SPECIAL XMAS DOUBLE NUMBER.

REGISTERED AT THE G.P.O. AS A NEWSPAPER

POPULAR WIRELESS

No 600
Vol. XXIV
Dec. 2nd 1933

CONTENTS INCLUDE:

FULL HOW-TO-MAKE DETAILS OF THE "DOUBLE X" 3

The First Set to Use the New "P.W." Contra-Phase System.

RESENTS THAT PLEASE

AN ILLUSTRATED REVIEW OF THE SEASON'S RADIO APPARATUS.

MY RADIO INVENTIONS

By LEONARD HENRY

ETC. ETC., ETC.

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Price 69/6. Write for free catalogue.

Advertisement of Jackson Bros. (London), Ltd., 72 St. Thomas' St., London, S.E.1. 'Phone: Hop. 1837.

A RADIO EXPERT FOR 12/6

The SHERLOCK HOLMES of RADIO

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The "All-in-One" Radiometer is sold at all good radio shops.

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The "All-in-One" Radiometer solves every radio problem, traces any trouble and ensures 100% reception at all times from any battery-operated radio set. Yet it costs only 12s. 6d. Isn't that a very small price to pay for such service? There's no instrument in the world at anywhere near the price which makes all the tests the "All-in-One" Radiometer makes. You can't afford to be without one—it will save you pounds a year.

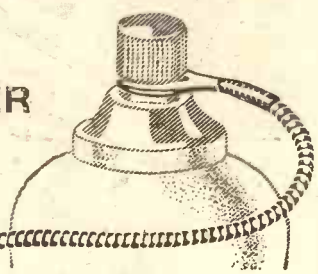
PIFCO ALL IN ONE RADIOMETER

℗R.5.

John Scott Taggart says

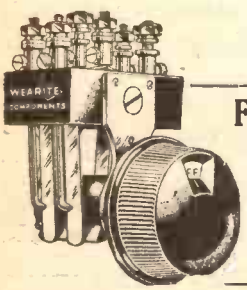
WEARITE COMPONENTS

FOR THE S.T. SUPER



Whether you are building the "S.T. Super" or the "S.T. Radiogram" Mr. J. Scott-Taggart recommends you to use these Wearite components.

Downright reliability, and a long-standing reputation for efficiency have guided his choice . . . follow "S.T." and be sure.



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The Wearite "I" series of rotary switches comprises the following:—

I 21 — 1-way	3/3
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The H.F.P.CHOKE 3/6

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Self-capacity 45 m.mfds.
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To Messrs. **WRIGHT & WEAIRE, LTD.,**
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Please send me Full-size Blue Print, together with full constructional details for building the "WEARITE TEAMSTER" up-to-the-minute 4-valve receiver. Also include copy of your NEW booklet of Components (P.12) and literature on Class "B" amplification. 3 penny stamps enclosed to cover cost and postage.

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Please send me a copy of Booklet 87 telling me how to convert my Battery Set to Mains Operation with an "ATLAS" Unit.

Name .....

Address .....

ATLAS
MAINS UNITS

CLARKE'S ATLAS

Φ14

ASK YOUR DEALER — HE KNOWS

POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
Technical Editor: C. V. DOWDING, Associate I.E.E.
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Chief Radio Consultant: P. P. ECKERSLEY.
Assistant Editor: A. JOHNSON-RANDALL.
Chief of Research Dept.: K. D. ROGERS.

XMAS AGAIN
P.O.'s LATEST
THE LIGHTNING BOGEY
CAR RADIO

RADIO NOTES & NEWS

POOR PIRATES
THIS TELEVISION
HOMING PLANES
LIVING LANGUAGE

Christmas Greetings.

A HAPPY CHRISTMAS to you, sir. Again it falls pleasantly to my lot to write the opening words of a Christmas Number of "P.W.," and I like to start with that time-honoured evergreen wish, coupled with the name of Young 1934.

May he be a good year for you and yours, and may all your input of Christmas hopes be exceeded by an output of amplified happiness that will keep your heart warm till *next* Christmas.

Anyway, you've got a fine Christmas Number of "P.W." in your hands to start with.

A Fine Issue.

I WON'T call your attention specially to any particular features of this week's number, because you will find it *all* good. But I am going to take this annual opportunity of saying how greatly I enjoy writing these weekly Notes to you.

Somehow, instead of just gathering readers, "P.W." seems to have established a host of friends—which is a much greater achievement. And so it is with special warmth that I give you all the Season's Greetings.

Repetition with a Difference.

DURING the Marchese Marconi's recent visit to the U.S.A. our American friends staged a very wonderful drama, based on Marconi's immortal three dots of 1901 which he received in Newfoundland from Poldhu on his kite aerial.

On this later occasion the inventor himself tapped out the three dots, which were then relayed from Chicago to New York, Rome, Berlin, Manila, Shanghai, San Francisco and thence back to New York, where, on a "sounder," Marconi heard them fit and well after their long journey. An artistic finish was given to the demonstration by causing the three impulses on their return to fire an aerial bomb!

Combating Interference.

LITTLE by little the various authorities are massing their forces against the common foe, "interference." The latest move is by the Post Office, which is providing all its offices with questionnaire forms on which listeners may describe their reception-troubles.

THE PAST

1933 has been yet one further year of great achievement for "Popular Wireless." Every worth-while radio development was introduced first by "Popular Wireless." In this journal you have had placed before you the FIRST Westector sets, the FIRST sets to use all the new valves such as Multi-Mu Pentodes, Double-Diode Triodes, Catkins, Double-Diode Pentodes, Class B, etc., etc. It was also "P.W." which described the first home-constructor's Cathode Ray Television and inaugurated the great National 5-metre Tests from the Crystal Palace and the International Quality Tests from Lisbon. Further, it was "Popular Wireless" which, in 1933, designed the only set ever to be praised by the whole of the British Radio Industry.

THE PRESENT

Indisputably the set which is being most widely built at the present time is John Scott-Taggart's great "S.T.500," which was exclusively described in "Popular Wireless.

In this, "P.W.'s" special Christmas Number, full details appear of a receiver incorporating a completely new circuit development, the Contra-Phase, which was entirely developed in the "Popular Wireless" Research Department.

THE FUTURE

Every successive year of triumph brings its full quota of tangible proof that "Popular Wireless" never rests on its laurels. What will it achieve in 1934? Where goes radio in 1934? For, whatever direction the march of progress takes, "Popular Wireless," by the unremitting effort of its unique consultative and permanent staff, is determined to remain, as always, at the very head of the column.

In the meantime, we offer our sincerest wishes for a right Merry Christmas to our readers, for it is by their appreciation and continued support that we are stimulated to further accomplishments.

THE EDITOR.

These forms are then to be sent to the Post Office Engineering Department through the local sectional engineers. In instances in which the cause of the trouble is shown to be a domestic appliance the owners will be advised about anti-interference devices.

Lightning and Sober Fact.

FROM the recent annual report of the Royal Meteorological Society I observe, in connection with summer thunderstorms, that the only tree struck by lightning of which a full account is available was being used as a wireless pole.

The radio set was uninjured, though the lighting fuses were "blown." One wireless pole which was struck is referred to. The set was properly "earthed" and undamaged.

Apparently aerials supported by trees are not thereby rendered especially liable to be struck, and, if they *are* struck, are not in danger if they are "earthed."

Radio off the Rails.

BECAUSE of the demand of the Performing Right Society for copyright fees the London and North-Eastern Railway has ceased, for the present, to give facilities for radio reception to passengers on its express trains, though it will continue to give reproductions of gramophone records for twelve months under an agreement.

A nice little cabaret show in the restaurant car, brighter menus, bigger towels, real soap—some of these might with advantage be supplied as well as earphones, I think.

"Car-Radio Pioneer."

WITH reference to this heading in our issue of August 5th, Mr. Don. B. Knock, Technical Editor of an Australian contemporary, states that early in 1923 he demonstrated a radio-fitted 7-seater to the Japanese Legation in London. The equipment comprised transmitter and receiver for C.W. telegraphy and telephony.

But this was for military work, and on that basis the Marconi Co. beats him by many years, I should say. Did any

(*Continued on next page.*)

ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

reader have his private car fitted for private radio earlier than 1923 ?

Poor Polish Pirates.

THE new regulations of the Polish Ministry of Posts, Telegraphs and Telephones provide the richest treat for convicted radio "pirates" that I have ever noted.

The offenders are liable to three months' imprisonment, a fine up to £70, confiscation of their receivers and the payment to the Post Office of a sum equal to six times the monthly licence fee. I hope that the sin-stained, crime-laden wretches are allowed to keep their boots and waistcoats !

This Television.

REALLY ! One feels "all at sea" over this television business. Heaps of talk, trials, transmissions and so forth, but still the desired result is "somewhere behind the ranges." Research and experiment go on unceasingly in every country in the world (I speak figuratively), and yet, in that forward-reaching land of America, the Federal Radio Commission commits itself to this statement :

"Many improvements are necessary before television will be entertainment." The Commission says that improvements in scanning must be made, and that pictures of one or two faces will not interest a public which is accustomed to modern films.

Radio on Rollers.

IN their search for novelty the Americans sometimes hit on the most unusual ideas. For example, early this month WJZ sent an announcer out into Central Park, with roller skates on his feet and a portable transmitter on his back, just to comment on Central Park and skating. Evidently the inspiration fountain is not working any too well !

This craze for "the stunt" at any price is reminiscent of a child who constantly demands new toys, which it discards as soon as it has tasted the paint on them. Can you imagine the B.B.C. offering a rolling announcer to Great Britain ?

"Got Him !"

AN esteemed American correspondent writes: "Justice still pursues with leaden feet. But if we cannot get 'crooners' for their chief crimes we can put them away for lesser offences."

He referred to a versatile radio "crooner" of Indiana who was recently sentenced to ten years of the best for taking part in a bank "hold-up." Possibly the part which he played was to "croon" to the nearest policeman until that official, all discipline forgotten, chased him for nine blocks, thus leaving the coast clear for the other conspirators !

New Radio Organisation.

FOR the new air route between Spain and the Canary Islands a very comprehensive radio organisation is in course of preparation. The aircraft will work on the wavebands of 40–80 metres and 500–1,000 metres.

The Canary Islands airport at Gando, Las Palmas, will be equipped with the very latest type of apparatus, including direction-finders.

The Madrid aerodrome short-wave plant will be a duplicate of that of Gando, and the intermediate station at Seville will for the time being work on medium waves. All this should interest the discriminating explorer of the ether.

SHORT WAVES

Good King Wenceslas was murdered nearly a thousand years ago. And the wireless has now made it possible for history to repeat itself every Christmas.

* * *

"Record Wireless Jam Coming."—Poster of daily paper.

The stoneless variety has already made a smoother thing of life.—"Punch."

* * *

Rheumatics are people who have short circuits in their sockets.—"Answers."

* * *

IGNORANT.

The novice who wanted to know what note to listen for when his friend started tuning in his new wireless set.

* * *

Radio Expert : "What on earth are you grinding up that copper wire for ?"

Radio Novice : "Well, I'm putting in my radio set, and it says here that good ground wire is the most important thing about the installation."

* * *

We understand that since the mislaying of Mr. J. B. Priestley's manuscript thousands of alarmed listeners-in have written to the B.B.C. imploring them to place a special guard on the Fat Stock Prices.—"Punch."

* * *

A Cheltenham reader writes to us asking if we can help him to locate the sepulchral noises which issue from his loudspeaker.

We would advise him to attend to the vaultage.

"Homing" Device Tried Out.

THE Marconi-Robinson "homing" device for aircraft was tried out by Mr. Grierson, the well-known British aviator, during his northern survey flight last summer, and proved its great value to aviators flying near the Magnetic Poles, or in fog or blind flying.

This device enables the pilot to tell whenever the nose of his aeroplane ceases to point exactly in the direction of the place to which he is flying, the only essentials being that the "place" shall be transmitting any kind of radio signals and that the plane is receiving them.

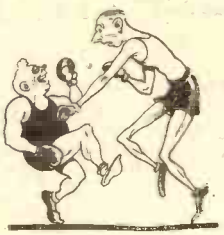
Mr. Grierson Speaks.

BAD weather was encountered between Thorshaven (Faroe Islands) and Reykjavik, Iceland, and about 50 miles from Reykjavik the "homing" device was switched on. "I could hear the specially slow signals which I had asked Reykjavik to transmit, and with growing confidence . . . I struck inland.

"The mountains ahead were covered in cloud, and as I drew near to them I saw the needle of my compass begin to swing off, owing to the magnetic disturbances for which Iceland is famous. Under such conditions no pilot . . . could have dared to have ventured out of sight of the ground, but with the Marconi-Robinson 'homing' apparatus to guide me I did not hesitate to climb straight into the cloud."

How a Language Grows.

ALTHOUGH my boxing days are over, I dearly love to see boxing matches between Territorial regiments and between schools ; they fight for glory alone and incidentally learn temper control. Recently I saw some senior schoolboys at fistic warfare, when one short, fat lad was matched against a tall, thin one—what we used to call "six feet of gaspipe."



The long 'un walloped the fat 'un to all points of the compass, but to his disgust Fatty always came up smiling for more. After winning on points the human skeleton said indignantly to the world in general : "Knock him out ? *Why, he's a blithering Catkin !*" Thus does a language acquire new words.

Can It Be Reversed ?

IT is freely reported that someone has invented a device which automatically switches off the radio receiver when the telephone receiver is lifted. Interesting ! If Bach bores you, ring up the B.B.C. and say so.

But what I want to know is, can the gadget be put into reverse, thus muting the telephone bell while one is listening in ? "Sorry I can't get your number. I expect Mulberry Hill 1404 is listening to the Western Brothers !"

Life in Our Empire.

A MAN who is home on leave from one of our African colonies was complaining to me that his sleep was disturbed by jackals, etc., who quarrelled over his domestic trash-can at night.

He said that, after having sweated at the local broadcasting station till 10.30 p.m., it was a bit thick to be awakened at 2 a.m. by howls which reminded him only too vividly of the amateur soprano who, a few hours before, had insisted on singing in Italian opera.

I have advised him to procure a very vocal jackal and let it broadcast as Mimi ! I am sure that the Swahili would love it.

ARIEL.

VOICES from EUROPE

Xmas Greetings from your Friends of the Ether

BEROMÜNSTER.

(Schweizerischer Landessender).

"From Switzerland, the island of peace, do we send deeply-felt Christmas greetings and the strong hope for peace into the world.

LEO HELD."

(Swiss National Transmitter, Beromünster).

PRAGUE.

(From the chief man announcer).

"Pleasant Christmas to 'Popular Wireless' readers, and many presents to all.

FRANT. HAVEL."

(From the lady announcer who speaks nine languages).

"Cordial Christmas greetings on wave 488·6 metres and best wishes for many presents to all listeners of the Prague broadcasting station, I send.

M. M. TOMANOVA."

BRUXELLES, No. 1.

I.N.R., speaking announcements in French.

(From the head announcer: Mr. Bracony, who has just celebrated his tenth anniversary as head announcer).

"In the course of the ten years in which it has been given me to speak in front of a microphone I have very often thought of the listeners of England who perhaps were listening to me.

"To-day, thanks to 'Popular Wireless,' I am pleased to be able to express my sincere sympathy, and to call to them, in thought, across space: Happy Christmas for all my dear listeners.

BRACONY"

(Producer and first announcer of the Institut National Belge de Radiodiffusion).

Above is Leo Held who sends greetings from the Beromünster station of Switzerland.

RIGA, LATVIA

relayed from Madona.

(From the chief announcer).

"Greetings from Latvia to the radio community of the whole world.

ALMA STEINS-BIRKMANIS."

KAUNAS, Lithuania.

This station has the longest broadcasting wavelength in Europe.

(Irena Garmiute, the lady announcer, sends this charming greeting).

"From my Lithuanian Fatherland, arisen out of the ruins of moss-covered castles, I send over radio's waves to the readers of 'Popular Wireless' cordial Christmas greetings.

IRENA GARMIUTE."

COPENHAGEN, DENMARK.

(From the chief daytime and lady announcer.)

"Christmas, 1933.

"First of all I would like to say 'Tak for sidst' ('Thank you for past kindness') to all my good friends who receive me hospitably nearly every day, and I hope that this hospitality will be further extended to me over the coming year.

"Take all my best wishes for a real glad Christmas and have good hope for the fulfilment of your wishes in the year 1934.

"Friendly greetings, GRETHE OTTO."

"To listeners out in the big world whose unseen guest I perhaps often have been, I send hearty Christmas greetings and all my best wishes for the New Year.

"Yours truly,

C. F. SCHIONNING."

Copenhagen, Kalundborg, and Denmark's Short-Wave Station).

RADIO-KATOWICE, Poland.

(From the chief announcer called "Tante Helene" by the "Katowicards" all over the world).

"In that moment so solemn and mysterious, when every Christian heart beats to the miracle of the Birth of Christ,

Continued on next page.)

A representative group of European announcers. From left to right they are FRANT HAVEL (Prague), M. TOMANOVA (Prague), M. BRACONY (Brussels), A. STEINS-BIRKMANIS (Riga) and I. GARMIUTE (Kaunas).

Five popular radio " voices "—G. Otto and C. F. Schionning of Copenhagen, Tante (Aunt) Helene who is often heard from Katowice, G. Weitzel of Hilversum, and Signorina Nini of the new Monte Ceneri station.

Permit me to transmit on the wave of Katowice, Poland—across the whole world—to you all, from the very bottom of my heart, 'Glory to God the Almighty, and on Earth Peace and Goodwill to men.'

" TANTE HÉLÈNE
" (Polskie Radio Katowice)."

HILVERSUM, HOLLAND.

(*A.V.R.O. is the oldest Dutch broadcasting company*)
From the Chief announcer :

" Also in the name of all members of the A.V.R.O.'s broadcasting staff do I send our European listener-friends with great pleasure my very best wishes for a pleasant Christmas and a Happy New Year.

" As the spokesman of one of the oldest European Broadcasting Institutes, is it my honourable duty to give you all our word that we would like to see broadcasting not exclusively used for national interests but, where possible, to give it international worth for the furtherance of friendship between nations.

" Broadcasting in the service of Goodwill and Peace.

" Let this be the deeper meaning of these Christmas greetings which the A.V.R.O. sends to all from the plains on the North Sea coast.

" GUUS WEITZEL."

RADIO SVIZZERA ITALIANA (MONTE CENERI).

(*National Transmitter for Italian-speaking Switzerland*).

(*From the Chief Tessin announcer : Signorina Nini.*

" *To our compatriots all over the world. . . .*"

" The typical sound of our church bells, the last mass at midnight. . . just as if one was still at home.

" At each stroke of the bells a sweet memory, distant and sad.

" *Mother, Father, Wife, Engaged . . .*

" For him who is far, for him who lives with us, for him who has forgotten, for him who feels eternal home-sickness for his Tessin, gather together at the awesome moment the wishes and hopes of all that are dear and unite them in my voice, trembling slightly from emotion.

" . . . . *Ring, you bells . . . . . .*

" SIGNORINA NINI,
" Radio Svizzera Italiana."

RADIO-ROMA.

(*From Mme. Maria Luisa Boncompagni, " Doyen " of all lady announcers*).

" Best wishes for a Christmas of serene Peace and a New Year of serene Happiness.

" MARIA LUISA BONCOMPAGNI."

Radio Roma's charming chief announcer is seen above—

In private life she is Mme. Maria Luisa Boncompagni.

RADIO-BUDAPEST.

(*From one of the lady announcers : Miss Lydia De Beothy*).

" I wish very pleasant festive days to our English listeners."

Budapest, 1933. " BEÖTHY LYDIA."

(Note : *The Hungarians always place the Christian name behind the family name.*)

RADIO-LUXEMBOURG.

(*From Miss Eva Siewert, announcer for German and occassionally English programmes*).

" My dear British listeners and lady listeners, very cordial Christmas greetings and the best wishes for the New Year. I hope that you will remain faithful friends of our station also in 1934.

" EVA SIEWERT."

HAMBURG.

(*From one of the lady announcers : Trude Meinz*)

" All dear listeners a happy Christmas.

" TRUDE MEINZ,
" Nordfunk, Hamburg."

[Editor's note : As we go to press further letters of greeting to readers of POPULAR WIRELESS from continental stations are reaching us. These will be published in the near future.

The lady on the left is a Budapest announcer, Beothy Lydia and the one in the centre is Eva Siewert of Radio-Luxembourg. On the right Trude Meinz is speaking into the Hamburg microphone.

PRESENTS *that* PLEASE

MAKE IT A RADIO XMAS

THE most acceptable present that can be made to anybody is undoubtedly that which is most useful. And, with one or two unavoidable exceptions, notably, perhaps, those hand-knitted woollen ties that aunts in general seem to have a weakness for when the festive season is in the offing, what more appropriately meets the case these days than a gift of "something radio"?

It's an idea, isn't it? In fact, it's more than an idea: it's a great notion, for the utility aspect of a radio gift is the predominant feature whether you choose to spend sixpence or six pounds. That is one of the great advantages of giving something radio—there is almost unlimited scope in the selection of your gift, irrespective of the price that you may feel inclined to pay.

The great advantage of giving "something radio" is that the utility aspect of the gift remains the predominant feature whether you choose to spend sixpence or six pounds. Whatever your limitations as to price, you will find plenty to interest you in this informative and comprehensive survey.

Many Amazing Advances.

Without a doubt Christmas 1933 will see a great increase in the radio-for-presents idea, for the very simple reason that in the months preceding it there have been more amazing advances in the technique of receiver design than in any similar period since broadcasting commenced.

Gifts that please! Can you imagine anything more likely to gladden the heart of one of your intimate radio friends than a gift of some component or other that will enable him to try out one of the latest circuit developments in his own set?

Iron-cored coils, automatic volume control, tone control, Class B output—in fact, any of the recently developed inventions forms the basis for an ideal gift. And imagine the joy of receiving such a gift at a time when the few days' respite from the daily task afford such an excellent opportunity for trying it out!

Aerial and Earth?

And even if you do not happen to know anybody to whom a radio gift would be appropriate—well, who is there among us who doesn't like suitably to commemorate the festive season by a gift to himself? 'Nuff said! The great question is, what shall it be?

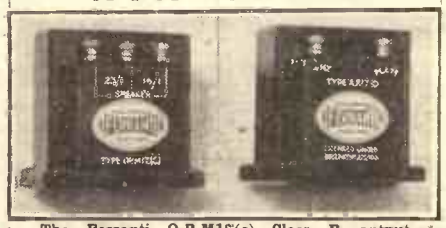
The aerial and earth? Why not? Make a journey by train from London to any of its numerous suburbs and observe *en route* the "barbed-wire entanglements" that their owners are gracious enough to refer to as aerials! Any of your friends?

Why not a present of the wherewithal to make a really neat and efficient job of it? In any case, it is as well to remember that even the perfect aerial and earth system will deteriorate through prolonged exposure to the elements, and a mid-winter overhaul is strongly to be recommended.

A coil of electron "Superial" and one of those natty little Graham Farish "Filt" earthing devices will accomplish wonders. And if you are feeling particularly generous, then a Radiophone "Receptru" screened down-lead and a Bulgin lightning switch will complete the installation. A present consisting of these four useful and efficient items would cost you 16s. 9d.: 1s. 9d. for the wire (50 ft.), 2s. 6d. for the "Filt" earthing device, 10s. for the down-lead, and 2s. 6d. for the lightning switch (model S.99).

To improve the aerial is one thing, but satisfactorily to "sort out" the stations resulting from the improvement is quite another. But, then, who is there among your friends, new aerial or not, who would not hold you in high esteem for a gift that would enable him to improve selectivity?

A POPULAR PAIR



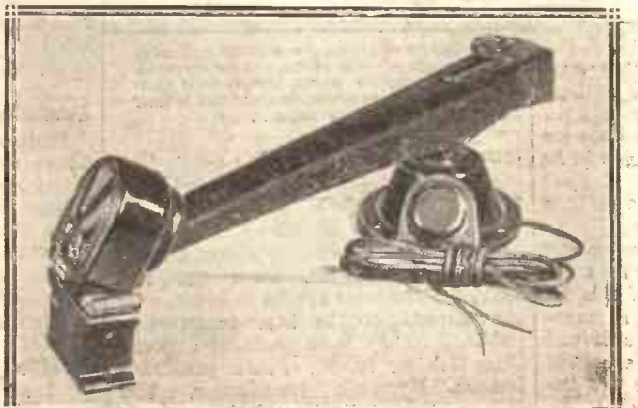
The Ferranti O.P.M17(c) Class B output transformer (left), and their A.F.17(c) "driver" transformer, make ideal presents for Class B enthusiasts. They cost 15s. each.

Modernising Old Receivers.

My suggestions? Those very popular iron-cored coils of Colverns—the first, incidentally, to be produced in this country—are obtainable in single or ganged units to suit almost any circuit requirement, and they cost 12s. 6d. for a single coil, 25s. for a two gang unit, and so on.

While on the subject of selectivity improvements, I wonder how many of you are aware of the fact that the R.I. "Micrion" dust-core coil is particularly suitable for modernising sets in which the old but famous "P.W." coil is employed? There must still be thousands of these sets about, and the gift to anyone owning one of a really efficient coil for modernisation purposes would no doubt be greatly appreciated. Truly a gift that would please, and the cost to you would be 12s. 6d.

