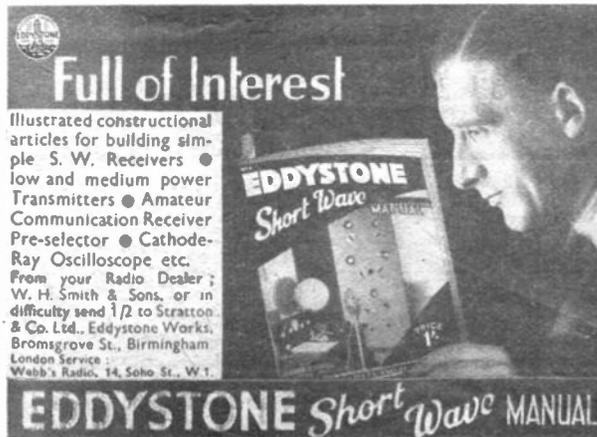
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