PUTTING THE "CHORD" INTO RECORD



There are few sets these days that have no provision for pick-up connections. Why not a present of this excellent Cosmocord model with volume control?

Don't Spoil The Ship.

Incidentally, any set of the old "P.W." coil days would no doubt work all the better for a change of tuning condensers. After all, they do wear out, and if you are planning to give somebody a coil for modernisation purposes it's a pity to spoil the ship. Why not spend an extra five or six shillings and give the condenser, too?

(Continued on next page.)

PRESENTS THAT PLEASE

(Continued from previous page.)

There is the Polar "No. 2" at 6s. 6d., complete with slow-motion drive, and the Ormond model R/486 at 6s. 6d. also with slow-motion device. J.B., too, do an excellent ·0005-mfd. variable condenser with slow-motion control for 7s. 6d. It is designated the "Popular Log Slow-Motion" condenser.

That extremely popular iron-cored coil of Telsens is another gift suggestion that should not be overlooked. It must surely be one of the most compact iron-cored coils on the market, a feature which renders it particularly suitable for modernising the H.F. ends of sets in which space is limited. I consider it remarkable value at 8s. 6d.

Bring It Up to Date.

The present-for-bringing-the-set-up-to-date idea is undoubtedly the one that will catch on this year, simply by virtue of the tremendous number of new ideas that have been introduced. Improvements on the H.F. side are undoubtedly very well worth while, especially in view

FOR PENTODE OUTPUT

Pentodes are popular. Why not a present of this fine Clarke's "Atlas" pentode output choke?

of the fact that our troubled ether conditions are not likely to get any better as time goes on.

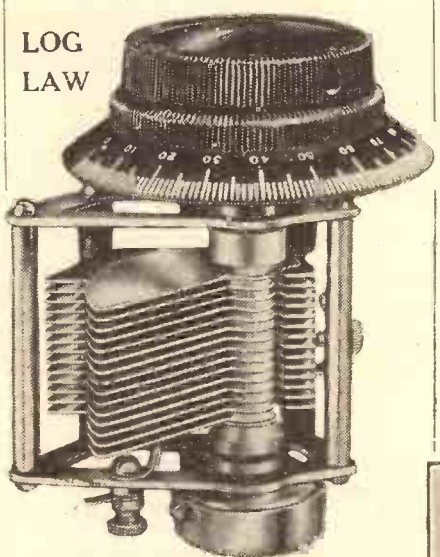
But improved sensitivity and selectivity are not the only things that are likely to bring joy to your friends. What about quality? What about Class B for all those who are forced to use batteries? Personally, I would rate the question of quality first. I would sooner have a few stations perfectly than a lot imperfectly.

Quality Components.

That leads me to think that several of my friends who ask me to enthuse with them over their quality will be receiving weighty little parcels from me at Christmas, and in those parcels will be Class B transformers and chokes! Perhaps I shall be better able to enthuse afterwards.

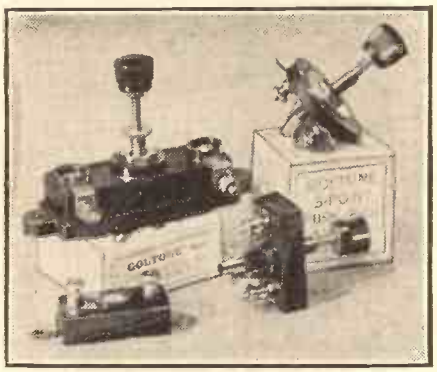
As a matter of fact, there are several makes that are worth bearing in mind if desiring to make a present of this description. The Benjamin Class B transformer at half-a-guinea and the universal "B" output choke at 11s. are excellent components. Then, too, there are the products of the old specialists at the game, Ferranti. Their driver transformer (the A.F. 17c) at 15s. and their O.P.M. 17c output transformer at the same price are every bit up to their usual high standard.

The name of British Radiogram makes its appearance in the Christmas presents lists this year for the first time, but from the performance of their products one might well imagine that they had been at the game for years. It's a point well worth remembering when thinking in terms of Class B components, for they, too, produce driver



This J.B. "Popular Log" slow-motion condenser is fitted with an improved type dial.

FROM THE GOLTONE RANGE



The Goltone catalogue is a veritable gold mine for Yuletide gift suggestions, and the examples, picked at random, above, include their compression and fixed condensers, and two of their popular switches.

transformers and output chokes that are obviously built up to a standard and down to a price.

Wearite and Multitone are other names that are representative of Class B component excellence. Their prices, too, are right. The same applies to Lissen, ever the friends of the home-constructing public, for they have produced a special Class B driver version of their justifiably famous "Hypernik" transformer. You will certainly be putting your friends on the right track if you give them a Lissen Class B driver transformer.

Perhaps some of you will want to be a little more ambitious. Perhaps, out of your large Christmas bonuses (I hope so, anyway), you will feel inclined to repay the kindnesses of your friends by being a little more generous in your choice of presents.

Valuable Class B Units.

Why not sport a complete Class B unit? W.B. do an excellent one for 27s. 6d. (without valve), and the high standard of workmanship associated with Blue Spot is also available in the form of a Class B unit. The price of the Blue Spot unit is 29s. 6d. (without valve). If you feel that you would like to run to a special Class B speaker, or if you are interested in moving-coil speakers of any description, you can count upon satisfaction if you include in your choice Blue Spot, W.B., Celestion, R. & A., Rola, Marconiphone, H.M.V., Amplion, Epoch or Igranic. They all make good modern speakers at prices ranging from about thirty shillings upwards.

Not all your friends will be battery users. Some may be on mains; some may have mains in the house and may still be using batteries. Mains units in

WHY NOT "OHMITES"?

Reliable resistances are always useful, and nothing could be more acceptable than a set of these Graham Farish heavy duty "Ohmites."

general are not exactly cheap things to build, and if I know the psychology of home constructors accurately, any contribution that you may feel inclined to make towards the parts for an eliminator will be thankfully received.

The beauty of buying Dubilier, T.C.C. or Igranic condensers with this idea in view is that you can spend pretty well what you like. It can either be a 2-microfarad 250-volt working type, costing something in the neighbourhood of four shillings, or else you can make it one of the higher-capacity types. A Belling & Lee combined mains plug and fuse is also a useful suggestion to bear in mind if you want a gift in the region of 3s. 3d.

Automatic Volume Control.

Varleys, I think, deserve a paragraph all to themselves. Everybody, at the present time, is talking about automatic volume control, and Varleys, so far as I know, are the only people yet to produce a complete A.V.C. unit for fitting to existing sets. What could possibly be a more acceptable present to anybody interested in home-constructor radio? It costs 15s. 6d.

Valves make ideal presents. And the great advantage of giving a valve is

(Continued on page 636.)

ECKERSLEY EXPLAINS—

This week our Radio Consultant-in-Chief explains how the bottom bend in a detector's characteristic tends to introduce distortion with low input voltages. This, he says, is why it is so often advisable to use a stage of high-frequency amplification.

WHY does every set in the world use high-frequency magnification? This intelligent question was fired at me the other day by one who is trying to know better.

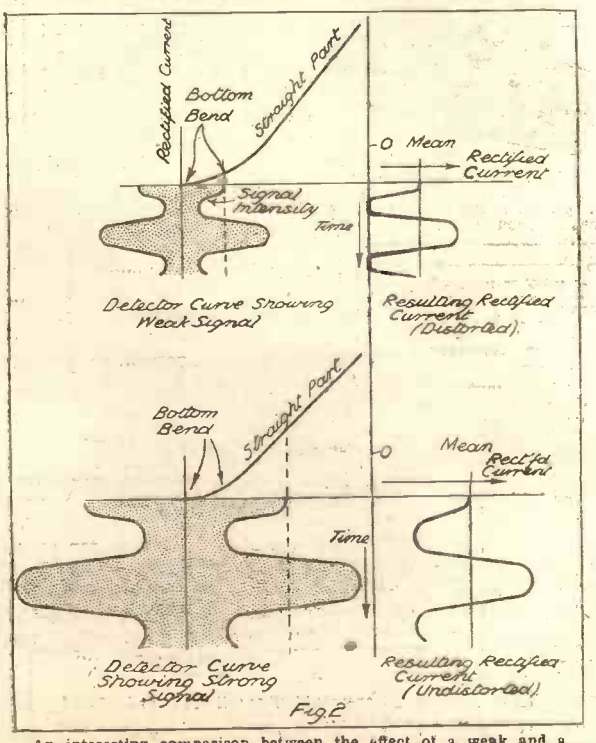
I suppose at rock bottom it is because every detector has a bottom bend, even if it is not a bottom-bend detector.

If you will look at Fig. 1 you will see what is meant by a bottom bend. The horizontal scale of the curve stands for the signal volts put in to the detector and the vertical scales stand for the *change* of current, as read by a D.C. instrument, produced in the output circuit due to the signal. This curve applies to all forms of detector, I think. In grid-leak detector the current decreases when the signal is applied, while with a bottom-bend detector the current increases when the signal is applied. But in both cases the current change is not proportional to the signal volts when the signal volts are (relatively) small. Where lack of proportionality exists is the place of the bottom bend.

Of course, if the signal volts and rectified or output current are not proportional, then nasty noises result, because, when modulation increases the signal, the rectified current change is greater than when modulation decreases the signal by the same amount that it increased it. Work this out for yourself. To do it draw, as in Fig 2, a bendy detector curve. Plot the signal volts modulated up and down, above and below the steady carrier-wave value, and you will find that the output current change is not proportional to the envelope of the H.F. signal volts. This must produce distortion.

But if, as in Fig. 2 again, the signal is big and the modulation not too deep, then the change of intensity of signal voltage due to modulation is accompanied by a corresponding change in rectified current output and all is well; no distortions arise.

AN INTERESTING COMPARISON



An interesting comparison between the effect of a weak and a strong signal on a detector which has a bottom bend is provided in this diagram. It will be noticed, as pointed out by P. P. E. in the accompanying article, that, while the output from the weak signal is somewhat distorted, that from the strong one remains comparatively unaffected.

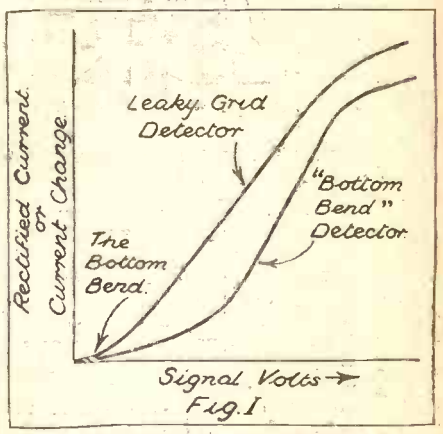
Must be Strong.

So, you see, you have to have a strong signal applied to any detector which has a bottom bend, and the signal has got to be strong enough to sit itself in the middle of the straight part of the detector curve, and then we have all got to hope that the sending station will not modulate so deeply as to carry the signal intensity on to the curvy parts of the detector characteristics.

Now it is found (see Fig. 1) that the detector characteristic is less bottom bendy with a leaky-grid detector than with a bottom-bend detector. That is why, to-day, we use, almost universally, the grid-leak detector and not the bottom-bend detector. But because all detectors, apparently, have a bottom bend we magnify the incoming signal (by high-frequency magnifiers) so that it shall be strong enough to get on to the straight part of the detector curve.

Suppose, however, it was found that a detector characteristic was dead plumb straight right from its little origin up the graph paper and into saturation. Then we would do away with high frequency, with all its troubles of screening and spurious retro-actions and Millers and dampings and distortions. Perhaps I am unfair to H.F. For cheap and simple sets I hate H.F., but recognise—if it's true that detectors all have bottom bends—that it is one of the things to use.

THE BOTTOM BEND



The bottom bend of a typical valve characteristic is shown in the diagram above. The curve on the left represents leaky-grid detection, while the other shows anode-bend rectification.

There are other good reasons, too. The designer of the more expensive sets wants to be able to turn one knob and bring in every station at equal strength. Certainly automatic volume control is a lovely thing, and you couldn't, as far as I can see at present, have A.V.C. without a variable-mu high-frequency valve.

L.F. Better Than H.F.

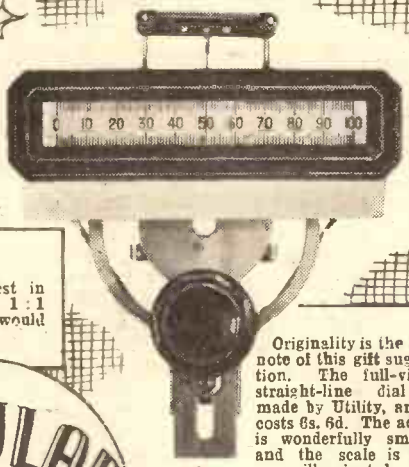
I think that, stability for stability, you can get more out of a "note" stage than out of a high-frequency stage. So that a detector and two note mag. set has a greater overall mag. than three valves with the conventional H.F. detector and note. But, as I have said, it's a question

(*Continued on page* 652.)

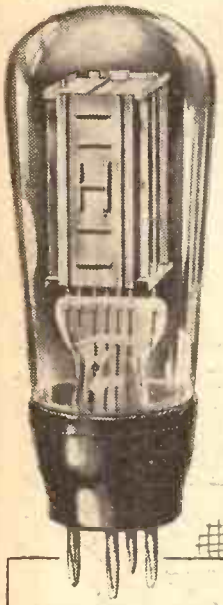
Wall of spending not more than 10/-!

Screening plays a most important part in the design of modern radio receivers and screened H.F. chokes are naturally much in demand. Why not a present on these lines? The Bulgin "superhet" model (left) costs only 5s. 6d., and the "standard" version (right) retails at 3s. 6d.

Due to the ever-increasing interest in quality of reproduction, this Telsen 1 : 1 Intervalve Coupling Unit, at 7s. 8d., would be a most acceptable gift.



Originality is the keynote of this gift suggestion. The full-vision straight-line dial is made by Utility, and it costs 6s. 6d. The action is wonderfully smooth and the scale is well illuminated.

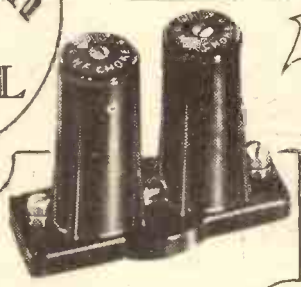


Valves are always useful, and there are several in the "Hivac" range at prices appreciably less than 10s.

With a maximum D.C. working voltage of 440, this T.C.C. 8-mfd. wet electrolytic condenser at 6s. makes an ideal gift for the set-constructor who is building an A.C. receiver.

POPULAR PARTS FOR ALL

Specially designed for smoothing circuits in rectifiers, etc., these Dubilier 8-mfd. dry electrolytic condensers cost 5s. 6d. each.

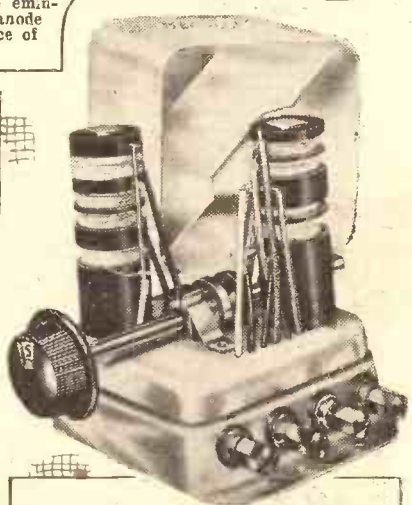


Binocular H.F. chokes are eminently suitable for S.G. valve anode circuits. 4s. 6d. is the price of this Amplion model.

The fine range of Tungsram valves provides wide scope for a "not-more-than-10s." present, and a valve is always sure of a welcome from the recipient.

Invaluable as an "efficiency-controller" in S.G. circuits, this Sovereign "Vario Choke" costs 3s. 6d.

The prices of any of these Hellesens condensers fall well below the 10s. mark. Electrolytic types of various kinds are available and are invaluable where compact set layout is desired.



Iron-cored tuning coil efficiency for 3s. 6d. might well be the description of this Wearite Junior "Nucleon" coil.

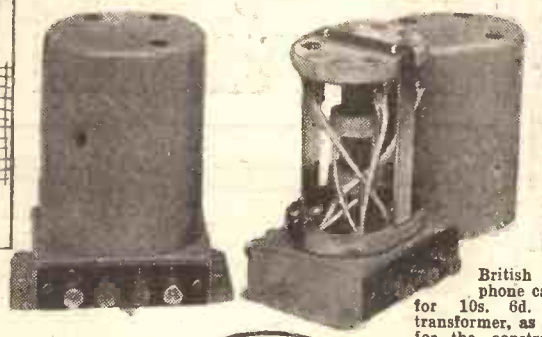
— or One Pound!

Britannia Batteries have an attractive range of batteries for all purposes. Prices of H.T. models range from 15s. 6d. and accumulators from 4s. 6d.—well within the £1 price limit.

Newcomer since last Christmas, the Block plateless accumulator with a capacity of 80 A.H. costs only 11s. 6d.

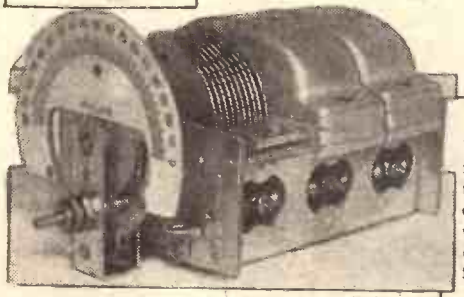
Below is the all-metal unbreakable "Catkin" valve, obtainable in the Marconi and Osram ranges. The price of this valve is 13s. 6d.

The double-diode pentode is one of the new developments of the 1933 season. The Cossor model seen here costs exactly £1.

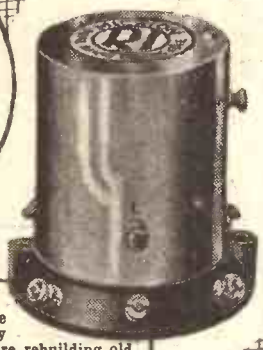


British Radiophone can supply, for 10s. 6d. an I.F. transformer, as seen here, for the construction of superhet receivers.

WIRELESS GIFTS FOR XMAS



Wingrove & Rogers manufacture many types of ganged condensers, and various models can be obtained from 19s. 6d. upwards.

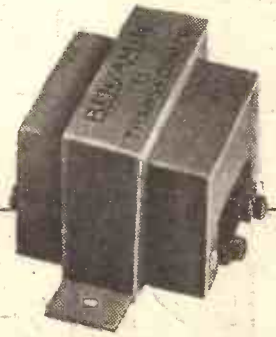


New coils will be wanted by many constructors who are rebuilding old sets this Christmas. An R.I. Micrion dual-range tuning coil would be most acceptable and, at 12s. 6d., would leave quite a lot of change from a £1 note.

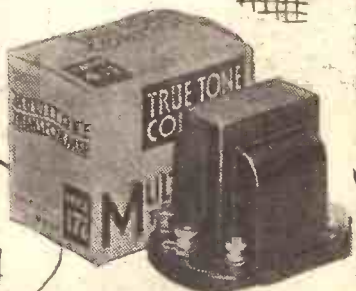
Mazda can supply this indirectly-heated variable-mu valve—the A.C./S.1V.M.—for 17s. 6d.

No valve will last for ever, and when it comes to renewing a battery variable-mu type, the Mullard P.M.12M. is eminently suitable. You probably know someone who would like it. It costs 15s. 6d.

The Osram lists can boast no fewer than seven variable-mu valves for different purposes. The V.D.S., seen here is an indirectly-heated D.C. type at 17s. 6d.

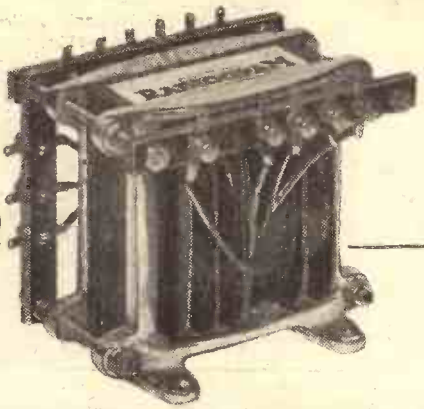


The Benjamin Class B transformer (10s. 6d.) is a component that will be welcome in many a radio fan's home, for Class B is the very latest advance in battery radio.

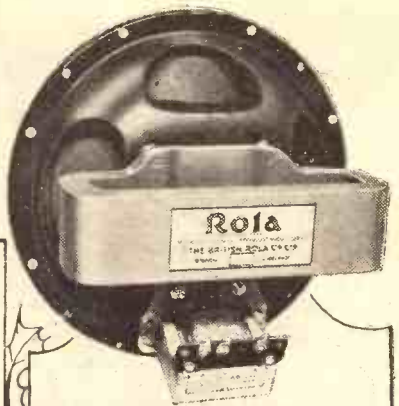


Tone control is obtained by means of the Multitone transformer shown above. It costs 17s. 6d. without the control potentiometer.

Gifts up to £5!

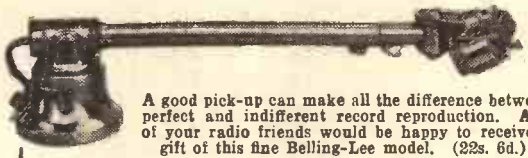


With the progress of the "Grid" system, increasing interest attaches to gifts for the conversion to mains operation of existing sets. This British Radiogram mains transformer is a remarkable proposition at 25s.

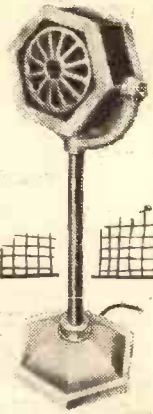


Good moving-coil speakers are universally acceptable presents. This permanent magnet model is the Rola F.R.6P.M. at £1 19s. 6d.

Real beauty of appearance is apparent in this fine Celestion moving-coil speaker. It is their model which retails at £4 10s. 0d.



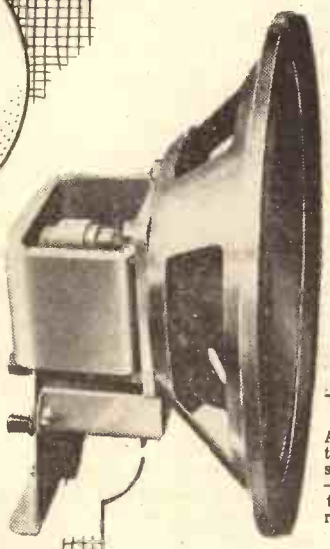
A good pick-up can make all the difference between perfect and indifferent record reproduction. Any of your radio friends would be happy to receive a gift of this fine Belling-Lee model. (22s. 6d.)



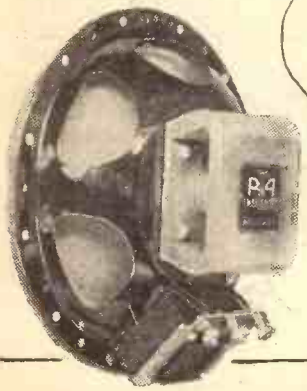
Hello, mike! And wouldn't your transmitting friends just love it! Epoch is the make, and it costs 4 guineas.

GIVE RADIO

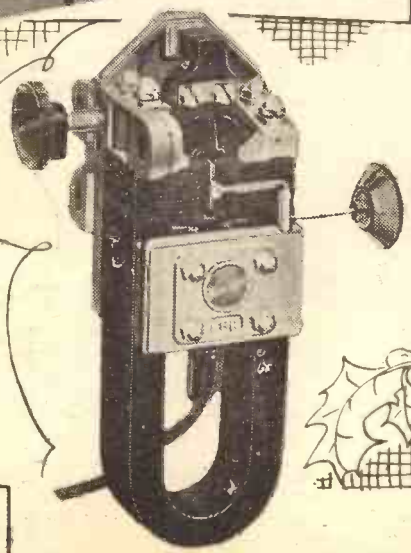
It would have to be some stocking to accommodate this magnificent gift! But imagine the joy of receiving an "Ingranipak" as a Christmas present. (57s. 6d.)



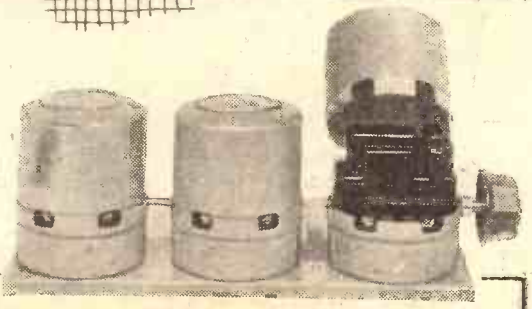
An outstanding feature of this W. B. "Microlode" speaker—the model P.M.6—is that it can be matched to suit any output arrangement. It costs 32s. 6d.



Thirty-five shillings will buy this fine example of modern moving-coil speaker practice. It is the R & A Challenger.

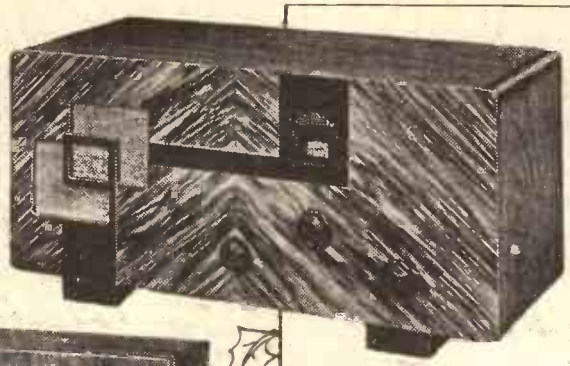


Truly a gift that pleases. The Blue Spot 66 R speaker unit at 27s. 6d.



Mr. "Can" gets perfect selectivity! So will your friends if you give them one of these Colvern Ferrocart ganged coil assemblies.

—and more than £8!



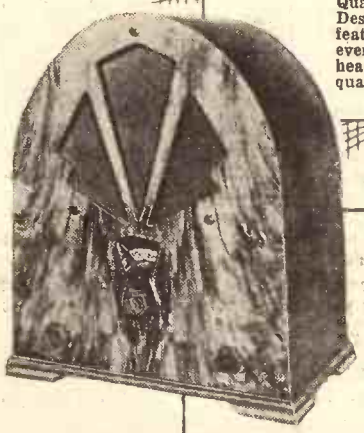
The strikingly modern Lissen three-valve receiver has a variable-mu stage, a detector and pentode output. It is available for either A.C. or D.C. mains, and the cost complete is 10 guineas.
Its pleasing lines are well illustrated in this photograph, which shows how beautifully the receiver will blend with any furnishing scheme.

Portables never lose their popularity, and the new "His Master's Voice" Superhet A.V.C. Portable Grand, with moving-coil speaker, still remains an outstanding bargain at 15 guineas.

The Columbia Model 1001 four-valve battery set incorporates the new Columbia system of C.Q.A. or Constant Quality Amplification. Despite this unique feature, which ensures every programme being heard with perfect quality, the price is only 11 guineas.

THIS YEAR

Modern design of a very striking character is featured in this beautifully proportioned floor cabinet, which is but one of the features of the Varley Square Peak Superhet. Automatic volume control and band-pass tuning are other refinements in this new five-valve receiver for A.C. mains, which can be bought ready to switch on for 27 guineas.



Here is the Marconiphone Model "283" receiver at only 15s. over £8. It is a three-valve battery model with a moving-coil speaker and local-distance switching. Really excellent value for little money.

12 guineas is charged for the Clarke's "Atlas" three-valve "A4" model illustrated here.
As well as its novel cabinet design, it boasts a pentode in each of its three stages, a variable-mu pentode being used in the H.F. stage.

The Ekco Model 74 was one of the biggest sensations of this year's radio exhibitions. It is obtainable in the same design for battery, A.C. or D.C. working, and is made in black and chromium, or in walnut finish. The walnut model which we have photographed costs 13 guineas.

P.W.'S XMAS GREETINGS

Personalities of the radio world—some who have made wireless possible, others who carry on broadcasting to-day—send their personal good wishes for "P.W.'s" twelfth Christmas.

From NOEL ASHBRIDGE, B.Sc., A.M.I.C.E., Chief Engineer of the B.B.C.

"In sending good wishes for Christmas and the New Year to readers of 'Popular Wireless,' thoughts naturally turn to anticipated events during the coming year in the realm of broadcasting. Almost at the beginning of 1934 we have to face a general re-arrangement of the wavelengths of practically all European stations.

MR. NOEL ASHBRIDGE

"This could be looked upon merely as involving a few days of hard work for the engineers concerned, were it not for the fact that several countries may still remain outside the agreement on the day when the new Plan comes into force. We cannot disregard the fact that this may mean some temporary dislocation. However, broadcasting is now such an important—one can almost say essential—feature in the home life of almost every country in Europe that it is inconceivable that a solution would not be rapidly found should serious difficulties arise.

"Probably the next most important technical event of the year in British broadcasting will be the opening of the new long-wave station at Droitwich. It is always unwise to say too much in advance about the performance of a new station, but in any case we can look forward to better listening for several millions of the population.

"Again, I hope that the end of 1934 will see a Regional station for Northern Ireland, either working or nearing completion.

"In conclusion I would like to thank the Editor of 'Popular Wireless' for giving me the opportunity of conveying to his readers the best wishes of the Engineering Branch of the B.B.C. for Christmas and the New Year."

From SIR OLIVER LODGE, F.R.S., Scientific Adviser to "Popular Wireless."

"Once more I send Christmas greetings and my good wishes to all listeners who read 'P.W.' We have had a splendid year as regards the weather, and I hope a profitable year in other respects. Trade is improving, the resources of the country are growing larger and I hope will not be wasted in another orgy of destruction."

From MARCHESE MARCONI.

"It always gives me much pleasure to wish every reader of 'Popular Wireless' a Happy Christmas and a Prosperous New Year.

Above
MARCHESE MARCONI.

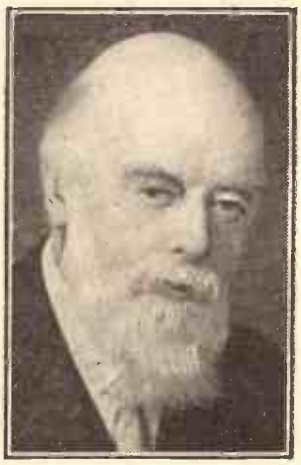
Left
MR. P. P. ECKERSLEY.

Right
SIR JOHN REITH.

"I do so this year with the more pleasure because I feel that the future is full of promise for even greater developments in radio. I am still of the opinion that we are a long way from finality in the matter of communication via the ether."

From SIR JOHN REITH.

"The eleventh year of British broadcasting has revealed no slowing down of any section of the great enterprise—public interest, trade or programmes. The service, its extension now consolidating throughout the Empire, looks forward to steady development.



SIR OLIVER LODGE.

"I am glad to have this opportunity of wishing your readers a very Happy Christmas and all good wishes for the New Year."

From P. P. ECKERSLEY, M.I.E.E.

"Here are my good wishes to 'Popular Wireless' readers for a very Happy Christmas. The fourteenth Christmas which broadcasting has enjoyed—for we had two of them at Writtle before the days of Marconi House and Savoy Hill! During those years one can discern a steady improvement in technical efficiency.

"So, when I wish you a Happy Christmas, I wish you sets which will receive many stations. Not because you will get good results—for I am not happy about the state of European broadcasting, with the overcrowding of the ether and the mismanagement of wavelengths. But because radio is a great hobby. I wish you the greatest joy from it."

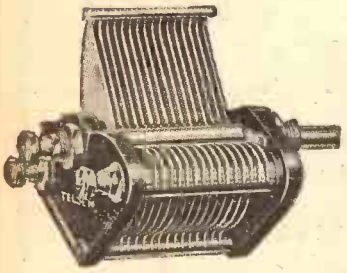
(*Continued on page* 649.)

TELSEN

TUNING

CONDENSERS

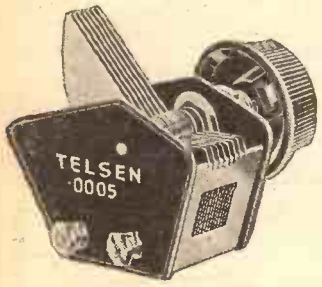
cover every requirement



TELSEN AIR-DIELECTRIC TUNING CONDENSERS

The precision and sturdy construction of this component ensure years of faithful service. Its frame is braced by three solid pillars, and the vanes clamped at three points, making distortion impossible. The rotor is also built into a rigid unit, generous bearings preventing backlash or end-play.

Capacity	*Price*
·00025 mfd. ..	2/6
·00035 „ ..	3/6
·0005 „ ..	3/6

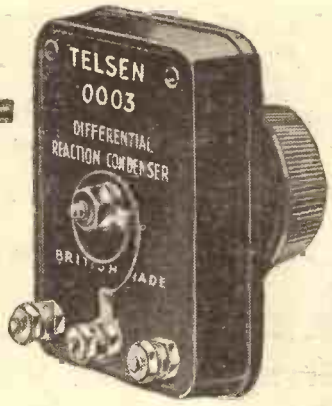


TELSEN BAKELITE DIELECTRIC TUNING CONDENSERS

Represent really remarkable value.

Very rigid construction, with high grade dielectric, ensuring permanently accurate spacing with minimum losses. Exceptionally compact. Complete with knob.

Capacity	*Price*
·0003 mfd.	2/6
·0005 „	2/6



TELSEN DIFFERENTIAL CONDENSERS

Similar in design and construction to the reaction condensers. Supplied complete with knob.

Capacity	*Price*
·0003 mfd. W.351 ..	2/6
·00015 „ *W.352* ..	2/6
·0001 „ *W.353* ..	2/6

TELSEN GANGED CONDENSERS

The finest ganged condensers ever produced.

For use where accurate and simultaneous tuning of two or three circuits is obtained by the rotation of one dial. A pressed steel frame of great rigidity eliminates distortion, the rotor and stator vanes being let into one-piece high pressure die castings to ensure accurate spacing. All sections are very carefully matched by means of split end vanes, and trimmers are provided. Complete with knob, pilot light escutcheon and two alternative tuning scales.

	Price
Single Unit	8/6
Twin Ganged	16/6
Triple Ganged	22/6

TELSEN REACTION CONDENSERS

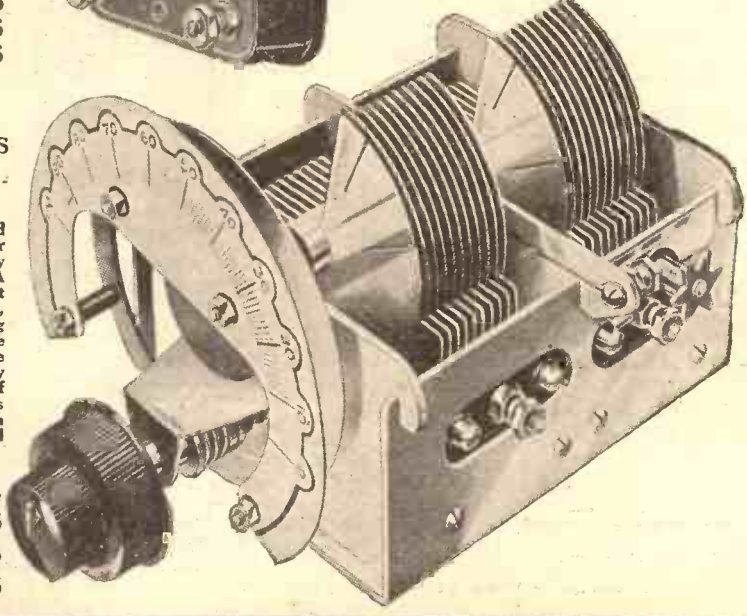
Entirely re-designed. Now incorporate several valuable improvements with no increase in price, the whole unit being also now enclosed in a strong dust-proof bakelite case. Supplied complete with knob.

Capacity	*Price*
·0003 mfd. W.354 ..	2/6
·00015 „ *W.355* ..	2/6
·0001 „ *W.356* ..	2/6
·00075 „ *W.357* ..	2/6
·0005 „ *W.358* ..	2/6

TELSEN AERIAL SERIES CONDENSER With Switch

Built on similar lines to the new reaction condensers, providing an ideal selectivity and volume control. Supplied complete with knob.

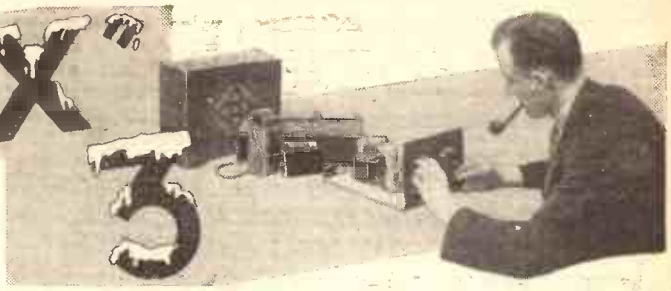
Max. Cap.	*Price*
·0003 mfd. No. W.350	2/6



TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

THE "DOUBLE X" 3



A "P.W." STAR SET FOR 1934

ONCE again we are able to present the home constructor with something entirely new. This "Double X" set is the very first set to use the Contra-Phase system, which has been entirely developed in the "P.W." Research Department.

Invented by G. V. Dowding, "P.W.'s" Technical Editor, with new applications and improvements due to K. D. Rogers, Chief of the "P.W." Research Department, the Contra-Phase is at once both a perfect energy control and a striking economy measure.

INTRODUCING THE CONTRA-PHASE SYSTEM

By means of a simple potentiometer-switch combination a wonderfully smooth volume adjustment is achieved, at the minimum setting of which the H.F. valve is switched out of action quite automatically.

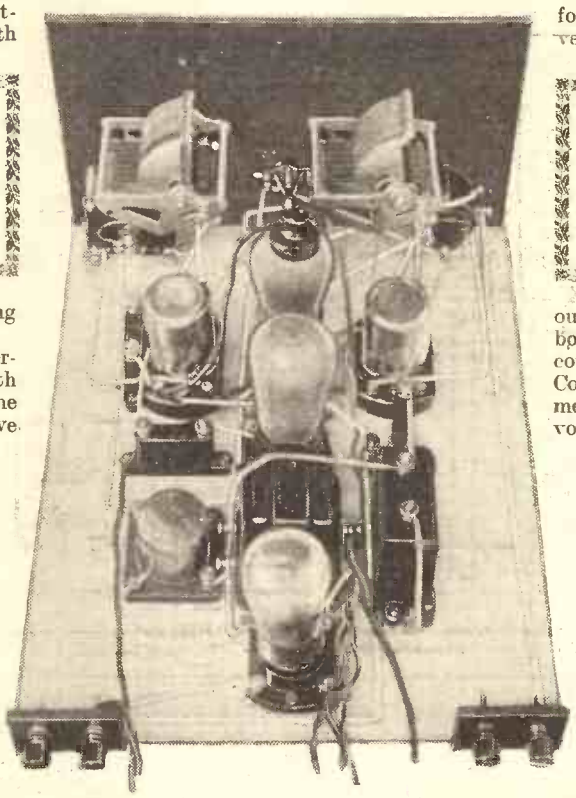
Perfect Sensitivity Adjustment.

In the ordinary methods volume controlling is carried out with all the valves in operation, an absurdly wasteful procedure. That can be compared with a motor-car whose engine always runs at full power, slower speeds than the maximum being obtained by clamping on strong braking effects.

You wouldn't think much of a car that functioned in that way, would you? And yet the battery set which uses an H.F. valve, whether the amplifying powers of that valve are needed or not, is almost as bad. H.T. and L.T. current are being thrown away most of the time.

All those hours when you have the local tuned in and the volume control turned down (or the tuning dials out of step) money is neeessarily flowing away, for H.T. and L.T. currents (particularly H.T.) represent solid cash investment.

That H.F. valve is simply not required for the more powerful stations, but it is very necessary that its switching in and out of circuit should be automatically bound up with the volume control if complications are not to arise. Actually, Contra-Phasing is a sensitivity adjustment—the theoretically perfect form of volume control, and one which in practice works almost uncannily.



The "Contra-Phase" is completely automatic in operation.

PERFECT ENERGY CONTROL AND STRIKING ECONOMY

A First Class Three.

Fundamentally, the "Double X" Three is a first-class S.G. three-valver, having a very high overall efficiency.

The Contra-Phase adjustment gradually moves the aerial input (as you operate the volume control) over from the S.G. input towards the detector input.

In other words, less and less of the energy developed in the aerial is

(*Continued on next page.*)

When the S.G. valve is not needed it goes out.

STANDARD PARTS ONLY ARE USED FOR THIS GREAT SET

Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.
1 pair matched screened iron-cored coils	Telsen, type W.422	—
2 ·0005-mfd. S.M. tuning condensers	Ormond, type R/486	Utility, Polar, J.B.
1 ·0003-mfd. differential reaction condenser	J.B. No. 1080	Telsen, Polar, Graham Farish, Ready Radio, British Radiogram
1 2-mfd. fixed condenser	T.C.C., type 50	Dubilier, Igranic, British Radiogram, Telsen, Graham Farish, Ferranti, Lissen
1 ·1-mfd. fixed condenser	T.C.C., type 250	Dubilier
1 ·0003-mfd. fixed condenser	T.C.C., type 34	Dubilier, Telsen, Lissen, Graham Farish
1 ·0002-mfd. fixed condenser	T.C.C., type 34	Lissen, Graham Farish, Dubilier, Telsen
1 50,000-ohm potentiometer with on/off switch	Bulgin, type V.S.36	Lewcos, Radiophone, Telsen
1 2-megohm grid leak with wire ends	Igranic	Dubilier, Lissen, Telsen, Goltone
1 30,000-ohm resistance with vertical holder	Graham Farish "Ohmite," 1½-watt type	—

Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.
1 Screened H.F. choke	Graham Farish, H.M.S.	Bulgin, Wearite, Telsen
1 L.F. transformer	Lissen Hypernik	R.I., Igranic, Varley
3 4-pin valve holders	Benjamin "Vibrolder"	W.B., Telsen, Lissen
1 3-point push-pull switch	Bulgin S.13	W.B., Lissen
1 2-point push-pull switch	Lissen	Telsen, Bulgin
1 Panel, 10 in. x 7 in.	Peto-Scott	Goltone, Permcol, Becol
2 Terminal strips, 2 in. x 1½ in.	Peto-Scott	Goltone
4 Indicating terminals	Belling-Lee, type R	Clix, Igranic, Bulgin, Eelex
1 Metaplex baseboard, 10 in. x 12 in.	Peto-Scott	—
4 Wander-plugs	Clix	Belling-Lee, Eelex
1 Wander-fuse	Belling-Lee	—
2 Accumulator spades	Clix	Belling-Lee, Eelex
1 Anode connector	Belling-Lee	—
5 yards 18-gauge tinned copper wire	Lewcos	Goltone
3 yards insulating sleeving	Lewcos	Goltone
Flex, screws, etc.	Peto-Scott	—

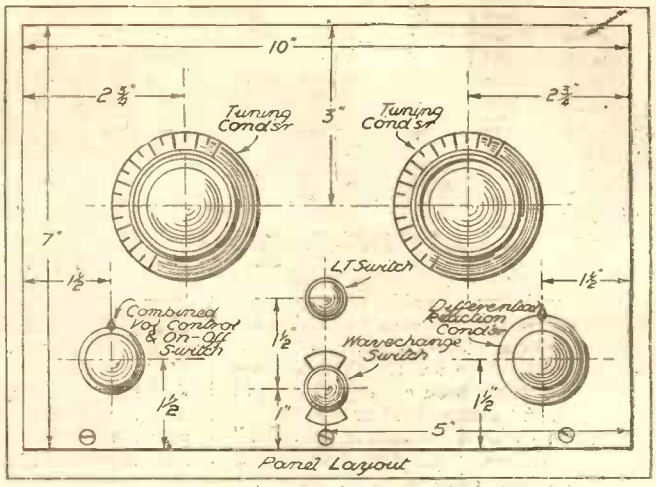
THE "DOUBLE-X" THREE

(Continued from previous page.)

passed to the S.G. valve and more and more is handed direct to the detector.

valve set (detector-L.F.), and is capable of giving ample volume on the speaker from the local, and perhaps quite a number of other stations.

The set will probably



ACCESSORIES THAT YOU CAN RELY ON

BATTERIES.—H.T. 120 volts: Lissen, Ediswan, Ever Ready, Drydex, Marconiphone, Pertrix, Siemens, G.E.C., Block accumulators.
L.T. 2 volts: British Radiogram, Exide, Lissen, Block, Oldham, Ediswan, Pertrix.
G.B. to suit Output Valve: Lissen, Siemens, Ever Ready, Ediswan, Pertrix, Marconiphone, Drydex.
MAINS UNITS (To give 120 volts at 25 m.a.)—Atlas, Ekco, Heayberd.
LOUDSPEAKER.—Blue Spot, Rola, Epoch, Ormond, R. & A., Atlas, Ferranti, Amplion, H.M.V., Celestion, G.E.C.
AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," Radiophone "Receptru" down-lead, Bulgin lightning switch, Graham Farish "Filt" earthing device.

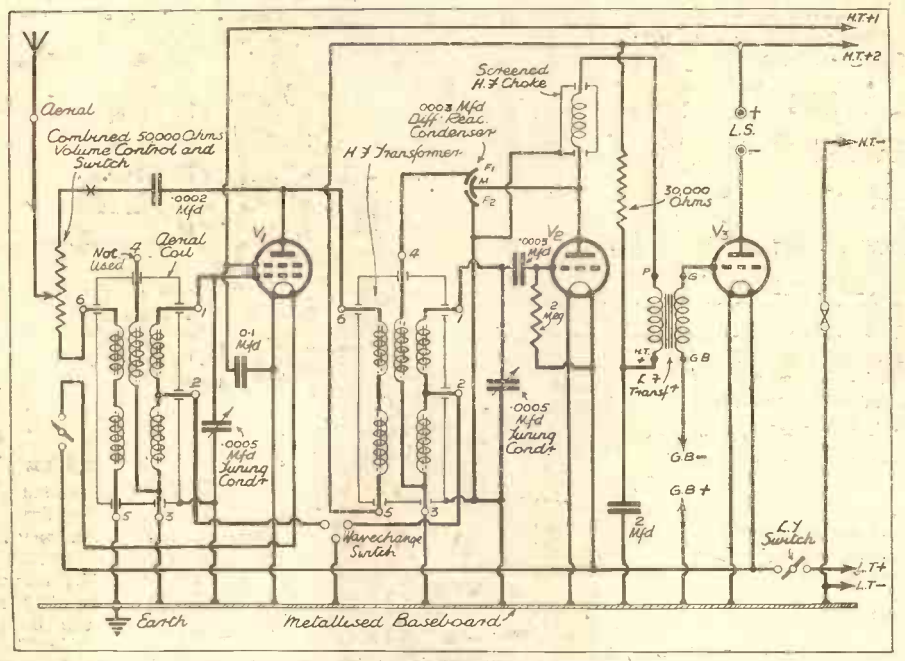
Finally, when only a negligible quantity is going to the S.G. valve the switch operates and the S.G. valve is switched off. The control is rendered more effective by virtue of the fact that an out-of-phase condition between the two portions of the input develops.

Very Economical.

In the reverse direction, the Contra-Phase acts in this way: Starting with the volume control hard over at minimum, the set is a two-

SIMPLICITY

Despite its originality, the circuit is quite uncomplicated, as shown to the right. Note the simple waveband switching and the logical Contra-Phase control of the aerial circuit.



SYMMETRY

The panel is of well-balanced and pleasing appearance and easily drilled as above.

The circuit connections are so unconventional that many constructors may wonder if the normal functions of the valves are interfered with in any way, either by introducing instability or by reducing the overall magnification.

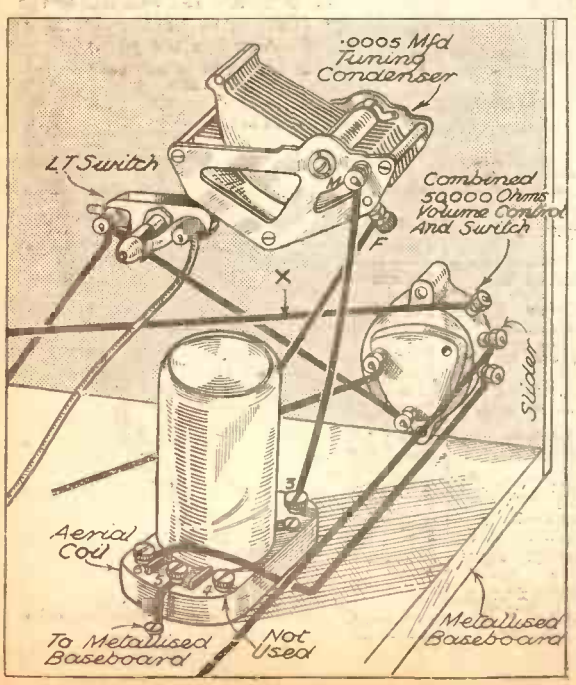
More Power.

Neither result occurs. On the contrary, the effectiveness of the set is such that we can't help thinking that the Contra-Phase actually increases the power of the set. There is more reason why it should do this than otherwise, but the improvement over a standard circuit is surprising.

For some time we debated as to whether or not we should fit the "Double X" with a battery economiser. In favour of this was the fact that its already low H.T. current consumption would be still further decreased, and against it that the cost of additional parts would be about 15s.

Not a lot for the advantages gained; in fact, it would be an investment that would return heavy dividends over the year. But so many constructors seem to prefer such things to be in the nature of optional

(Continued on page 645.)



CONTRA-PHASE CONTROL

The 50,000-ohm potentiometer and the run of its few connections are clearly shown to the left. It is amazingly efficient in action.

be used for long periods in this condition and provides a highly economical form of reception, too. If more volume is needed and a tour round the foreigners desired, a touch of the volume control brings in the S.G. H.F. valve and the sensitivity of this is adjusted in exact accordance with the requirements—all this with the one little knob.

THE VALVES FOR FIRST-CLASS RESULTS

Make	S.G.	Detector	Output Batt.	Output Mains
Cossor	220 S.G.	210 H.F.	220 P.A.	or 230 X.P.
Mullard	P.M.12	P.M.1H.L.	P.M.2A.	or P.M.202
Mazda	S.215B.	H.L.210	P.220	or P.220A.
Marconi	S.22	H.L.2	L.P.2	or P.2
Osram	S.22	H.L.2	L.P.2	or P.2
Hivac	S.G.210	H.210	P.220	or P.X.230
Tungsram	S.220	H.R.210	L.P.220	or S.P.220

SELECTIVITY Simplified
QUALITY Purified—

R.I. HAVE MASTERED INTERFERENCE & DISTORTION

Interference the bugbear of modern reception, and distortion, the danger of modern valves, are the two principal snags in radio that R.I. have mastered with the "Micrion" Adjustable Inductance Coil, and a range of transformers which are admitted to be the best of their types obtainable.

Remember, R.I. components are the solution to selective and amplification problems—experienced constructors fit R.I. first to prevent those problems arising.

'MICRION'
ADJUSTABLE INDUCTANCE IRON CORED COIL

The coil that has conquered interference—that enables your set to bring in station after station with clear-cut separation. It is easily fitted in place of existing coils, no costly troublesome alterations being involved. Just a turn of the adjusting inductance screw on the "Micrion" case is all that is needed to obtain the exactly same dial reading—if the aerial is altered at any time the same adjusting screw brings the tuned circuit into line—and other coils in the same set can be matched. "Micrion" is the finest iron cored coil in the world—described by the "Wireless World" as from 30% to 40% better than any air cored screened coil.

"Micrion" Adjustable Inductance Coil. List No. B.Y.36. Actual Size, 2¾ x 2¾ x 3 ins. high. **12/6**

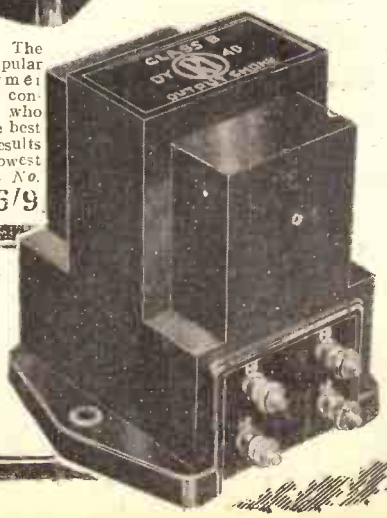
PARAFEED. The transformer that gives fullest efficiency in Parallel Feed Amplification.

Primary Inductance 85 henries. *List No. D.Y.43* **6/9**

'DUX.' The most popular transformer with the constructor who wants the best possible results for the lowest cost. *List No. D.Y.29.* **6/9**

R.I., makers of transformers that have set the standard of design and efficiency since 1922. More than ever in demand to-day because they definitely improve the tone and increase the volume of any set—don't try them *last* as a cure for distortion and lack of power. Buy them first to prevent disappointment.

HYPERMITE. The smallest really efficient transformer in existence. With Nickalloy core. High Primary Inductance (50 henries). *List No. D.Y.20.* **12/6**



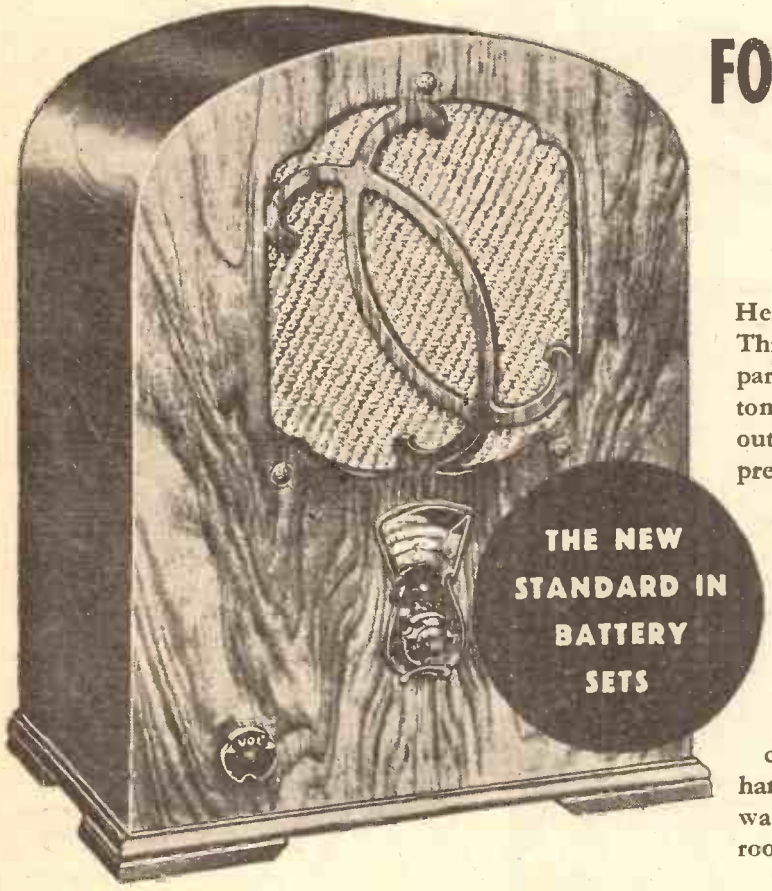
R.I. DRIVERMU "CLASS B" TRANSFORMERS (illustrated on right) are the inevitable choice of the experienced constructor and the best for the beginner. Ask your dealer or write to us for the R.I. "Class B" Brochure.

The full range of R.I. Transformers is illustrated and described in detail in the R.I. Catalogue, the best Radio Component Reference Book in the world—and the best source of inspiration when choosing gifts for your radio enthusiast friends. Ask your dealer or write to R.I. for a free copy.

The Advertisement of Radio Instruments Ltd., Croydon, Surrey. Phone: Thornton Heath 3211

ENJOY QUALITY PERFORMANCE WITHOUT ELECTRIC CURRENT

FOR £8.15.0



Here is the remarkable Columbia M.C. *Battery* Three with a performance in every way comparable with that of much dearer sets. The tonal quality from its moving-coil speaker is of outstanding power and purity. The band-pass pre-selector circuit brings in all the main foreign programmes, each clear of its immediate neighbour on the dial. Local station reception is held in check by the sensitivity control—and heterodyne whistle is eliminated by the Tone Control. Gramophone record reproduction from a pick-up is heard on this set with astonishing realism and volume. If desired, an additional speaker may be connected. H.T. consumption is low—only 7 m.a., and the large, handsomely-proportioned cabinet, finished in walnut, adds distinction to the furnishing of any room. Ask to hear it at any Columbia dealers.

SPECIFICATION

Inductively-coupled band-pass circuit. Permanent-magnet moving-coil speaker with provision for additional speaker. Single tuning with local-distance control. Tone selector. Output, 200 milliwatts. Marconi valves. 120 v. H.T. Battery with 6 v. grid-bias combined. 2 v. 45 amp-hours accumulator. Facilities for connection to pick-up. Walnut finished cabinet 18⅞" high. *(Prices not valid in I.F.S.)*

Have you heard the amazing Columbia C.Q.A. Battery Radiograph Four—the first really satisfactory battery radiogram? Ask your Columbia dealer to let you hear it, and to explain the wonderful new Columbia C.Q.A. principle which gives all-mains performance from a battery set on radio and records at astonishingly low battery consumption. **The Columbia C.Q.A. Battery Radiograph Four — price 20 guineas, or by Hire Purchase.**

To the Columbia Graphophone Co., Ltd., 98 Clerkenwell Road, E.C.1.

Please send me particulars of the M.C. Battery Three and the C.Q.A. Battery Radiograph Four without obligation.

NAME.....

ADDRESS.....

..... P.W. 2/12/33.

Columbia

RADIO AND RADIO-GRAPHOPHONES

THE COLUMBIA GRAPHOPHONE CO., LTD., 98 CLERKENWELL ROAD, E.C.1.

YOUR SET at XMAS

by the Technical Editor

WHAT is your set going to be at Christmas? A crystal set? A pre-S.G. det. and L.F. two-valver with a voice like an asthmatic frog?

The mere thought is an insult to Sir John Reith and his stalwart band of ether shakers. And an insult to your own ears.

Let's make this Christmas a grand rebuilding Christmas. Trade is better; the future is brighter. Don't hang on to your old time-worn gear a moment longer.

If every home-constructor in this country would make it his pleasurable duty to do something to improve his radio, if only by installing one new valve and a new loudspeaker, the trade figures would at once leap up quite a tidy bit. And unemployment would leap down.

Adding Class B.

There is a whole heap of worth-while things which can be done. But I do want to make it clear that the genuine pearls of wisdom which I am going to lay before you are not dictated by Chambers of Commerce.

My advice is solely directed towards the obtaining of better radio. You know, some of you home-constructors don't do the "roll-your-own" movement credit. You hang on to four- or five-year-old instruments and just tinker now and then with modern developments.

That's very bad. You ought to pull up your socks and show your "ham" friends who have to take what the factories give them, just what can be done. In fact, make it your year.

What about your loudspeaker? Or is it merely a quiet mumbler? You must start right. If you haven't got a loudspeaker which is able to do its stuff clearly and without distortion it's no use building up a good output from your set.

I suppose most of you, or at least many of you, will be using batteries for H.T. That implies little restriction these days.

First you want your set to be capable of providing a clear response. The oboe sounds horrid on a set which has the whiskers (i.e. harmonics) shaved off its treble. And who wants to miss those oboe obbligatos? Er—yes, I suppose you do.

The sound advice in this happily-written article is solely directed towards the obtaining of better radio. "Let's make this Christmas a grand rebuilding Christmas," says the author, and gives a number of really practical suggestions on how you can improve your set.

Well, anyway, even Jack's Painful when his treble falls by the wayside.

But clarity without volume is like holly without berries at Christmas. With your parlour cluttered up with company you'll want about twice your usual volume, or the music won't get over properly. The absorption powers of a Christmas gathering are enormous!

Two Alternatives.

Well, there are two alternatives. Class B is one. I'll go farther and say Class B is A1. It's too new to have soaked in yet. Only about a quarter of a million people are using it—more or less: probably less.

Do you realise how easy it is to add Class B to an existing set? As easy as adding a leaf to a dining-table. Easier, if my wretched dining-table is anything to go by! Rather funny about that, by the way.

There's a sort of screw thing which holds two sliding fitments together. Of course, I lost it. Such things must be made to lose. And, of course, there was no other screw in the house to take its place. There never is.

But was I stumped? Certainly not. Inventors never are. I looked round for a longish piece of metal or wood to spring the two sliders outwards. Nothing doing. Some more thought. A brainwave! Out into the cold, dark garden I went to cut off a bough of one of the fruit trees. It did the trick. Beautifully firm. Look, I can sit on it! (Fortunately, there *was* a bottle of embrocation in the house!)

However, this isn't radio. We must get back to Class B. What can you get from a Class B valve? About seven times the volume, with only a quite small addition of H.T. current.

That is, compared with that miserable little two-volt power valve (so called) that you are at present using.

The New Economy.

The other alternative is to use a bigger power valve of the ordinary type. "Ah," you say, "that means bringing up the H.T!" Not at all. Enter the Westector Economiser. I don't suppose even now more than quite a small percentage of you constructors realise what a fine thing that Westector Economiser scheme is.

It makes it possible for you to use a big output valve without taking any more H.T. current than does a quite small power valve. As for a quite small power valve—but who wants to use such a thing as that at Christmas?

Now, don't run away with the idea that big power valves, or Class B, for that matter, add much, if anything, to the amplification of a set.

A Cabinet Hint.

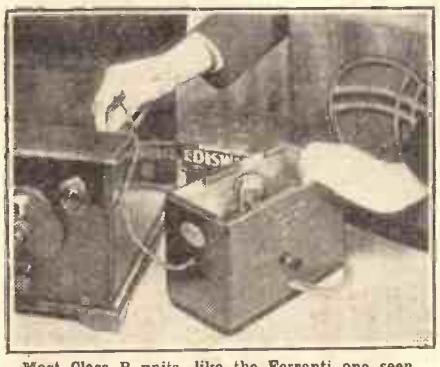
That isn't the way with them at all. It's just this: they will receive more input and push it out without distortion. If earlier valves in the set wilt under the strain of trying to supply more input, then something must be done about them too.

A big man might and should be able to carry a heavier load of coal than a small man, but that doesn't say that he is able to run as fast.

Which reminds me. Are you one of those untidy souls who never think of hiding the nakedness of a set chassis with a cabinet? If so I urge you to mend your

(*Continued on next page.*)

WHY NOT MORE POWER?



Most Class B units, like the Ferranti one seen here, are extremely easy to add to a receiver. They enable the dry battery user to obtain all the volume he can wish for.

WATCH YOUR L.T.

You really ought to get that spare accumulator for Christmas. They are generally very reliable, but you never know, and a Christmas without radio—well!

YOUR SET AT XMAS.

(Continued from previous page.)

ways. It is time we constructors made all our home sets look like radio sets instead of amateur laboratories.

There's no reason why a home-made receiver shouldn't look neat and tidy. I was talking to one of our trade friends the other day, and he told me that for every 100 kits of parts he sold he supplied only 10 cabinets!

What do you constructors keep your sets in? Egg boxes? Oh, of course, you don't worry about a "box."

What About A.V.C.?

You leave the "works" exposed as a dumping ground for dust, microbes and discarded fly's legs. Forgive my bitter sarcasm, but it is a scandal. Who's going to back me in a Cabinets-for-All Campaign?

My next spot of advice may sound fantastic—at first. It is that you should investigate automatic volume control. Sounds a pretty stiff proposition for Christmas, I know. But ponder over its benefits.

It reduces fading and institutes a volume level for practically all stations within certain limits. How grand to be able to tune in a foreigner and be able to let go of the controls without that disconcerting periodic reduction of volume! It means you can take a whole Hitler speech from "Gut Morgen" to "Gut Nacht" *without missing a word.*

What a splendid treat for your friends at Christmas! All the crowned heads of Europe use automatic volume control; not because of their crowns, but in spite of them. And their heads rest the easier for it. Awful nuisance, when you are wearing a heavy gold crown, to have to keep on jumping up and rushing over to the set to adjust the volume.

Those Multi-Mu's.

No, Horace my boy, you do not necessarily have to use a double-diode-peroxide pentode. That little Westector dry rectifier will do the job in conjunction with multi-mu H.F. valves.

Multi-mu is not, in my opinion, a happy term. It applies too aptly to a cat family. And multi-mu pentodes and S.G.'s don't necessarily squeak any more than most other valves.

Talking about S.G.'s, how's your accumulator? I've been having some trouble lately with one of the jelly type. For a time it did its stuff quite well; then suddenly it started to play tricks, running all kinds of periods from nil to normal per charge.

Candid Confession.

Candidly, I don't know why; haven't had time to investigate this particular spot of bother yet. But if you haven't got a spare accumulator you really ought to get one for Christmas. Your present one may not be unspillable; it may have given you magnificent service; but remember what Gladstone said in 1888. He said . . . he said . . . Well, it doesn't matter a darn what he said, anyway.

So far I have been addressing myself mainly to battery folk, so I must now weave a spell or two for the D.C.–A.C. fraternity.

You can easily find out if you have the mains laid on. Dig a trench about six feet deep across your front garden. If your pick strikes through a pipe and water gushes out, that indicates it is a water-pipe. If nothing visible comes out, but there is a terrific explosion when you strike a match, then, no doubt, it is a gas-pipe.

Power Possibilities.

Should neither of these things happen it is quite likely that the pipe carries the electric mains.

A more certain, and perhaps easier, method is to note whether or not people turn the lights on in the house by means of switches.

Rather elementary, you say? My rejoinder is that some listeners must have elementary minds or they surely wouldn't build up miniature power stations for their sets out of wet and dry batteries when, for less cost, they can derive H.T. and L.T. from the mains which run to their very feet.

Yet they do—plenty of them. However, there cannot be many "P.W." readers among them! That's flattery.

Mind you, I'm not running down batteries. No, that's wrong: I *am* "running down" batteries. I use quite a lot of batteries of one kind and another.

And there is a lot to be said for this method of providing electrical power. If you haven't got the mains you needn't think you are missing a lot.

A modern battery set can give a mains outfit a pretty good run for its money. And batteries have improved a great deal.

I have mentioned a spot of bother I've experienced with an accumulator. But I can assure you that I have also had reason to use strong language about mains outfits. Some of them are terribly noisy. They dig up hums and grunts seemingly from the far ends of the earth.

The Sympathetic Set.

Yes, if the mains can be a blessing they can also be a curse at times, what with all this electrical interference which can seep through the power plug and which has caused a bevy of learned gentlemen to go into session, and various other things.

Which reminds me of a very curious incident that happened last Christmas.

I had some friends at home for a convivial evening. With each new arrival the set stopped working, or, at any rate, the music dropped from full volume to a mere whisper until he or she had entered the room and sat down.

Very effective! But it wasn't prearranged. Of course, I pretended it was—until the wretched set packed up when it shouldn't. Was my face red?

I knew the reason. It was caused by an accidental conjunction between a gas-pipe and the mains conduit underneath the flooring which was affected by vibration. This upset the earth characteristic of my outfit. I should have put it right before.

Remember the Moral.

There is obviously a moral here, and that is you should make certain that you clear all those little faults as soon as they evince themselves.

I'd like to be able to tell you in a few words just what might happen to your set and how you could quickly and easily put it right.

But that can't be done. And yet, although there are a hundred and one common faults, let alone out-of-the-way failures, you'll miss most of them if you get into the habit of periodically running over your outfit, testing batteries, tightening terminals and so on.

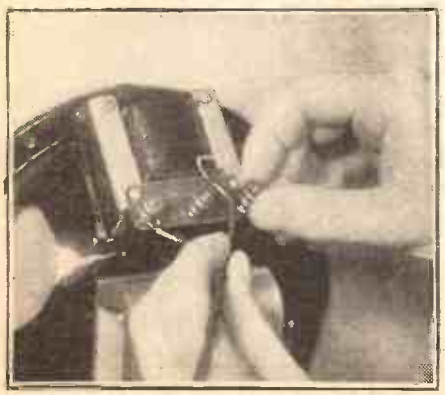
Your set at Christmas is going to be a very important item, and therefore deserves to be treated before as such just as much as during the festivities.

On which note of seriousness it is fitting that I should conclude, as the mouse said when he was sucked into the organ-pipe.

BUILD A NEW SET!

Why not scrap that old, out-of-date set and treat yourself to a Christmas present of a kit of parts for a new design? If your set is two or three years old its proper place is in the junk box, for the advance in receivers will have put it right out of date.

FINDING THE BEST TAP



It is as well to try all the taps on a loudspeaker input transformer to decide which gives you the most pleasing reproduction.

GET REALITY!

at CHRISTMAS

Your set this Christmas can give reproduction more vivid and lifelike than you ever thought possible. Thousands of W.B. users have been astonished at the improvement the "Microlode" has made in the performance of their sets.

Two typical letters:

"I wonder how many listeners realise (as I did when trying out the 'Microlode' pointer) how much volume is wasted when the speaker is not correctly matched to the output valve."

"I have connected mine up to my set (a straight 3-valve) and it's hard to realise it's only battery operated, so real is the reproduction, due, of course, to the accurate matching ratio scheme."

'MICROLODE'
P.M.4A — 42/-

Unique features evolved in the W.B. laboratories place this speaker in a different class from all other moving-coil reproducers ● The 'Microlode' feature, giving more perfect matching to the set than before possible, brings an evenness of response, obtainable in no other way ● The 'Mansfield' magnetic system, W.B. engineers' famous method of obtaining greater strength from the magnet, brings sensitivity, crisp attack and clear brilliant top notes ● Hear one at your dealer's to-day and realise what you have been missing!

And here is a new way of obtaining radio in another room.

The "Equilode," just released, uses an adaption of the Microlode principle. It is the ONLY extension speaker that will work perfectly from ANY set. It embodies also a volume control and "extension off" switch. As a Christmas present to yourself or a friend it is ideal. Price 33/6. Write for the folder.

'MICROLODE'
P.M.6 — 32/6

The improvement will AMAZE you

Whiteley Electrical Radio Co., Ltd., Radio Works, Mansfield, Notts.

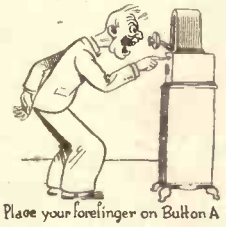
Sole Agents in Scotland: Radiovision Ltd., 233, Vincent St., Glasgow, C.2. Sole Agents in I.F.S.: Kelly and Shiel, Ltd., 47, Fleet St., Dublin.

MY RADIO INVENTIONS

BY LEONARD HENRY

A recognised star of the broadcasting firmament, the inimitable Leonard turns to radio as a further outlet for his irrepressible good humour.

SOME people have a great admiration for those lofty-domed, horn-rimmed chaps who wire in to wireless and make two loudspeakers grow where only one grew before. I admit they invent the most marvellous things, and it's wonderful how, with just a simple matter of half a dozen valves, a few rheostats and heterodynes and things, and about fifteen miles of wire, they produce a receiving set that will do anything except boil eggs and shine shoes.



But it does seem to me they waste a lot of time inventing things that aren't much real use. For instance, first they invent a set that, with careful wangling and a lot of luck, will just get the local station.

What Is Really Wanted.

Then they mess about with the darn thing till only the touch of a master hand can keep the local station from popping in cheerfully all round the dial. Then, when they're told to make it more selective they get it so sensitive that if the baby cries and sets up a few unexpected vibrations, you are jerked from a select suburb of Birmingham into the wilds of Germany before you know where you are. I mean, it's so much wasted effort that could have been diverted into far worthier channels.

Now the gadgets I am going to invent, when I can give the matter a few moments' attention, are really useful ones. For instance, you must have suffered many a time from dangerous rises in blood pressure because Professor Dogsbody was lecturing on "The Advantages of a High Rate of Income Tax"; or Sir Ardnamurchan Alley was giving a bright little health talk on "Why Holidays are Bad for You"—*and you couldn't answer back.*

For Genuine Sufferers.

I hope to put on the market quite shortly, a wireless set which has a neat little mouthpiece beside the loudspeaker. Underneath the mouthpiece will be a small button, known as Button A.

When you feel your blood pressure rising, you place your forefinger firmly on Button A. Directly your blood pressure reaches a certain number of pounds per square inch, Button A will be very depressed, and will thus complete the circuit, linking you up with the studio and enabling you to speak into the mouthpiece and *tell* the lecturer precisely *what you think of him.*

The Button A idea is to ensure that only genuine sufferers will apply. After all, one can't have B.B.C. lecturers troubled with frivolous complaints.

Two Guineas a Time.

The same device will, of course, enable infuriated listeners to give sopranos the bird, comedians the raspberry, chamber music a few dismal hoots, and political speeches three hearty groans.

Obviously it is what the public is waiting for, and at a couple of guineas a time it ought to make my fortune.

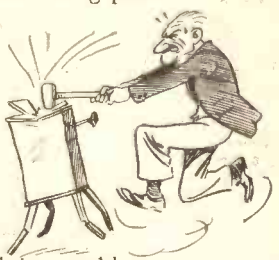
Then there's this business of remote control. It's very nice to be able to sprawl in your armchair and twiddle your set without the bother of getting up and taking two smart paces forward, but that's only pandering to pure laziness. *I'm* going to invent something *useful. My* remote control will give the works to your next door neighbour's loudspeaker.

A Neighbourly Action.

When he's blasting away at a brass band concert and making enough din to disintegrate the coal in your cellar, you just twiddle the dial of your control switch and either fade him out to a metallic whisper *or tune him into the Fat Stock Prices.* Or if he is turning your Sunday afternoon nap into something doctors operate for, you quietly snatch him from Radio Paris and, by a simple adjustment, make it impossible for him to get anything but Bach Cantatas.

That'll learn him! Cheap at five guineas, I think? An absolute gift, my dear sir.

Then I'm sure you have had that nerve-racking experience of sitting through a programme of which you only like bits. Either you have to endure thirty minutes sheer horror for the sake of getting the thirty minutes you really want to hear; or you are continually jumping up and switching on and off at the wrong places.



Suppose, for instance, you have an intense admiration for the Searcham Graspington Quintet. You see they are to play from 8 p.m. till 9 p.m. Unfortunately, the programme also includes Miss November Fadeaway, soprano, and Mr. Tootal Viyella, baritone, and you have a mass hatred for sopranos and baritones.

How It Always Happens.

At about 8.5 you hastily switch on and hear the last majestic chords of one of your favourite pieces, perfectly played by the Quintet. Then there is dead silence till 8.7.

Just as you are certain your set has gone phut the voice of the announcer states that Miss November Fadeaway will sing five songs. You stand it for about a song and a half, and then switch off.

At 8.15 you cautiously switch on and find *Miss Fadeaway still in full blast.* At 8.20 you try again, and hear the last five bars of the Quintet's rendering of another favourite piece. Then Mr. Viyella unburdens himself in six songs, and so it goes on till you take a coal hammer to your set and buy a gramophone.

Now my invention will obviate all this. It will be a neat little filter contraption which will fit over the loudspeaker and will only let through the music you like. It will have a big dial with about half a dozen pointers on it.

You set the pointers to the things you fancy, and the rest will be as though it

(*Continued on next page.*)

THE MAGIC BOX.

Christmas is the time for reminiscences, and many pleasant memories of the early days of broadcasting will be revived by this happy reminder of catswhiskers and all that.

I CAN scarcely realise what utter back numbers we were where wireless was concerned, even a year after 2 L O's voice first shattered the ether. Quite suddenly, I remember, it dawned on us that we were missing something.

Green as the proverbial grass, we sauntered down the Strand, gazing in awed rapture at what you dear readers would unhesitatingly label "bundles of junk."

A Prize—At a Price.

Finally, summoning up courage, we plunged into what seemed a less piratical store than the average, and after parting with not a few good "Bradburys," emerged with a 6-inch cube of magical possibilities.

A second pirate produced 'phones at cut prices. When, at last, we got outside, we felt like going back and cutting his throat. In the network of byways between the Strand and Tottenham Court Road we chanced on a humble dealer who actually had insulated wire at something less than 18-carat prices.

We almost fell on his neck and wept; to show our gratitude we bought up his stock; we felt we could do no less, and anyhow we needed the 90 odd feet.

Once home, lunch seemed an interminable affair, but at last we were free to make a start. Cautiously we prized up the lid, disclosing the catswhisker and crystal nestling inside.

Gingerly, very gingerly, we touched the catswhisker to the crystal. Just what we expected, I don't know. I rather think a blinding flash, and a nasty shock. You can see how very green we were; we didn't even think of rubber gloves as an elementary precaution.

Anyhow, nothing worth mentioning seemed to happen. Much relieved, we proceeded to turn the room into a perfect geometrical nightmare of wire.

After a long discussion on the habits and vagaries of ether waves, our "book of words" touched on the matter of earths, merely advising us to tie the wire to a water pipe. Even our feeble brains had arrived at that solution before we opened the book.

The Burning Question.

The burning question with us was whether the wire should be insulated or bare. Fortunately, in the light of subsequent knowledge, we chose the right path.

Having done that, we went the whole hog, and scraped the water pipe to a satisfying brightness. From this moment I date our arrival in the ranks of the "fans."

Jeff, Caractacus & Co.; how we revelled in their breezy cross talk, still believing in our innermost selves that the B.B.C. has failed to produce their equal since. Perhaps it was just the effect of novelty; the question can never be answered.

We still possess that little crystal set, but it has long ceased to be a box of mystery. A young cousin, with vandalish instincts, saw to that. A careless elbow, a crash, and the mystery box flew open. In place of the intricate mass of delicate and shining apparatus we had imagined, there lay revealed a rough block of wood, covered with enamelled wire. Like so many other things in this world of illusion, it, too, was but a "whited sepulchre."

T. L. P.

THE PASSING OF AN "OLD TIMER"

Many pre-broadcasting crystal-set "fans" will learn with regret that the famous Horsea masts have been dismantled in this drastic manner.

never was. You leave your set switched on, and whenever the B.B.C. is thoughtful enough to hurl one of your favourites into space, *you get it.*

Otherwise, the silence is unbroken. That ought to be a bargain at three guineas a whack.

There are at least four million listeners in England, and I'm pretty certain they will all buy all my gadgets, so that gives me a gross income of about £40,000,000. Allow, say, half for expenses and I still have twenty millions to my credit.

That will give me a bit of working capital for my greatest invention, my *pièce de résistance*, my *magnum opus*, my *ipso facto*. That will be a complete apparatus for washing and sterilizing wireless waves.

Just think how things are at present. Positively insanitary, I call it. Here are all these waves being sent out, not only by the B.B.C., but by stations throughout the civilised world, and also by Chicago; *and not a thing is done to purify them.*

Unwashed Waves.

Has anyone the right to send waves gate-crashing into your house without even taking the trouble to see they are free from the more virulent forms of microbe? For all you know, they may be sodden with septic sediment, reeking with rotten residue,

MY RADIO INVENTIONS

(Continued from previous page.)

clotted with garbage, and inundated with uliginous matter.

Yet morning, noon and night, for twenty-four hours of the day, these myriads of waves with inconceivably fulminating potentialities are sweeping unhindered into your homes. *It is a grisly thought.*

Acid Tests.

When my method is universally adopted, each broadcasting station will have to issue a certificate that all waves dispatched are of Grade A quality, warranted free from contamination by rinderpest, guaranteed innocent of any trace of malfeasance, bacteriologically tested for onomatapoea and with all carboxyhaemoglobin extracted by triple distillation.

Then they'll be the sort of waves a girl can introduce to her mother.

The purifying process will be simple, but effective. The waves are first passed through a bath of powerful acid.

Then they are subjected to a pressure of eighteen and a half atmospheres—good, strong atmospheres, the type one finds just before closing time. After that they are rapidly cooled to a temperature of 80° below freezing point.

This part of the process is very important, and to make sure of success the operators will all be blondes who are trained to *give nothing but icy glances.*

When they have been thoroughly chilled, a battery of powerful electric fans, in charge of a highly skilled staff of football, cinema, and speedway fans, is turned on them. This will blow away the last remaining cobwebs, so for the final stage the waves will be gently heated by an abundant supply of hot air. You might think that this latter is a commodity of which the B.B.C. already has plenty. If not, it could be specially generated at Broadcasting House, till the waves are warm and dry enough to carry in safety either the hottest jazz or the driest lectures.

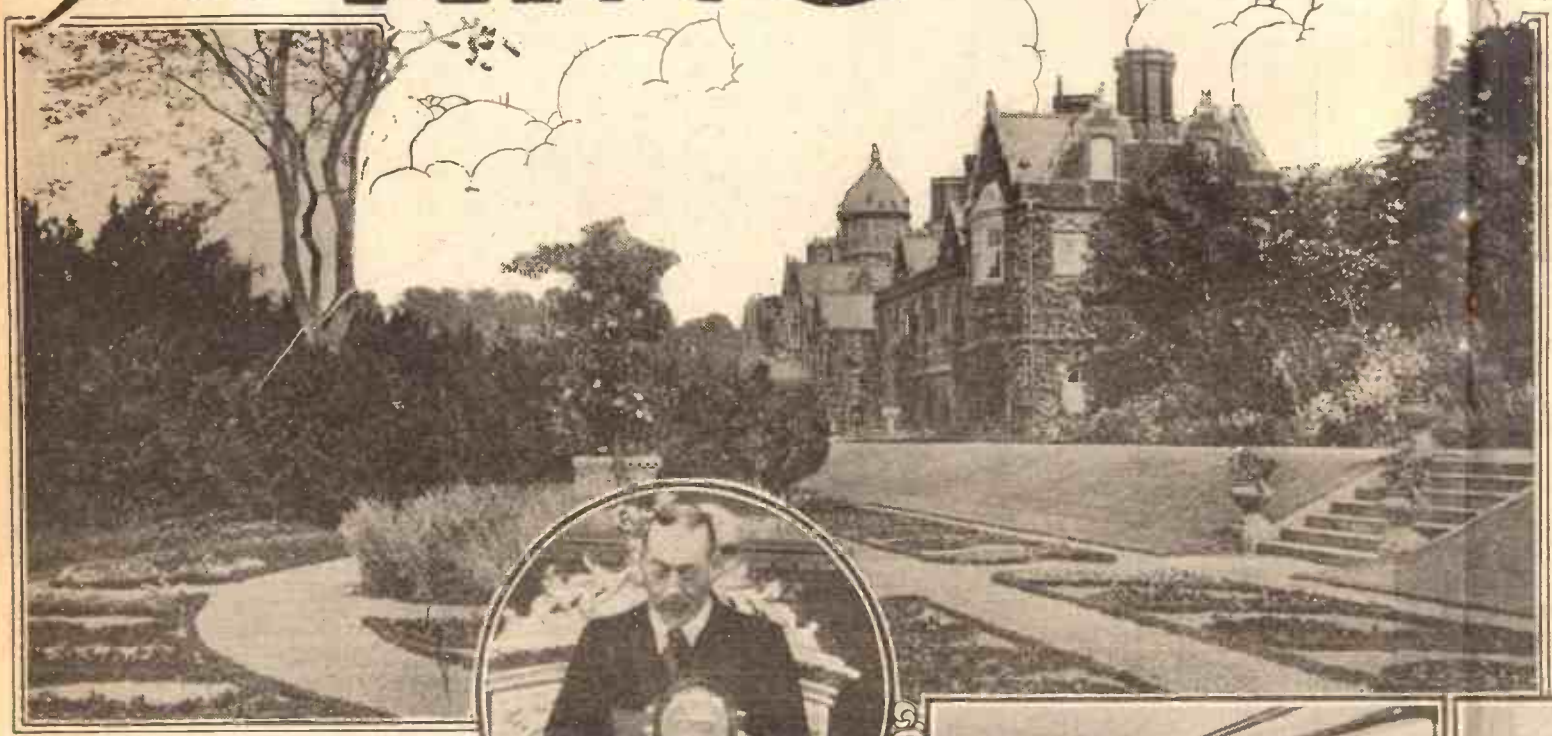
A Fair Offer.

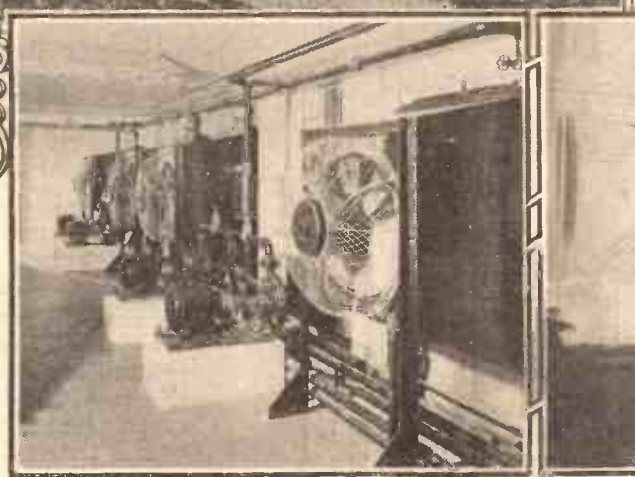
I think that if each listener paid an extra sixpence for his licence, and this additional sum was handed over to me, I should be amply repaid for my trouble in ensuring Pure Waves for Pure Programmes.

That, ladies and gentlemen, concludes my list of forthcoming attractions, but in case I am too busy to work out the minor practical details, I am prepared to consider a cash offer for the lot as they stand. Now then, what offers? Any advance on five bob? *Going, going, GONE!*

LEONARD HENRY.

The KING SPEAKS





ON CHRISTMAS DAY H.M. THE KING WILL BROADCAST A MESSAGE OF GOODWILL TO THE PEOPLE OF HIS EMPIRE.

> " . . . I speak now from my home and from my heart to you all; to men and women so cut off by the snows, the desert, or the sea that only voices out of the air can reach them; to those cut off from fuller life by blindness, sickness or infirmity; and to those who are celebrating this day with their children and their grandchildren—to all, to each, I wish a happy Christmas."

Nearly twelve months ago, at a little after three o'clock on the afternoon of Christmas Day, those words were spoken by His Majesty the King into a special microphone on his desk at Sandringham House. By the aid of wireless, the King was enabled to do what no other king has ever done before—to speak at one and the same time to his people at home, and his people in the Dominions overseas.

For listeners in the British Isles, in Canada, in Australia, in South Africa and in countless parts of the world, this personal message from the King was the great event of Christmastide. You can imagine, therefore, the enthusiasm which has greeted the announcement that His Majesty will once again broadcast on Christmas Day, 1933.

Christmas at Home.

It has long been the King's custom to spend Christmas at his Norfolk home with his family. And so, when the Royal broadcast is heard on December 25th, you will be able to imagine for yourself a scene very similar to that being enacted in thousands upon thousands of homes throughout the country.

Before the end of November the King and Queen had already selected, from the grounds of Sandringham, the young fir tree which will dominate the Christmas party in the afternoon. You can imagine the King, when the mid-day meal is over, walking to the small room in Sandringham House where the microphone will be waiting for him, together with an unobtrusive signalling system which will indicate that the engineers are ready for the broadcast to begin.

Just a Family Gathering.

And at the end of the broadcast, the King will return to the party and the Christmas tree, and will, perhaps, help Princess Elizabeth to play with the miniature theatre which she has been promised for a present. There will be presents, too, for everyone at Sandringham House and for the people of the village. For at Christmas the King can forget for a while the cares of State and become just the squire of the village.

So that this Christmas broadcast will be no official occasion, but a message of goodwill from "my home" (as the King said last year) to your home.

* * *

Many of you, used to your daily dose of wireless programmes, and having a long time ago ceased to wonder at anything which the B.B.C. may do in the course of entertaining you, will probably not realise the vast amount of work and responsibility which attends a broadcast of this nature. The slightest technical hitch would be regarded as a calamity, not only by listeners but, even more, by the B.B.C. which jealously guards a reputation for efficiency and constant service.

Reliable Broadcasting Service.

The actual breakdown time during 1932 amounted to ·023 per cent of the total programme time—roughly an average of nine-tenths of a *second* in every hour! An infinitesimal amount, of course, looked at like that. But there is no knowing when these nine-tenths of seconds may occur. That they never occur when the King is speaking is due not to good luck but good management.

In charge of this Christmas broadcast will be Mr. Gerald Cock, director of outside broadcasting, and his assistants. To Mr.

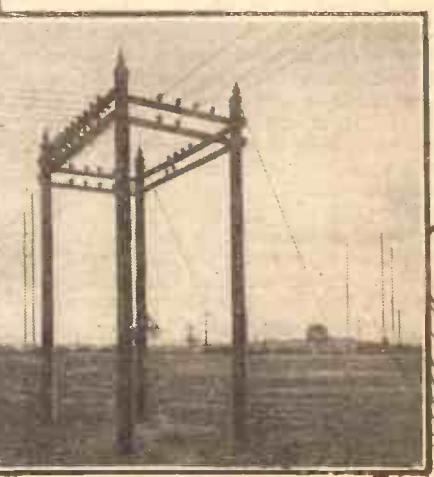
TO HIS EMPIRE

The King's broadcast in the Empire celebration programme in the afternoon of Christmas Day, 1932, was the most universally proclaimed programme in the whole of the ten years' history of British Broadcasting. This year His Majesty will again sit at his desk in his Norfolk home, and will speak to the peoples of the British Commonwealth of Nations—and to listeners throughout the Continent of North America.

Cock has already been given credit for many outstanding broadcasts. He is responsible for the Boat Race, the football commentaries, the racing broadcasts, and the hundred and one other items of a like nature which make up the daily programmes. To-day he may be organising a relay from a London theatre, to-morrow, perhaps, it is the launching of a new liner from one of the dockyards of the North; the day after the Prime Minister's speech at a banquet may claim his attention. It's all in the day's work.

But even to Mr. Cock and his department, these broadcasts from the King hold some excitement. And there is plenty to be done before the best of all broadcasting voices is heard on Christmas Day.

Here is illustrated, photographically, the way in which the King's message will reach the Empire. His Majesty, who will be at Sandringham (illustrated on the left), will speak into the gold microphone seen in the circle. His message will be conveyed by landline to Broadcasting House, and from thence to Daventry, and the Empire short-wave transmitters, sections of which are shown in the remaining three photographs.



The preliminary arrangements for the Sandringham relay are not made in the ordinary way. There is no question of Mr. Cock calling one fine morning at Buckingham Palace and saying:

"We think it would be a good idea if His Majesty were to talk to the Empire again this year; perhaps we can arrange to talk the matter over one day soon!" The Director-General himself must carry out the first arrangements, and the actual suggestion must come from the King. But once settled—and it is well known in Court circles that the King himself welcomes the opportunity which the B.B.C. can offer—Mr. Cock can get to work.

Two Alternative Routes.

It is a generally known fact, of course, that the B.B.C. works in close co-operation with the G.P.O. whenever long-distance relays have to be carried out. A special department on the technical side of the B.B.C. deals with the matter, but the lines used for outside broadcasts are the ordinary trunk telephone lines, rented to the broadcasting authorities for so many minutes at so much a minute. The first move, therefore, is to make arrangements for lines to be available between Sandringham and London for the afternoon of Christmas Day. Leaving nothing to chance, two alternative routes have been arranged for this year's broadcast.

Special Repeater Stations.

The microphone in the King's study at Sandringham House is connected through the private royal exchange to the London trunk exchange in London, and from there a line runs to the control room at Broadcasting House. To ensure the broadcast being kept up to adequate strength, special repeater stations will be installed along both the trunk routes.

Arriving at Broadcasting House, the signals will be passed through one of the permanent amplifiers—D Amplifiers, they are called—which is installed in the control room for the purpose. This is a three-stage, resistance-coupled amplifier using directly-heated valves fed from central batteries used for all the amplifiers. As the sound level of incoming transmissions varies according to the lines used, there is a potentiometer in the first grid circuit which controls the overall amplification.

From here the King's message will be sent out along the permanent lines which connect Broadcasting House with all the British stations and with the short-wave Empire transmitters at Daventry. At the time of writing it is not definite which of the Empire transmitters will actually be used, but it is quite certain that the broadcast will be put out through an omni-directional aerial, with the addition of other systems as may be found suitable to the prevailing conditions.

It should be obvious, then, that so far as human ingenuity and skill can contrive it, the King's message to his people will be technically perfect.

Relayed to America.

The broadcast this Christmas will take on a special significance which it did not have in 1932. Last year, when the elaborate Christmas programme was arranged to celebrate the commencement of regular Empire broadcasting services, the broadcasting authorities of the United States applied to the B.B.C. for permission to relay the programme, or at least the King's message, through their vast network of stations.

It was felt on that occasion, however, that the programme was so entirely Imperial in character as to warrant confining it to the limits of the Empire. So the American relay never took place.

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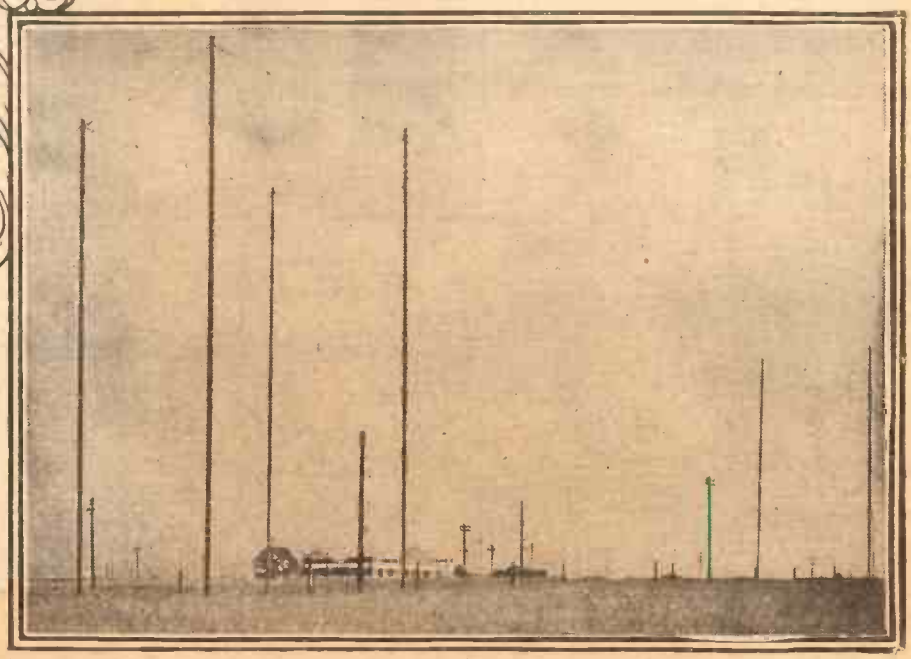
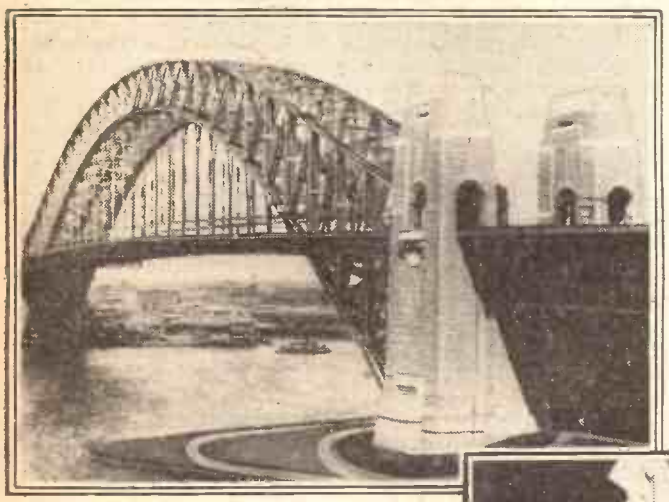


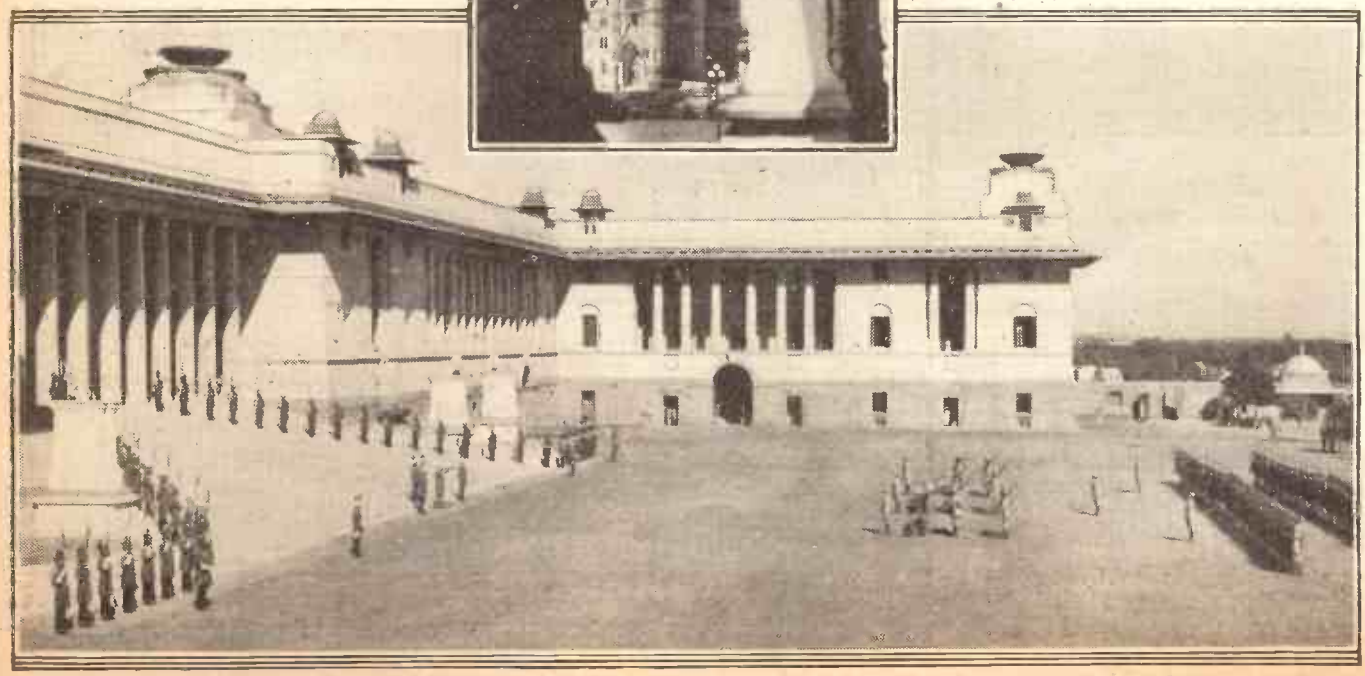
THE KING SPEAKS TO HIS EMPIRE

(Continued from previous page.)

This year the King has signified his willingness for his message to be available for world-wide relay, and although the American authorities have not yet asked official permission, the officials concerned are confident that there will be a general "hook-up" of the speech through the whole chain of stations controlled by the National Broadcasting Company and the Columbia Broadcasting System, the two biggest radio concerns in America.

Some idea of the vastness of this relay may be gathered from the fact that the N.B.C. alone controls no fewer than 600 separate broadcasting stations, while the C.B.S. is also responsible for a large number. But the listeners of the States are always anxious to hear any word broadcast by "King George of England," and that such an opportunity as the Christmas message should be missed is not to be thought of.





From the heart of the English countryside to the far-flung outposts of Empire travels the King's message to his people. A voice speaking into a gold microphone in the little Norfolk village of Sandringham will be heard by millions of English-speaking men and women celebrating their Christmas in the farthest corners of the earth. The bridge across Sydney Harbour, the clock-tower at Ottawa, the vice-regal Lodge at Delhi—these are the landmarks which typify the vastness of the audience which will listen, on December 25th, to its King-Emperor.

The technical arrangements for the American side of the broadcast will, of course, follow the usual lines of trans-atlantic relays. Recent programmes from America have shown that vast strides have been made recently in this branch of radio.

The G.P.O. will again be called in to co-operate with the B.B.C., and the outgoing transmission from Broadcasting House control room will be handled in the same way as an ordinary transatlantic telephone call by picked operators in the G.P.O. Anglo-American radio-telephony service.

Over 300,000,000 Listeners.

The white population of the British Empire is in the region of 60,000,000. It is reliably estimated that the United States broadcasts reach no less than 300,000,000 listeners. So, when you sit in your chair on the afternoon of December 25th, you will know that you are but one of many million listeners in all parts of the world! Some of the listeners will just be starting their Christmas Day, some will be entering upon the early hours of Boxing Day. In Australia, Melbourne will be in Boxing Day, while Perth and Adelaide will still be enjoying Christmas trees. But all will make an effort, a very special effort, to find some sort of loudspeaker through which they can hear the voice of their King.

* * *

Finally, there is an interesting "side-line" to the broadcast which will provide a permanent record of an historic occasion. The King's speech will be recorded, in the control room of Broadcasting House, on the steel tape of the Blattnerphone, from which it can be reproduced later not only for the benefit of those Empire listeners who were unable to hear the original broadcast, but also for record in the B.B.C. library.

A great deal of trouble, you may say, for a broadcast which will last only a few minutes. But it is trouble which will be well repaid, for no more popular programme item has ever been conceived, either for this country or for the listeners of the Empire, than the occasion of a message of goodwill from the King-Emperor.

"No Tears with a PILOT AUTHOR KIT"

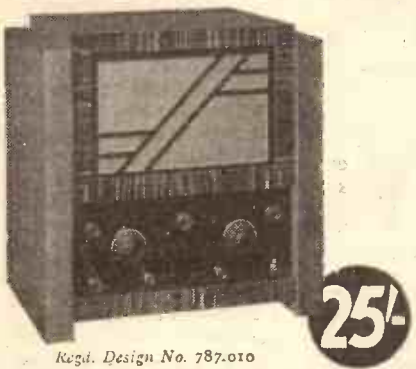
S.T.500

PILOT AUTHOR KIT
EXACT TO SPECIFICATION

The Pilot Kit SERVICE was founded in 1919.

See the PILOT on the carton. It's a real guarantee.

PETO-SCOTT S.T.500 WALNUT CONSOLETTE



Regd. Design No. 787.010

An outstanding example of cabinet craftsmanship. Hand French polished. Veneered Macassar and Walnut finish by experts. Cash or C.O.D. 25/-. Carr. and Packing 2/6 extra, or 6/- *Deposit and 4 monthly payments of 6/- (including carriage and packing). Baffle-Baseboard Assembly, 3/6 extra.*
Specified PETO-SCOTT TABLE CABINET. CASH or C.O.D., 19/6 (Carriage 2/6 extra). Or 6/- Deposit and 3 monthly payments of 6/- (including carriage and packing).

SEND FOR 1934 CABINET CATALOGUE.

CASH — C.O.D.

£5-5-0

OR YOURS FOR **9/6**

Balance in 11 monthly payments of 9/6.

KIT "A" Comprising Mr. John Scott-Taggart's Kit of FIRST SPECIFIED Components, including Telsen "Class B" Output Choke, Peto-Scott "Metaplex" Baseboard and Ready-drilled Panel and Terminal Strip. Less Valves and Cabinet. With FULL-SIZE Blue Print and copy "Popular Wireless," Oct. 21st. Cash or C.O.D. Carriage Paid, **£5-5-0**
or 12 monthly payments of 9/6.

KIT "B" As Kit "A" but including 4 Specified Valves. Cash or C.O.D. Carriage Paid, **£7-10-3**
or 12 monthly payments of 13/9.

KIT "CT" As Kit "B" but including Peto-Scott Specified Walnut Table Cabinet. Cash or C.O.D. Carriage Paid, **£8-9-9**
or 12 monthly payments of 15/6.

KIT "CC" As Kit "B," including Peto-Scott Specified Walnut Consolette Cabinet. Complete with Baffle Baseboard Assembly, but less Speaker. Cash or C.O.D. Carriage Paid **£8-18-9**
Or 12 monthly payments of 16/3.
If Peto-Scott Permanent Magnet Speaker required add 15/- to Cash Price or add 1/3 to each monthly payment.

IMPORTANT

Order from PETO-SCOTT any separate items for the S.T.500. We specialise in, and carry the largest stocks in the country of all FIRST SPECIFIED PARTS. Delivery from stock. Therefore, you KNOW that you are certain of receiving the parts Mr. John Scott-Taggart chose. WE DO NOT SUBSTITUTE. Send Cash or C.O.D. Orders over 10/- all Post Charges Paid. Easy Terms on orders over £2.

S.T.500 STRUCTAKIT

With Free Copy "POPULAR WIRELESS" and OFFICIAL BLUE PRINT.

7/6 CASH OR C.O.D

Comprising Peto-Scott Baseboard with Metaplexed Section; Ready-Drilled Panel and Terminal Strip; S.T.500 Screen; B.R.G. Mounting Bracket.

CONVERT YOUR S.T.400 to S.T.500

With Free Copy "POPULAR WIRELESS" and OFFICIAL BLUE PRINT.

YOURS FOR **5/-**
BALANCE IN 8 MONTHLY PAYMENTS OF 5/3

Peto-Scott S.T.500 Conversion Kit comprises all FIRST SPECIFIED parts required to convert your S.T.400 to the new S.T.500, including output choke but less valve. CASH or C.O.D., Carriage Paid, 42/-. H.P. TERMS: Complete Kit with Valve, 12 monthly payments of 5/3.

"DOUBLE X"

KIT "A" Author's Kit of First specified parts, including ready-drilled panel with Metaplex baseboard, less valves and cabinet.
Cash or C.O.D. Carriage Paid, **£3-18-9**
Or 12 monthly payments of 7/3.

KIT "B" As Kit "A" but with Valves, less Cabinet, Cash or C.O.D., Carr. Paid. **£5-13-3**
Or 12 monthly payments of 10/3.

KIT "C" As Kit "A" but with valves and Peto-Scott Universal Type Table Cabinet. Cash or C.O.D., Carr. Paid, **£6-8-3**
Or 12 monthly payments of 11/9.

Essential Accessories

1	Set of specified valves	£1	14 6
	Peto-Scott Universal Type Cabinet ...		15 0
1	Pair Telsen W.422 iron-cored coils ...		17 0
2	Ormond R.486 tuning condensers		13 0

"A.C. "DOUBLE X"

KIT "A" Author's first specified parts, including Peto-Scott Metaplex Chassis, Baffle Baseboard Assembly and Metal Rectifier, but less Valves, Speaker and Cabinet.
Cash or C.O.D. Carriage Paid **£9-16-0**
Or 12 monthly payments of 18/-.

KIT "B" As Kit "A," but with Valves only. Cash or C.O.D., Carr. Paid, **£12-5-6**
Or 12 monthly payments of 22/6.

KIT "C" As Kit "A," but With Valves and specified Peto-Scott Cabinet, less Speaker. Cash or C.O.D., Carr. Paid. **£13-15-6**
Or 12 monthly payments of 25/3.

Blue Spot 29 P.M. Speaker. If required, add £1-12-6 to Cash or C.O.D. prices, or 3/- to each monthly payment.

S.T.500 FINISHED INSTRUMENTS

"S.T.500," complete in Peto-Scott Walnut Table Cabinet, exact to Mr. John Scott-Taggart's FIRST Specification. Aerial Tested. Complete with Valves.
Cash or C.O.D. Carriage Paid, **£10-0-0**
or 12 monthly payments of 18/3.

"S.T.500," complete in Peto-Scott Walnut Consolette Cabinet, exact to specification. With Peto-Scott Moving-Coil Speaker. Complete with Valves. Ready to Play. Aerial Tested.
Cash or C.O.D Carriage Paid, **£11-5-0**
or 12 monthly payments of 21/-.

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Dear Sirs,—Please send me, CASH/C.O.D./H.P.: .....
for which I enclose £.....s.....d. CASH/ H.P. Deposit.
NAME.....
ADDRESS..... P.W., 2/12/33.

ANY ITEM SUPPLIED SEPARATELY—ORDERS OVER 10/- SENT C.O.D. CARRIAGE AND POST CHARGES PAID

THE MIRROR OF THE B.B.C. By O. H. M.

SIR JOHN REITH BACK

Experiments in the News Bulletins ?—Director of Variety Spends the Money—Christian Science in the Programmes.

SIR JOHN REITH managed to visit America, and to create a great stir there, without any considerable publicity reflection on this side. It was noticeable that he kept himself out of any of the relays the B.B.C. took from the N.B.C. in connection with their Radio City festival. Despite the shortness of his stay, however, Sir John " took in ' a great deal of American practice on all sides of the work, and his ideas have already found their way into most of the departments concerned at Broadcasting House. He is stated to be chiefly concerned that his organisation learns the technique of that crisp presentation at which the Americans are so adept.

News Changes.

As I exclusively forecast, Mr. Holt, the able news-editor of the B.B.C., has been transferred to the publications department. No announcement is made yet as to his successor, but there are indications that the change means the end of the professional journalist's control of the broadcast news bulletins. We are probably in for a spate of experiments in " special interpretations."

Expensive Variety.

The rapid development of variety programmes under the vigorous and ambitious direction of Eric Maschwitz, alias Holt Marvell, is proving expensive to the B.B.C. I hear that one of the leading programme builders in the provinces has been told to abandon his pet projects because there is not enough money to go round since London variety really got going. I was the first to tell of these new variety plans and to welcome the lightening of the programmes which they seemed to promise. But it appears that the pendulum has swung too far if the provinces are to be starved.

Ambitious Dickens Programme.

Christmas programmes are now taking shape, but much detail work remains to be done by the Entertainments Branch and the Presentation and Religious Departments at Broadcasting House.

A week before Christmas a real old-fashioned Dickensian celebration may find a place in the programmes. This year, a more ambitious project is in view, namely, a full-size presentation of "A Christmas Carol," lasting over an hour. It will be broadcast in the National programme on December 18th and in the Regional programme on December 19th.

The Advent of Christian Science.

So Christian Science is at last breaking through the B.B.C. barrage. For many years abortive attempts have been made to induce the B.B.C. to admit Christian Science to the list of recognised religions providing services on the air. Finally, Lord Lothian intervened, and as a result of correspondence with Sir John Reith the latter has promised that there will be a special series of Sunday talks on Christian Science early in 1934.

New Radio Productions.

Authors and composers are working hard upon six new radio productions of the operetta type, of which " Good Night, Vienna " and " The Castle on the Hill" are excellent examples. When finished they should prove to be some of the high spots of the programmes for 1934.

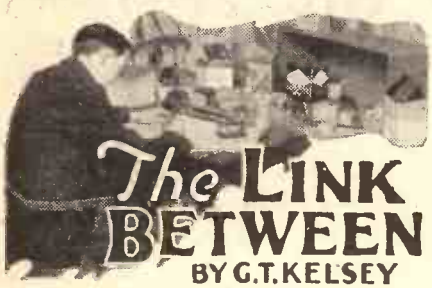
Herbert Farjeon's " One Day in Summer" (with music by George Posford) is a romantic story of Switzerland ; but Henrik Ege relies on an aerodrome setting for his story " Ace of Hearts," for which Harry S. Pepper is writing the syncopated score.

James Dyrenforth is writing the book and lyrics and Kenneth Leslie Smith the music for " Love Needs a Waltz." It will probably be a case of jazz versus the Viennese waltz.

(*Continued on page* 648.)

BROADCASTING UNDER DIFFICULTIES

While we in England are experiencing real wintry weather, the M.C.C. team, which recently arrived in India, is enjoying the best of sunny conditions. In the photograph above, you see Mr. D. R. Jardine, the captain of the team, on the occasion of his arrival, broadcasting under somewhat difficult circumstances.



Weekly jottings of interest to buyers

" THE Link Between "—weekly notes of interest to buyers—and this the special Christmas Number of "P.W."! What a golden opportunity!—for who is there among our vast army of readers who is *not* a potential buyer at this time of year ?

But first, to live up to the title under which I write, I have a twofold duty to perform. A great number of trade personalities with whom it is my pleasurable duty to come into contact have asked me, through the medium of these notes, to convey their cordial wishes for the festive season to all " P.W." readers, and I know that " P.W.'s " great army will join me, not only in reciprocating their greetings, but in wishing them continued prosperity in the future. Here's to still better sets, to new components and to lower prices! And now we are all friends !

Next, then, this great question of radio Christmas gifts. What wouldn't I give for several pages all to myself this week ! But then, again, where's the need ?

Who could possibly want better guidance on the choice of radio Christmas gifts than that which is given in " P.W.'s " special Supplement this week ? If you cannot find what you want in that, then I am almost prepared literally to eat my hat ! It is about as complete as it possibly could be, and, moreover, it contains suggestions to suit all pockets.

* * *

There is little need for me to attempt in any way to supplement the information contained in that guide. In any case, it is extremely doubtful whether I could single out even one solitary item that is not adequately covered. But, as this is the Christmas Number, I feel that it might perhaps be helpful at least to devote a paragraph or two to the question of radio Christmas gifts in general.

First, your friends with commercial receivers. Short of giving a replacement set of valves (and why not ?) there would seem, on the face of it, to be little scope for originality. Actually you *can* be quite original.

There are few sets these days that are not provided with sockets or terminals for the connection of both a pick-up and an external loudspeaker. Why not, then, a present of one or other of these extremely useful accessories ?

And what about a static-interference eliminator ? The K.B. " Rejectostat " is a useful suggestion to bear in mind.

(*Continued on page* 649.)

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through " P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way—just quote the number or numbers.

ONLY 22 WORKING DAYS TO XMAS ORDER YOUR RADIO NOW FROM PETO-SCOTT

READ THIS SATISFIED CUSTOMER'S LETTER

Gentlemen,

Your letter of the 30th Oct. to hand. I think your "**Extended Credit System**" a good idea and makes the public dealings with you a real pleasure; in fact, there is a personal contact observed between "firm and customer."

One way and another during the past 10/12 years I have obtained goods on the H.P. system from various firms, **but never before have I had such a pleasure in dealing with a firm such as yours.** For instance, the forms of agreement and pertaining letters I have received from other firms have been outlined in a stiff and (if I may call it) an unfriendly manner, and one got the idea that these firms were conferring a blessing and privilege upon a customer in granting H.P. terms, which to customers does not go down very well.

I observed in your agreement with me it was stated that although the name of one's employer was given, the same would not be approached; now that is a sound idea.

I took up with you—an absolute stranger—received my form of agreement and a nice letter—I sent my first instalment, and almost by return received the goods (that is another good point in your favour—despatching the goods quickly). Yours faithfully, J. A.

MANUFACTURERS' KITS IN SEALED CARTONS

LATEST RELEASE
BRITISH RADIOPHONE KIT
"MATCHED PERFECTION SEVEN"

Detailed list of Parts with complete **PILOT AUTHOR KIT** Prices and **FREE BLUE PRINT**

SEND POSTCARD TO-DAY

NEW LISSEN SKYSCRAPER FOUR ALL-WAVE CHASSIS MODEL, complete kit comprising all components, including set of Lissen Valves. Cash or C.O.D. Carriage Paid, £5/12/6. Balance in 11 monthly payments of 10/3. — Send 10/3 only

NEW LISSEN 7-VALVE SUPER-HET (Chassis Model), complete with Lissen Valves in Sealed Carton. Cash or C.O.D. Carriage Paid, £8/17/6. Balance in 11 monthly payments of 16/6. — Send 15/- only

MOVING COIL SPEAKERS

NEW BLUE SPOT 45 P.M. MOVING-COIL SPEAKER, with input transformer. Cash or C.O.D. Carriage Paid, £2/5/0. Balance in 7 monthly payments of 6/-. — Send 6/- only

NEW BLUE SPOT 29 P.M. PERMANENT MAGNET MOVING-COIL SPEAKER With input transformer. Cash or C.O.D. Carriage Paid, £1/12/6. Balance in 6 monthly payments of 5/-. — Send 5/- only

NEW LISSEN P.M. MOVING-COIL SPEAKER with input transformer. Cash or C.O.D. Carriage Paid, £1/5/0. Balance in 4 monthly payments of 5/6. — Send 5/6 only

NEW W.B. P.M.4A. MICROLODE PERMANENT MAGNET SPEAKER complete with switch-controlled multi-ratio input transformer. Cash or C.O.D. Carriage Paid, £2/2/0. Balance in 7 monthly payments of 5/9. — Send 5/9 only

FERRANTI CLASS "B" SPEAKER AMPLIFIER. Comprises M.C. Speaker, Class "B" Power Output Transformer with Class "B" valve. Cash or C.O.D. Carriage Paid £4/4/0. Balance in 11 monthly payments of 7/9. — Send 7/9 only

NEW ROLA CLASS "B" PERMANENT MAGNET MOVING-COIL SPEAKER AND AMPLIFIER. Complete with Valve and input Transformer. Two models: A for PM2B, PD220 and 220B; B for 240B and HP2 (state which when ordering). Cash or C.O.D. Carriage Paid, £3/11/0. Balance in 11 monthly payments of 6/6. — Send 6/6 only

ROLA F6P.M. PERMANENT MAGNET MOVING-COIL SPEAKER, with input transformer. Cash or C.O.D. Carriage Paid, £2/9/6. Balance in 8 monthly payments of 6/-. — Send 6/- only

R. & A. "CHALLENGER" PERMANENT MAGNET MOVING-COIL SPEAKER. With special Ferranti multi-ratio input transformer. Cash Price, Carriage Paid £1/15/0. Balance in 5 monthly payments of 6/6. — Send 6/6 only

ATLAS C.A.25 ELIMINATOR, for Mains, Class "B" and Q.P.P. Four tappings: 60/80, 50/90, 120, 150, 25 m/A. Cash or C.O.D. Carriage Paid, £2/19/6. Balance in 10 monthly payments of 6/-. — Send 6/- only

NEW GARRARD MODEL 202A. 12-in. Turntable. Electric Motor for A.C. mains. Cash or C.O.D. Carriage Paid, £2/10/0. Balance in 8 monthly payments of 6/-. — Send 6/- only

PILOT CLASS "B" FOUR KIT

WITH COLVERN SCREENED COILS

Peto-Scott again triumphs with this up-to-the-minute CLASS "B" Battery 4 Kit at the right price. Provides super-selectivity and sensitivity with outstanding mains quality and seven times the volume of the ordinary battery set. Single-dial tuning; screened coils; built on Metaplex. Comprises Variable Mu S.G., detector. Class "B" power-driven and Class "B" output valves. Complete Kit (less valves) includes detailed "simple to build" instructions and Assembly Blueprint. A superlative Class "B" Kit with matched and tested components guaranteed for 12 months by Peto-Scott.

KIT "A" Cash or C.O.D., Carriage Paid.

£3-10-0 or 5/- deposit, and 12 monthly payments of 6/-.

YOURS FOR 5/-

KIT "B." As Kit "A" detailed above, but including 4 PETO-SCOTT matched and tested Valves. Cash or C.O.D., Carriage Paid £5/2/6, or 12 monthly payments of 9/6.

KIT "C." As Kit "A" as detailed above, but including 4 PETO-SCOTT matched and tested Valves and Peto-Scott Consolette Cabinet, as illustrated. Cash or C.O.D., Carriage Paid. £5/15/0, or 12 monthly payments of 10/6.

Recommended PETO-SCOTT SPEAKER if required, add 22/6 to Cash Prices, or 2/- to each monthly payment.

PILOT CLASS "B" CONVERSION KIT

Converts your present Battery Set to Class "B" Amplification. Complete with all necessary components, **including driver transformer, Class "B" output choke, W.B. 7-pin valveholder, B.V.A. 240B valve,** wire and screws, etc.

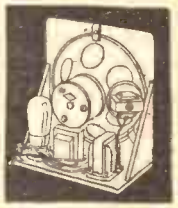
Full-size Blue-print, assembly instructions, and diagrams. **Cash or C.O.D. 37/6.**

Balance in 7 monthly payments of 5/6.

Peto-Scott Class B Speaker, Cash or C.O.D., Carriage Paid, £1/2/6. Or 2/6 deposit, balance in 5 monthly payments of 4/6.

PILOT CLASS "B" SPEAKER AMPLIFIER KIT

Assemble this amazing Unit yourself in less than half an hour. **Gives seven times the volume with mains quality from your existing battery set.** Complete Kit comprises B.V.A. Class "B" Valve, Peto-Scott Permanent Magnet Moving Coil Speaker, B.R.G. Driver Transformer and Input Choke, seven-pin Valveholder, Peto-Scott Baffle and Baseboard Assembly, all necessary Wires, Screws and plug-in Valve Adapter, **with full size Diagrams and Assembly instructions.**



complete with Speaker Cash or C.O.D. Carriage Paid, **55/-** **Or send only 5/-** *Balance in 11 monthly payments of 5/-.*

SUITABLE FOR ANY BATTERY SET

PETO-SCOTT STRAIGHT BATTERY 3

THE IDEAL FAMILY RECEIVER

Tonal quality, volume and range, all this with the Peto-Scott Straight Battery 3—an amazing performance surpassing sets at double the price. Special simplified tuning makes it the ideal family receiver, enabling everyone to receive a full range of programmes—even those with little or no experience. Built on Metaplex. New type non-microphonic detector, followed by R.C.C. for quality and final transformer-coupled power stage. New type 2-circuit tuner and single dial slow motion illuminated tuning. Selectivity aerial taps. Pick-up sockets. B.A. speaker with floating cone. Complete with British Valves and long-life Batteries, full aerial equipment and ready to play. Housed in walnut cabinet as illustrated, its beautiful appearance will delight you.

YOURS FOR 5/-

Cash or C.O.D. **Carriage Paid.**

or 5/- down and 18 monthly payments of 6/- **£4-19-6**

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Dear Sirs,—Please send me CASH/C.O.D./H.P.....

for which I enclose £.....s.....d. CASH/H.P. Deposit.

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ADDRESS.....

P.W., 2/12/33.

SEND DIRECT to AVOID DELAY — CASH, C.O.D. or EASIWAY

The S.T.500—

No sooner had Mr. Scott-Taggart described the "S.T.500" than thousands of constructors—experienced "old hands" and novices—set themselves the exciting task of building this new set. In an incredibly short time letters began to pour into this office, filled with praise and enthusiasm for a remarkable receiver. Some of these letters have already been published. Here is a further batch from all parts of the country, setting the seal on Mr. Scott-Taggart's latest triumph.

WALES

"FINEST SET EVER HANDLED."

[*From B. Jones, 12, Eisteddfa Road, Llwynypia, Glamorgan, S. Wales.*]

"Having built and tested the 'S.T.500' these last two weeks, I say that it is the finest set that I have ever handled. Its selectivity is amazing on both wavebands—a thing that I thought would never happen—and with plenty of punch. I am satisfied that at last I have what I wanted."

GLASGOW

"IT IS WONDERFUL."

[*From C. Aird, Wellfield Street, Springburn, Glasgow.*]

"The 'S.T.500' is great. In fact, it is wonderful."

NEWCASTLE

"I LOGGED 103 STATIONS."

[*From C. G., Sidney Grove, Newcastle-on-Tyne.*]

"I was connecting the aerial and earth on to the completed 'S.T.500' some 36 hours after it was published. The set I built was absolutely identical with your set. The same evening I logged 103 stations. The local station is only half a mile away."

KENSAL RISE

"REMARKABLE PERFORMANCE—AMAZED."

[*From N. W. Holmes, 19, Mortimer Road, Kensal Rise, London, N.W.10.*]

"I wish to add my tribute to the remarkable performance of the 'S.T.500.' This is my first acquaintance with such a circuit, and my technical knowledge, I admit, is practically nil. Yet results obtained have amazed me."

HARRINGAY

"PERFECTLY SATISFIED."

[*From E. Hume, Duckett Road, Harringay, London, N.4.*]

"I have built the 'S.T.500' and am perfectly satisfied."

FLEETWOOD

"THE PERFECT SET. ABSOLUTELY 'IT'!"

[*From W. Laws, 12, Oxford Road, Fleetwood.*]

"It did not take me long to see the merits of your divinely inspired '500.' I had some odds and ends hanging about, and rigged up a rough mongrel sort of '300/500.' Gee whiz! I was at the shops before they were open next morning and fitted up the double reaction stunt. It's absolutely 'it.' The perfect set at last! I've only one fault. It won't clean my boots!"

CHORLEY

"A MAGNIFICENT SET."

[*From J. Hartley, 11, Corporation Street, Chorley, Lancs.*]

"Thanks very much for the 'S.T.500.' It is a magnificent set."

HERE IS PROOF!

MITCHAM

"A VERY FINE SET."

[From C. J. Thimbleby, Ashbourne Road, Mitcham, Surrey.]

"I must write and thank you for a very fine set. I have now had it working just over a week, and I think the 'S.T.500' is the goods. I have built the 'S.T.300,' '400,' and 'Push-Push Five,' but I consider the 'S.T.500' beats them all and is easier to handle, as I was quite at home with it after two evenings."

SOUTHSEA

"BETTER THAN A SUPERHET."

[From T. S. Potts, 7, Shaftesbury Road, Southsea.]

"Congratulations on the 'S.T.500.' I have followed your work since the 'S.T.100.' The new set is great. I have just tested out a 1934 Superhet (6 valves), but would not change from the '500.' I shall be interested to see what you can do to your next set to improve this one. I do not think you can!"

[The "S.T.500" is standardised by me for twelve months. The "S.T.300" has been standardised for two years. So there is no need to worry about my next set!—J. S.-T.]

GLASGOW

"DELIGHTFUL FEELING OF POWER."

[From D. Burke, 35, Eldon Street, Glasgow, C.3.]

"Since plugging in the P.M.2D.X. as detector, the difference is a perfect revelation, and although the reaction results on the 'S.T.400' were a joy, it was nothing as compared to the delightful smoothness and feeling of power which the aerial reaction on the 'S.T.500' gives.

"May I say how much I appreciate all you have done for the amateur and the many hours of real joy you have given us? I am afraid the 'S.T.500' will have to be the last set I shall build, as I cannot spare the time now to dabble in my favourite hobby, but I am quite certain that it is the best possible 'last set' as far as I am concerned."

[I greatly appreciate your remarks, as I do all letters from readers who tell me their results.—J. S.-T.]

LEICESTER

"UNCANNY SELECTIVITY."

[From R. H., Queen Street, Leicester.]

"I have now built 'S.T.500,' I get uncanny selectivity and range."

CAMBRIDGE

"A GREAT IMPROVEMENT."

[From C. O., Girton Road, Cambridge.]

"Following the publication of 'S.T.500,' I have modified my previous A.C. 'S.T.400' and find the separate balanced reaction on the aerial a great improvement."

CORNWALL

"KNIFE-EDGE TUNING."

[From C.H., Calstock, Cornwall.]

"Your double reaction gives knife-edge tuning."

SOUTHSEA

"PRACTICALLY ANY STATION IN EUROPE."

[From G. F. Martin, 14, Teddington Road, Milton, Southsea.]

"In reply to your general request for letters about the 'S.T.500' I wish to take the opportunity of thanking you for such a wonderful circuit. It is a mains version of the 'S.T.500,' but the H.F. circuits are identical to yours. She nearly went up into the air on connecting up, and now without exaggeration I would say that it is possible to get practically any station in Europe. The volume is terrific, and it is possible to receive many stations at good volume without an aerial at all. It is perfectly stable and handles beautifully, and quality is all that could be desired.

"As regards selectivity, it does all you claim for it. Reaction on both aerial and anode is beautifully progressive and smooth. A remarkable circuit."

(Continued on page 652.)

The A.C. "DOUBLE X"

Extra power with the utmost economy is the principle behind the design of the "Double X" receivers described this week. In the A.C. model economy is achieved by using three valves in such a way that the extreme maximum of sensitivity is obtained, assuring high selectivity and an unusually powerful output. The results from this remarkable three-valver challenge those normally associated with receivers having nearly twice the number of valves.

Designed and Described by K. D. ROGERS.

"EXCELSIOR" is apparently the motto the valve manufacturers have kept before them during the whole of the history of the valve in this country. While in America the efficiency of the valve has not always been the first consideration, in Britain the "slope" has ever been of paramount importance.

The result is that higher and higher mutual conductances have been achieved, and the stage gains of our sets have been on the upward path right from the word "go" some years back.

Valve Progress.

Progress was slow up to the time of the screened-grid valve and the coming of the indirectly-heated mains types; but since those days things have moved very rapidly, and the pentodes especially have been improved almost beyond recognition, while such valves as the A.C.2H.L. have elevated the reputation of detectors and first L.F. valves for high magnification.

Probably the most astounding valve of all is the recently released A.C.2Pen., a Mazda valve of amazing characteristics designed for A.C. operation. It has the steepest slope of any valve so far developed for ordinary use, having a mutual conductance of 9·0 ma/V. and a sensitivity factor of 485 mW/Vg².

This might not seem so surprising were the valve of the small type; but it is capable of giving an undistorted output of something like 3,400 milliwatts, and to do so requires a peak grid input of only 3 volts.

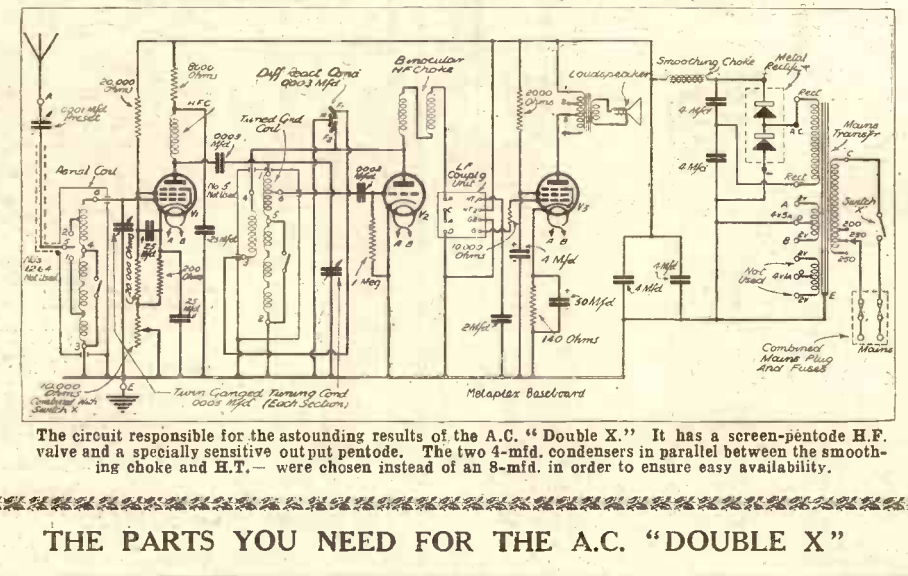
It has been designed specifically for the output stages of sets where the utmost sensitivity is required, or where detector overloading is to be avoided and yet large output volume is to be obtained without intermediate stages of L.F. between detector and power valve.

Pentode Output.

Such a pentode enables a set to be designed in which three valves only will produce as much power as is required for any ordinary room, and which will at the same time be able to give that power not only on the local stations, but on a large number of distant transmissions as well.

(*Continued on page 624.*)

HIGH SELECTIVITY AND SUPER POWER



The circuit responsible for the astounding results of the A.C. "Double X." It has a screen-pentode H.F. valve and a specially sensitive output pentode. The two 4-mfd. condensers in parallel between the smoothing choke and H.T.— were chosen instead of an 8-mfd. in order to ensure easy availability.

THE PARTS YOU NEED FOR THE A.C. "DOUBLE X"

Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.
1 Special chassis	Peto-Scott	—
1 Power pack frame	Peto-Scott	—
1 A.C. "Double X" Cabinet	Peto-Scott	—
1 Double-gang ·0005-mfd. tuning condenser and dial	British Radiophone, types 604 and 711	—
1 Coil unit and base	Colvern coils K.G.O. and K.G.R.	—
1 ·0003-mfd. differential reaction condenser	Graham Farish	J.B., Telsen Polar, Bulgin
1 ·0001 to ·00015-mfd. max. preset condenser	Polar	Igranic, Telsen, Goltone
1 Double 4-mfd. fixed condenser	Dubilier B.E.355	—
1 4-mfd. fixed condenser	Dubilier L.E.C.	T.C.C., type 87
1 4-mfd. fixed condenser	T.C.C., type 87	Dubilier L.E.C.
1 4-mfd. electrolytic condenser	Dubilier (dry type)	T.C.C.
1 50-mfd. electrolytic condenser	T.C.C., type 12-volt	—
1 2-mfd. fixed condenser	Dubilier, type B.B.	T.C.C., Telsen, Igranic
3 ·25-mfd. tubular condensers	Dubilier, type 4406	T.C.C.
2 ·0003-mfd. fixed condenser	Dubilier, type 610	T.C.C., Telsen
1 ·002-mfd. fixed condenser	T.C.C., type S	Dubilier, Telsen
1 10,000-ohm potentiometer and on/off switch	Bulgin, type V.S.32	—
2 20,000-ohm resistances and horizontal holders	Graham Farish "Ohmite," 1½-watt type	—
1 8,000-ohm resistance and horizontal holder	Graham Farish "Ohmite," 1½-watt type	—
1 2,000-ohm resistance and horizontal holder	Graham Farish "Ohmite," 1½-watt type	—
1 200-ohm resistance and horizontal holder	Graham Farish "Ohmite," 1½-watt type	—
1 140-ohm resistance and horizontal holder	Graham Farish "Ohmite," 1½-watt type	—
1 10,000-ohm resistance with wire ends or terminals	Dubilier, 1-watt type	Graham Farish
1 1-megohm grid leak with wire ends or terminals	Igranic	Dubilier, Graham Farish
1 H.F. choke	British Radiogram No. 40	Bulgin, R.I.
1 Binocular H.F. choke	Igranic	Telsen
1 Smoothing choke	Wearite H.T.14	—
1 L.F. coupling unit	R.I., type D.Y.32	—
1 Mains transformer	Ferranti S.M. 3-4	—
1 7-pin valve holder	W.B., large type	Benjamin, Graham Farish
2 5-pin valve holders	W.B., large type	Graham Farish, Benjamin
1 Metal rectifier	Westinghouse, H.T.8	—
1 Combined mains plug and fuses	Bulgin F.15	—
1 Terminal strip, 2¾-in. × 1½ in.	Peto-Scott	—
2 Terminals	Belling-Lee, type R	Bulgin, Eelex
1 Anode connector	Belling-Lee	—
2 Reels "pull-back" wire	British Radiophone	—
1 Foot screened wire	Goltone, type R.43/96	—
Flex, screws, etc.	Peto-Scott	—

THE A.C. "DOUBLE X"

(Continued from page 622.)

An ordinary detector coupled by means of a transformer to the A.C.2Pen. will constitute a compact receiver that will give tremendous volume on the local transmissions, and this, plus an H.F. stage, will on other occasions bring in distant stations at colossal strength.

Normally, any set that will provide anything like 3-watts power output has to be built on generous lines if it is to be at all sensitive to distant transmissions, the valves that are so useful on weak stations being more or less useless on the local owing to the fact that a great deal of volume cutting has to be carried out when they are used.

With the A.C.2Pen. this is not the case, for this valve will provide a surprising output from a very small input, thus maintaining not only the power required, but the sensitivity necessary for distant stations.

Small wonder then, that we have chosen the A.C.2Pen. as the basis of the all-mains receiver for the Christmas number of POPULAR WIRELESS, for in that set we wanted the very greatest amplification we could obtain with a limited number of valves.

Astounding Sensitivity.

With the arrangement employed we obtain astounding sensitivity, for in addition to the steep slope of the pentode valve, with its large power output, we have used one of the latest multi-mu screened H.F. pentodes, the whole providing enormous range of reception at a surprisingly big output strength.

Some idea of the amplifying powers possessed by the receiver may be obtained from the fact that at Tallis House, where the preliminary tests of the "Double X" were carried out, the Northern Regional came in

(Continued on page 626.)

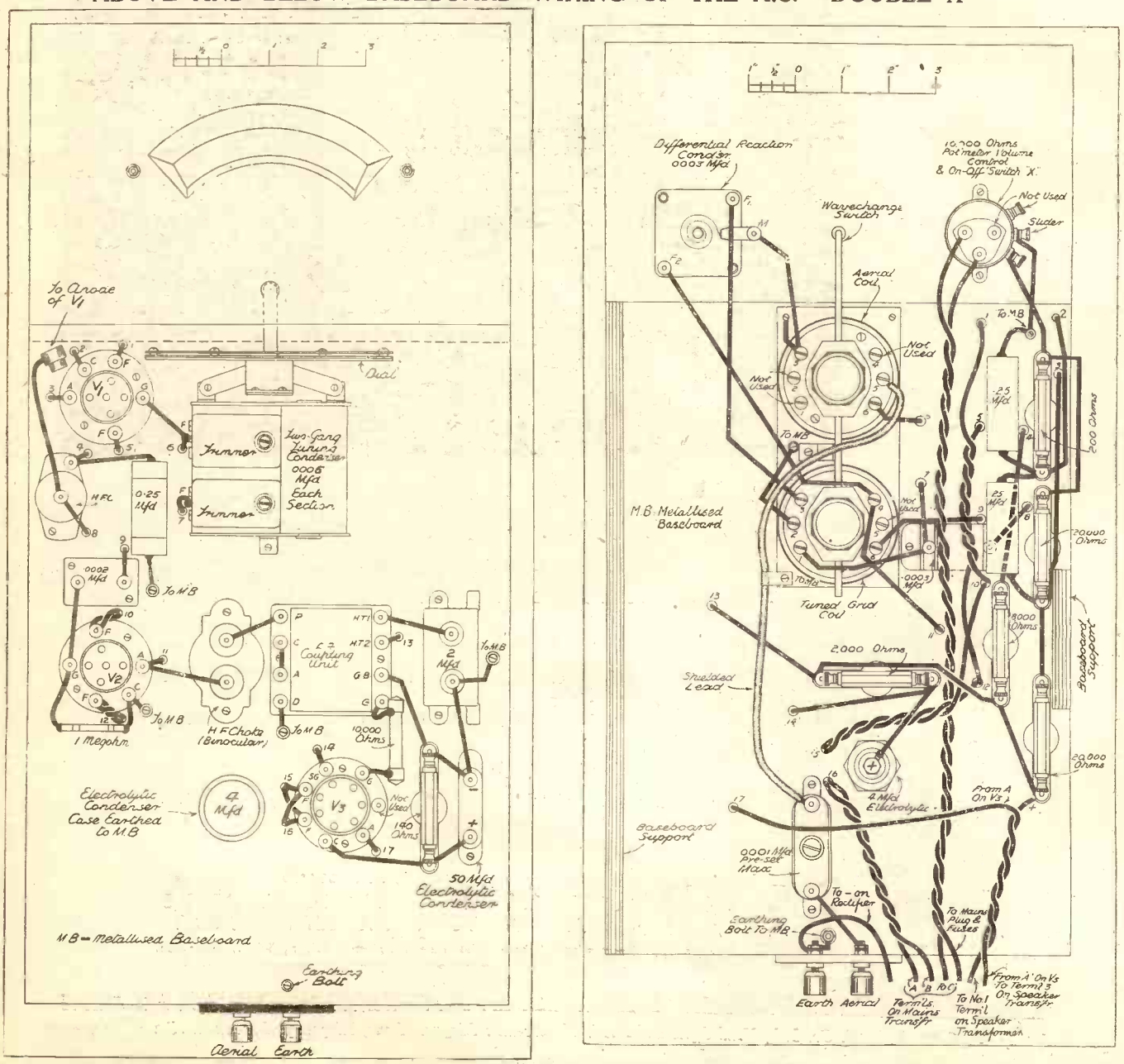
SUITABLE ACCESSORIES

VALVES.—H.F.—Mullard V.P.4. Det.—Cossor 41M.H.L., Mullard 354V., Marconi or Osram M.H.4, Mazda A.C./H.L., Tungsram A.R.4101. Output—Mazda A.C.2/Pen.

LOUDSPEAKER.—(With output transformer) Blue Spot P.M.29, W.B., Rola, Celestion, R. & A., Atlas, Ferranti, Epoch, Marconiphone, Ormond, G. E. C., Amplion, Magnavox, H.M.V.

AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," Radiophone "Receptru" down-lead, Bulgin lightning switch, Graham Farish "Filt" earthing device.

ABOVE AND BELOW BASEBOARD WIRING OF THE A.C. "DOUBLE X"



The left-hand diagram shows the above- and the right-hand the below-baseboard layout and wiring of this remarkable three-valver. Some leads go through the wooden chassis, and the holes are numbered so that it is an easy task to correlate the two diagrams.

THE A.C. " DOUBLE X "

(Continued from page 624.)

during daylight at a strength that required volume controlling.

In other words, not only was reaction not necessary, but the full magnification of the multi-mu pentode was not required, the potentiometer not being fully turned to the right.

Small Grid Voltage Required.

This is due partly to the ranging properties of the H.F. stage, of course, but it is also due to the fact that such a very small grid-voltage input is required to load fully the output valve. A 3-volt peak input is easily obtainable from a detector that is transformer coupled, and so it is possible to load fully the pentode from a very large number of stations. The transformer ratio used is 1 : 3. and with an amplification factor for the detector of about 30–35. it is easily seen that if only half that amplification factor is obtained in practice (say 15) we get a stage gain of 45, so that we need but a matter of a volt L.F. on the detector grid to give us full loading of the output valve.

This is, of course, a rough calculation, and the actual figures depend upon the particular detector valve employed; but it serves to illustrate how very sensitive the receiver is and to explain why the set is such a good distance getter.

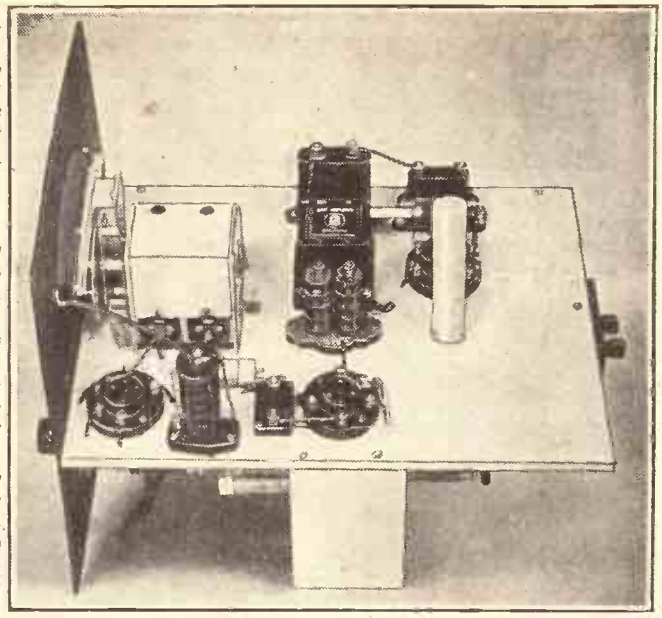
High Selectivity.

As a matter of fact, the question of sensitivity is even more important than it would seem at first sight, for not only does it enable us to receive distant stations at good strength—obviously many can be received without in any way requiring reaction, and at *full* volume—but it gives us the power to employ exceedingly high selectivity and still to have ample margin of amplification to provide plenty of punch in the output.

This is where the preset series aerial condenser and reaction come in. In most cases the aerial condenser will best be set nearly all "out"—that is, at minimum capacity—while the selectivity can further be enhanced by decreasing the sensitivity of the multi-mu pentode (turning the volume control to the left) and bringing up the reception strength by means of reaction.

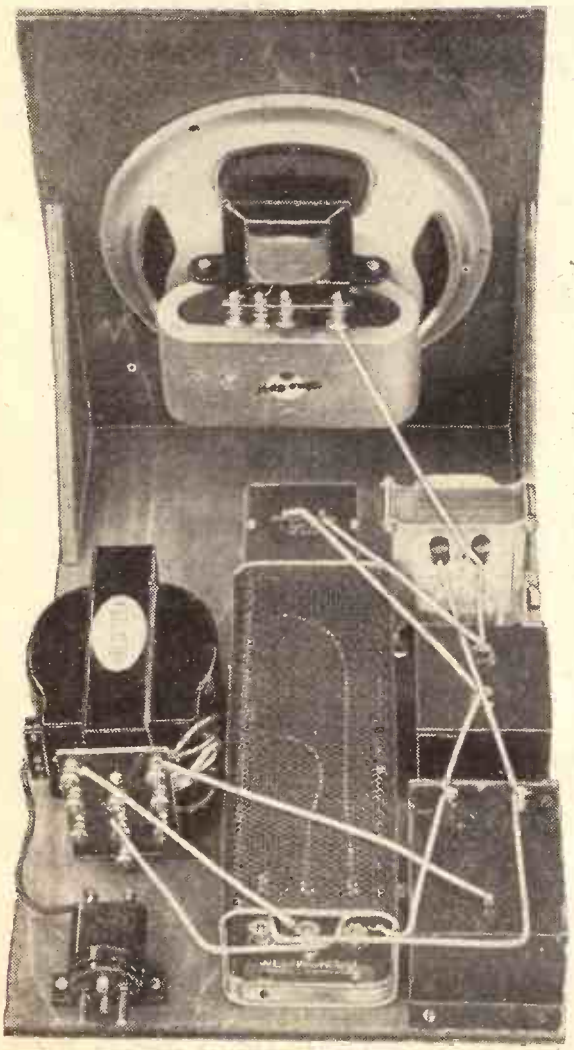
(Continued on page 650.)

UNUSUALLY NEAT DESIGN



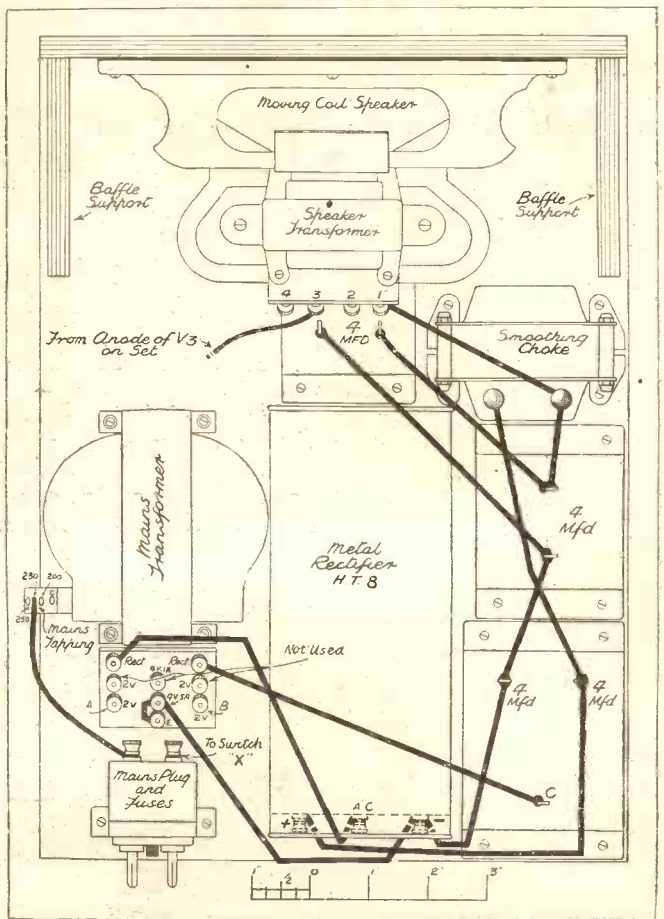
A side view of the receiver showing the general layout of the upper side of the baseboard, and the wooden support that is used on the inner side (nearer power pack) of the chassis.

THE "DOUBLE X" POWER PACK



In connecting the power pack to the set, one lead from the on-off switch on the latter is joined to the terminal marked "X" on the diagram—i.e. to the one side of the mains plug. The other switch lead is taken to "C" on the mains transformer input side. The photograph shows only the leads on the power pack itself, and none of the inter-connections between it and the receiver.

EASILY AND QUICKLY BUILT



The Power Pack for the "Double X" also contains the loudspeaker and fits in the cabinet beside the chassis. It is best to connect up the two sections before they are pushed right into the cabinet.

BETTER

RANGE & SELECTIVITY

Marconi VS 24

Variable-mu battery S.G.

Marconi VS24 is a new high-efficiency 2-volt variable-mu valve giving high and stable amplification with strict economy in H.T. and L.T. current consumption. VS24 is constructed on extremely robust lines and is thus remarkably free from microphonics, while its short grid-base simplifies both Automatic and Manual methods of volume control. . . .

15/6

Marconi VP 21

The battery H.F. Pentode

Marconi VP21 is a Marconi innovation of first importance—the very first Variable-Mu H.F. battery Pentode. VP21 is particularly suited to the new iron-cored coils which make the most of its exceptional characteristics, with the added advantage of smooth and distortionless volume control. .

15/6

WITH THESE BETTER H.F. VALVES

G. Marconi

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Address .....

P.W., 2/12/33.

MARCONI VALVES

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FROM THE TECHNICAL EDITOR'S NOTE BOOK

TESTED and FOUND—?

This is probably the most widely read review of new apparatus appearing in radio journalism to-day. Instead of presenting test reports on dry as dust conventional lines, "P.W.'s" Technical Editor discusses the various components from practical points of view, and incidentally manages to crowd in an enormous amount of interesting and useful information of a general nature.

THE "MICRION" COIL

IT is an unfortunate fact that stability and enterprise seldom go together. For the most part when a concern has laid down a solid foundation it becomes, to say the least of it conservative, even unimaginative.

There are, I believe, more exceptions to this in radio than in most trades, but even here there are all too few. However, it cannot be said that Radio Instruments lack either quality. When iron-cored coils became something of a vogue R.I. produced a typical R.I. representation of the new line. That is, something good but also something different from all others.

This is the "Micrion," and in my opinion there is something about the name itself which is characteristic of R.I. They do manage to frame excellent names for their products.

In the "Micrion" advantage has been taken of the permeability-tuning principle in order to provide what are in the nature of trimming adjustments.

This is a very valuable new application of the principle. The cores of the "Micrion" are movable within, of course, a restricted range, and that varies their inductances. Either or both the medium and long-wave characteristic can therefore be adjusted, the adjustment being effected by means of readily accessible milled screws. (You can see these screws plainly in the photo.)

The great advantage of this elasticity is that an old coil can be replaced by a "Micrion" without the tuning scale being rendered useless. Also, of course, it makes it a simple matter to align two tuning dials.

The "Micrion" Dual-Wave Coil is in part the modern equivalent of the immensely popular "P.W." Dual-Range Coil of which R.I. sold so many, and it has wider applications as well as a higher order of efficiency.

It has, too, the additional merit that it is fully shielded and is much smaller.

The workmanship is first class—that goes without saying. And you will note from the illustration that the terminals are most conveniently placed and cunningly inclined for easy wiring.

I was glad to note that the break-through bogey has been adequately dealt with in this R.I. design of iron coil. In only too many coils of all kinds break-through is a serious blemish.

An iron-cored dual-range coil of high efficiency from the R.I. factory.

Altogether, I consider the R.I. "Micrion" to be a fine component, and that this is already being appreciated by constructors is obvious from the large sales I hear it is commanding.

ARMCHAIR CONTROL

Those of us who are "gadget minded" are apt to purchase many things whose useful lives are very short indeed, for the simple reason that they can offer little but a novelty appeal.

But I have recently encountered a "gadget"—no. I don't think in this case that is the right word. The "Modula" Armchair Control, made by the British Pix Co., Ltd., deserves a better description.

For controlling volume at a distance this useful accessory is manufactured by the British Pix Co.

It is a most attractive refinement, and I can recommend it to the attention of all readers who like to listen in comfort and still maintain perfect control of the outputs of their sets.

I suppose there are many listeners who tolerate a standard volume level rather than keep getting up and going over to the set. Whatever the item, it blares through at the same power. Worse, the B.B.C. balance and control are such that speakers often roar in with the same over-all volume as a full brass band.

With a "Modula" on the arm of your chair you can adjust the volume perfectly from inaudibility (when something you don't want to hear is on) to full power.

It comprises a neat little resistance control, ranging from about 150 ohms to over a megohm, according to measurements on my sample (so it ought to be able to give ample adjustment), and full instructions are supplied with it for fitting it to any type of set.

The complete "Modula," with 12 feet of cable, costs 2s. 11d., and for 4s. an armchair strap for holding it in position is also included.

Should 12 feet not be long enough, it can be obtained with a 36-foot cable for 1s. 6d. extra.

We tested the device in conjunction with both battery and mains sets, and found that it did its job thoroughly.

I can think of many less acceptable gifts for Christmas than this "Modula," but none superior at its price.

AMPLION SCREENED H.F. CHOKE

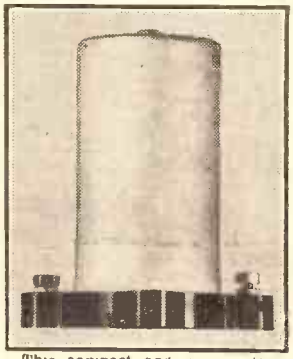
H.F. chokes are often, I fear, taken for granted by constructors. This is very evident from the correspondence we receive.

Certainly H.F. chokes used for some purposes, such as in a reaction circuit, need not necessarily rise to a very high standard of efficiency. It is in such cases that "any old choke" might prove quite satisfactory. I say "might," you will notice.

But when it comes to certain other tasks, such as being included in the anode circuit of an S.G. valve, the H.F. choke is in every sense a "key" component, and the successful operation or otherwise of the set may depend upon it.

I number the Amplion Screened H.F. Chokes among those which are able to fulfil onerous functions of this nature. It is a good H.F. choke, and it has been found suitable for our modern high-efficiency circuits.

It is a compact, well-made component and its high inductance is not offset by self-capacity. Indeed, its self-capacity is, for practical purposes, quite negligible.



This compact and well-made Amplion H.F. choke has a high inductance which is not offset by injurious self-capacity.

Also I am able to say that it has reliability. I have had one in use myself for some time, in experimental apparatus, which has imposed on it what is really an unfair current load as judged by normal values. But it has stood the infliction without faltering. And that is, as you must admit, a stern test.

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes and on microphone personalities of the moment.

THE new sports talks introduced by Howard Marshall seem very attractive, with such celebrities as Larry Gains, the negro boxer, Joe Davis, the snooker-king, Ernest Barry, J. H. Taylor, Sir Malcolm Campbell to give talks.

* * *

But they'll have their work cut out to surpass in interest Howard Marshall's collection of record eaters, talkers, dancers, instrumentalists, writers and skaters. The freak records that appealed to me most were those of Louis Cousumo, who ate 410 feet of spaghetti in an hour; Mr. Jack Evans, who lay for 7½ days in an open coffin; and Mr. Kelly, who for 49 days and nights sat perched on a 13-inch disc at the top of a flagpole etc., etc.

An odd jumble of facts, as Howard Marshall confessed, but all very interesting. The speaker dealt rather with the grotesque side of record breaking, besides giving some interesting statistics on the speeds of men, beasts and birds.

* * *

I think it would take more than an Eddie Pola to compère the 4.30 Saturday variety show to success. The hour is all wrong, for one thing. Performers can't be in any mood for performing this sort of fare, nor listeners for listening to it. Then, again, the performers are usually very crude. Only occasionally do we get someone with real talent. All the same, I like the Barnstormers Dance Band. I wouldn't mind hearing them again.

But the humorists! Ugh! Gilbert Somebody from Yorkshire must be an optimist if he thinks he is going to create a furore with that "Buying-Some-Furniture" act of his. Yet it made someone in the audience laugh. That fellow must have been sent from heaven.

* * *

I am convinced that S. Kneale Kelly is indispensable to successful variety, and I'm sure Max and Harry Nesbitt, George Buck and Dorothy Ward recognise what they owe to the B.B.C. Theatre Orchestra when they perform. Nothing hangs

(*Continued on page* 647.)

G.E.C. H.T.

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144,000 milliwatt hours
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RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos.

Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

THE ON-OFF SWITCH FAILS TO CONTROL THE SET.

G. E. (Gidea Park, Essex).—"Tackling the building of a D.C. mains set from a sketch of it, with values, etc., all in, but no dimensions or practical details, was 'certain to result in failure,' my friends told me. But they have changed their tune since they heard it.

"Honestly, it's great. But although I didn't tell them at the time they heard it, I am up against a funny sort of fault on it.

"As I say, the results themselves are fine, but the switch is playing up. *It makes no difference at all*, whether it is on or off. And yet I can see it working, and I am as sure as anybody can be that it is in good order.

"So what I have to do is to disconnect the set by the mains plug every time. This acts all right, of course, but when I plug in it does not matter whether the switch is up or down, as the set goes on either way.

"And, of course, to put it off I have to pull the mains plug out every time.

"It is only a small point, but I should like it put right. And I am very anxious to know how it happens, as it is right outside anything I have ever come across."

You have certainly struck an unusual one! The probable explanation is that your earth wire is shorting the switch out of action.

What we think is happening is this: The mains themselves are well and truly earthed, and you have probably connected your earth wire direct to the earth lead, and not through a big fixed condenser, as is usual.

Therefore your earth wiring is *connected to the mains all the time* through the common earth connections. And if the switch is in the mains lead which is externally earthed it won't make any difference whether the switch is on or off, because there is a permanent connection quite apart from the switch wiring.

You could cure this by changing over the switch to the other mains lead. But a better plan, and the one we recommend, is to put a 1-mfd. fixed condenser, of the correct test voltage, in between the wiring and the set's earth terminal.

This will isolate the set (as it should be isolated) from the mains connection via the common earths, and the switch will then act properly.

WHAT ARE THE WAVELENGTHS OF HARMONICS?

T. H. (Fordingbridge).—"In reading wireless books I have often been interested in harmonics, harmonic interference, etc., but so far I have not been able to understand these, never having met with a simple explanation.

(*Continued on next page.*)

"P.W." PANELS, No. 146.—PARIS, RADIO LL.

This is another of the less well-known Paris stations, which is, however, strongly received at times in this country.

* * *

The wavelength is 366·7 metres, and the call "Radio L L" is pronounced almost as in English, so it is easily recognisable.

* * *

The power is low—1·2 kilowatt—and the distance from London about 214 miles.

* * *

Closing announcement "Ici Radio L L, notre émission est terminée. Bon soir Mesdames, Mesdemoiselles, Messieurs."

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

"Apparently the wireless harmonic is something like the same thing in music—a sort of secondary accompanying the main effect. But why a station which works on medium waves should be picked up on a short-wave reading, and so on, is a mystery to me. Please explain."

In music the main frequency is often (in fact, nearly always) accompanied by other frequencies; and all the varieties of tone quality are due to particular combinations of these.

The separate frequencies are called "partials." And the partial having the lowest frequency is known as the "fundamental," whilst the others are known as "overtones" or "upper partials."

If such overtones have frequencies that are exact multiples of the fundamental frequency they are called harmonics.

In wireless transmission a somewhat similar effect is produced, and the transmitting aerial radiates not only its main wave, but harmonics of this. They are relatively feeble and unimportant, but can be detected by a sensitive set, even at great distances.

Such harmonics are definite multiples of the fundamental frequency. For example, if a station works on 600 metres its frequency (in cycles) will be 500,000. Multiply this by two, by three, etc., and you have the frequency of the station's harmonics.

Thus, 500,000 multiplied by two is 1,000,000, which corresponds with a wavelength of 300 metres. So we find the 600-metre station has one of its harmonics on 300 metres.

Again, 500,000 multiplied by three is 1,500 000, which corresponds with a wavelength of 200 metres. So we find another harmonic of the 600 metre station on 200 metres. And so on.

In fact, as there is an inverse relationship between frequency and wavelength we need not bother about the frequency aspect at all, but can find the wavelength of the harmonics by *dividing* the main wavelength by 2, 3, etc.

When the wavelength is divided by *two* the result is generally called the *second* harmonic; if divided by *three* the *third* harmonic, and so forth.

From this you will see that when searching with a short-wave set, especially if in the neighbourhood of a powerful broadcasting station, it will be possible to pickup a number of lower wavelength versions of its programme as the various harmonics are tuned in.

THE SURPRISE LOUDSPEAKER AT THE CHRISTMAS PARTY.

J. M. M. (Halifax).—"My idea is to use my old cone loudspeaker, which is very sensitive, as a microphone, connected to the set in the kitchen, to give 'fake' announcements.

"I have tried this speaker, connecting its terminals direct to the L.F. transformer's H.T.+ and P. terminals, after undoing these from the wires which connect them to the detector's plate circuit.

"The result is that anything I say into the loudspeaker when it is connected to the transformer in this way is repeated at amplified strength by the ordinary loudspeaker on the set. So if I take the set's loudspeaker wiring through into the front room I can get 'announcements' through to there from the loudspeaker microphone in the set in the kitchen.

"That is all plain sailing. But I don't want to take the main loudspeaker through into the front room in this way. What I want there is a concealed loudspeaker.

"With this I hope to be able to make remarks, which apparently come from nowhere, by using concealed wiring and an 'invisible' loudspeaker. Will you say if, in your opinion, the following method would be O.K. ?

"Instead of an ordinary loudspeaker in the front room, I run the wires from the set to a loudspeaker unit (Blue Spot), which is not mounted in the usual way to a cone, but is fastened to a large thin wooden panel, forming part of a cupboard door.

"I have never tried this stunt myself, but I am told that it can be done, the thin wooden panel acting instead of the cone as the diaphragm. If such a scheme would work I can fix the loudspeaker unit very inconspicuously, because the panel in question has a letter-rack hanging on it permanently, and the unit could be completely hidden by this, the thin wires going along the back where they would not be seen.

"I hope I have made it clear. Thin wires in the front room to the concealed loudspeaker unit, mounted on the cupboard door, which is the diaphragm. These wires taken to set's ordinary loudspeaker terminals, and set altered to act as voice amplifier by connecting another loudspeaker to its transformer primary.

"If it will work I am expecting any amount of amusement from it, so please say what you think."

As you describe it the scheme is quite practicable, and it should be a success.

The only point that strikes us is that apparently you think of mounting the "concealed" loudspeaker

(Continued on next page.)

DO YOU KNOW—

the Answers to the following Questions ?

There is no "catch" in them; they are just interesting points that crop up in discussions on radio topics. If you like to try to answer them, you can compare your own solutions with those that appear on a following page of this number of "P.W."

(1) How many microphones does the B.B.C. use for a broadcast from a theatre ?

* * *

(2) What is the object of using a baffleboard for a loudspeaker ?

* * *

(3) About how many hours of broadcasting are provided by the B.B.C. stations in a year ?

* * *

(4) Of the above, how much entertainment is lost, owing to B.B.C. breakdowns, in an average year ?

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from previous page.*)

unit on the outside of the cupboard door. Why not put it inside ?

We think it would be better there because it should be rigidly mounted with respect to the "diaphragm" (the cupboard door in this case), and that would surely be easier to do from behind the door.

All that would then show from outside the cupboard would be the small central nut which normally is fixed to the centre of the cone of the loudspeaker and that, of course, could be completely hidden behind the letter-rack.

A SIMPLY SWITCHED SET FOR THE OLD FOLKS AT CHRISTMAS.

P. S. C. (Hertford).—" Having fallen for the 'S.T.500,' I am going to make over my good old 'Economy Three' to the old folk for Christmas. But I want to do away with the tuning and use switching instead, so that all they have to do to go from London National to Regional is to push in a switch.

" It's an easy enough set to tune, goodness knows, but being old they can't manage it. (It is the 'This Year's Economy Three,' which you gave in the June 24th POPULAR WIRELESS.)

" I do not even want to bother them with the wave-changing, so perhaps the switches now used for this could be put to use for tuning from Regional to National ?

" The set is working perfectly at present, and I shall be very sorry to part with it. But the amount of pleasure they will get from wireless is out of all belief, as they live right out in the fields, with nothing at all to do after the cows have gone in for the night !

" So if you think it is a promising scheme I shall be very pleased to get the details of how to do it for them "

The idea is quite practicable, and all you will need in the way of extra components is a couple of preset condensers, with a maximum capacity of about ·00025 mfd.

The first thing to do is to cut out the long waves permanently. The easiest way to do this is to remove the wires that run from each 3 terminal on the coil units to the wavechange switches, and also take off the wires from these switches to the foil on the baseboard.

This leaves the switches free of wiring. And you complete this part of the job by joining the respective 3 terminals to the 2's, or to the foil to which these are connected, whichever is easier.

The preset condensers should be placed close to the switches, one on either side of the screen.

Join one side of each condenser to the copper-foil or to the moving vanes of the adjacent tuning condenser again choosing whichever is more convenient.

Then join one side of each preset to one terminal of the neighbouring wavechange switch.

The next and final constructional step is to connect the remaining terminal of the respective wavechange switches to the fixed plates of the adjoining tuning condensers.

That really completes the alterations, but you will have to " set " the new tuning when the set is installed.

It is a very simple matter. What you do is to " open " the two switches, which leaves the tuning exactly as it originally was, apart from the fact that you cannot get the long-wavers. Then you must carefully tune in the London National.

Get the tuning dead accurate on both condensers. And then either lock them in that position, by fixing the moving vanes, or else marking so plainly that even the old people will have no difficulty in resetting the dials.

Now pull the wavechange switches out. The National programme will probably disappear, and what you have to do is carefully to adjust the presets until you hear the Regional programme instead.

THE ANSWERS

TO THE QUESTIONS ON PAGE 633 ARE GIVEN BELOW.

(1) It varies, but usually six are employed—three in the footlights, and three in the wings, up-stage, etc.

* * *

(2) To preserve the low-note response.

* * *

(3) About 58,000 hours.

* * *

(4) Only about 14 hours are lost—some ·023 per cent of the total.

DID YOU KNOW THEM ALL ?

CHANGING OVER A FIVE-VALVER TO MAINS VALVES

L. E. C. (Plympton).—" Can you help me by giving details and diagram to convert my set to A.C. valves ?

" It is a five-valver, employing two S.G. valves, grid-leak detector, resistance-coupled first L.F. and transformer-coupled last stage. There is a loudspeaker-output filter (choke and 2-mfd. condenser), and also provision for switching in a pick-up for gramophone records, in front of the first L.F.

" It is laid out on a big baseboard, as per sketch enclosed. The coils are home-made, and as there is plenty of room I use no screening. (Don't believe in it.)

" As the circuit suits me very well I don't want to make much alteration, but any suggestions that might strike you would be welcomed and considered when rewiring.

" The idea of using mains valves is, of course, the extra power and efficiency. I dare say it will be more convenient, too."

We are afraid we cannot assist in the way you expect, because we do not think the set would be a success on those lines.

The much higher amplification of mains valves, as compared with those of the battery type, is likely to give rise to all sorts of trouble in a change-over of this magnitude.

Even a single S.G., detector and output-stage receiver requires a certain amount of experimental work to ensure stability when mains valves are substituted for battery types. And this is especially true if little screening is used.

But with a non-screened receiver using *two* S.G. stages and *two* L.F. stages as well we think instability would be certain to be very troublesome.

Take our advice and don't attempt it.

Telsen
H.F. CHOKES
cover every requirement

TELSEN SCREENED H.F. CHOKES

These new Chokes have been very carefully designed so that their efficiency is consistently high over the whole of the waveband for which they are intended. They are small and compact and the metal screen, which is connected to an earthing terminal, entirely prevents interaction with other components.

"All-wave" Binocular (10-2,000 metres) **5/6**

"Standard" (100-2,000 metres) **3/6**

"Short Wave" (10-100 metres) **3/6**

TELSEN STANDARD H.F. CHOKE

Covering the entire broadcast band, and occupying only the minimum of baseboard space, the Telsen Standard H.F. Choke has proved deservedly popular ever since its introduction. With an inductance of 150,000 micro-henries, a resistance of 400 ohms, and an extremely low self-capacity, it is highly suitable for use in reaction circuits, and is constantly being specified in this respect by the leading set designers. **2/6**

TELSEN SHORT-WAVE H.F. CHOKE

This choke is specially designed to cover the complete short wave length band, usually considered to extend from 150 to 10 metres. "Blind Spots" have been eliminated, and its extremely low self-capacity makes it a thoroughly reliable and efficient component for all short-wave circuits. Enclosed in a neat bakelite moulding, it occupies a minimum of space. **3/-**

TELSEN BINOCULAR H.F. CHOKE

In H.F. amplification, the performance of a choke is of supreme importance. Where the very highest efficiency is the primary requisite, the Telsen Binocular H.F. Choke is the inevitable choice. It has a high inductance of 250,000 micro-henries, with a very low self-capacity and a practically negligible external field (due to its binocular formation). It is from every point of view the *ideal* choke—and where high-class circuits are concerned definitely the *essential* choke. **4/6**

Get the TELSEN RADIOMAG N°5 - Now only 3D

ANNOUNCEMENT OF THE TELSEN ELECTRIC COMPANY, LIMITED, ASTON, BIRMINGHAM

PRESENTS THAT PLEASE

(*Continued from page 592.*)

that you can definitely be original, for never before in the whole history of radio have so many new types been available in a single season. Alas, it would require a complete article and a much longer one than this to run through all the new types that are now available, but I can at least make one or two suggestions.

Cossors were first with Class B. Their 220B (price 14s.) and its larger brother, the 240B (price 14s.), are still enjoying tremendous popularity, and moreover, on the score of efficiency, they are still likely to. Either would make a most acceptable present.

A Notable Feature

Then there is the Mullard P.H.2B., also in the front rank for Class B amplification efficiency. A notable feature of this famous Mullard valve is that it requires only a small "driver." Most keen constructors possess a Mullard P.M.2 D.X. or a valve of somewhat similar characteristics, and that serves admirably as a "driver" in this case. The price of the Mullard P.M.2B. is 14s.

One of the most startling valve developments of the year was that of unbreakable valves. Who is there among your "mains" friends who would not be truly grateful for a gift of a Marconi or Osram unbreakable "Catkin" valve, even if you do feel inclined to live up to the spirit of the thing and throw it at him?

The range of Mazda, too, includes several rather revolutionary additions, any one of which would make an ideal gift. One particularly outstanding example is the A.C.2/Pen., the price of which is 18s. 6d.

With valves, as with almost everything else in radio, when it comes to gifts, you can pay almost what you like. Lissen, Hivac, and Tungsram are all responsible for excellent valves, and in these cases the prices of the popular types of valves are very reasonable indeed. G. T. K.

USING A PENTODE

A description of the simple alterations entailed when an ordinary battery output valve is replaced by a pentode valve.

CHANGING over to a pentode valve in place of a triode is usually a comparatively simple business, although there are one or two points which must be watched if difficulty is to be avoided in all cases.

Actually the only extra connection required is that to the priming grid. This should be made through a decoupling resistance of about 5,000 ohms used in conjunction with a 2-mfd. decoupling condenser.

From the maximum H.T. lead of the set, therefore, a wire should be taken to one end of the 5,000-ohm resistance, and the other end of this resistance should be joined to the priming grid terminal of the pentode valve. To the priming grid also will be joined one of the condenser terminals, the other terminal of this component being joined to L.T.—.

Some pentodes have an extra pin in their base necessitating a five-pin valve-holder, in which case the extra wiring will be taken to the terminal of the valve-holder marked "G."

Other pentodes have a terminal on the side of the valve base to which the resistance and condenser must be joined if this type is used.

If a moving-coil speaker is used this will almost invariably be fitted with a matching transformer, in which case a suitable tapping to match the speaker to the pentode can be selected.

If there is no matching transformer, however, a pentode output choke would be required, otherwise reproduction might be somewhat unsatisfactory. In some cases it may also be desirable to introduce some form of impedance equaliser, such as a 50,000-ohms variable resistance in series with a ·01-mfd. condenser across the output choke.

Adjust the Grid Bias.

Other points must be borne in mind. In some instances the grid bias for the new valve will be considerably different from that previously employed, and the values must be suitably adjusted. It is quite easy to overlook this point.

If a mains unit is used care should be given to ensure that the current requirements of the new valve will not cause the eliminator to be overloaded. Should this be the case, of course, it is improbable that the change would be rewarded by any increase in output.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Remote Control.

WHEN remote-control devices were first brought in a few years ago they never appealed to me very much, and I didn't think they were likely to catch on. It seemed to me that they didn't really fill a great need, as most people would have the set handy in the room which they generally used and would hardly be likely to want to control it from different parts of the house.

With the various developments which have taken place in sets, speakers and output circuits, however, the remote-control idea has become more popular, although, of course, it is still only a relatively small percentage of listeners who find the need for it. At any rate, it has justified various manufacturers putting on the market quite successfully a number of excellent remote-control units for various purposes.

If the set cannot be used in the living-room it is generally because the aerial lead-in is more conveniently brought to some other room, and therefore, to save running the lead-in through the house, the set is placed in that room.

Loudspeaker Extensions.

If you want to make a loudspeaker extension it is best to use either a choke or transformer output so as to insulate the speaker from the D.C. current. The output choke or transformer, by the way, should preferably be tapped and also the component should be able to carry up to 10 or even 15 milliamps safely.

With most sets you need only run one wire for the loudspeaker extension, the other terminal of the speaker being connected to some convenient earth point, so that the circuit is completed via the earth to the negative side of the low tension.

An exception must be made, however, in the case of a mains set or mains unit, in which a condenser is included in the earth lead, because obviously, although such a set is earthed for high-frequency current, it is not earthed for D.C.

L.T. Remote Switching.

Sometimes it is an advantage to switch the low-tension current from a distance, and in this case either you should have heavy low-resistance leads—since the low-tension voltage is small and the current relatively large—or else (and this is preferable) you should use a relay.

It is no use having long leads in the low-tension circuit if these have an appreciable resistance, because you will get quite a large percentage of voltage loss which will completely upset the working of the receiver. A relay is much better.

In the same way that you can operate the low-tension current from a distance, so you can control the mains switching in an all-mains receiver, but naturally you must take extra care with the insulation of the components used.

Watch Grid Leads.

When it comes to controlling *volume* from a distance it is not quite so simple as switching, because, as a rule, you are dealing with a grid lead and, as you know, long leads in the grid circuit are very apt to set up howling or to cut off high notes or cause various other troubles.

For the purposes of a volume control you can use a variable resistance across the terminals of the loudspeaker, but this, again, tends to affect the tone. Another way is to have a set of fixed condensers of different values which, by means of a rotary switch, can be thrown alternatively across the windings of the speaker. You will find that as you use larger capacity condensers across the speaker the tone will be lowered, owing to the bypassing of the higher notes.

Mains Units Voltages.

When you are using an H.T. mains unit remember that the unit incorporates *resistances*, which are used for the purpose of dividing the voltage to the different tappings. Even the highest tapping has an appreciable amount of resistance in series with it. This means, in the first place, that decoupling is necessary to avoid interaction between the different circuits.

(*Continued on page* 640.)

NO OTHER KIT IN ALL THE WORLD CAN GIVE YOU

ENGLAND-EUROPE-AMERICA-AUSTRALIA

as this new All-wave "Skyscraper" does!

COMPLETE WITH FOUR VALVES £5·12·6

WORLD-WIDE NEWS AND ENTERTAINMENT for Home Constructors ONLY!

At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World "Skyscraper" 4 tunes from 12 to 2,100 metres. It brings two complete new wavelength ranges within reach of the ordinary listener—stations and programmes which before he was never able to receive—Ultra Short and Short-Wave transmissions from the ends of the earth. And remember you get these stations throug Double-Balanced Pentode Output giving brilliant reproduction on a Moving-Coil Speaker—as much power as a Mains Set from ordinary high-tension batteries.

Lissen have made this All-Wave All-World Radio available to Home Constructors because it brings back the thrill of conquest to hear America and Australia *direct* on a set you have built yourself, it makes you an enthusiast to realise what a wonderful thing you have created. When you see the Great Free Chart of the All-Wave All-World "Skyscraper" 4, which tells you how to build it and how to work it and why it gives such marvellous results, you will agree at once that it will be wise of you to build for yourself rather than buy a factory-assembled receiver which cannot give you these new and intriguing short-wave stations. The FREE CHART simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. YOU CAN'T GO WRONG! But get the Chart and see for yourself—then build the Lissen All-Wave All-World "Skyscraper" 4, the SET THAT SPANS THE WORLD!

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LISSEN ALL-WAVE ALL-WORLD 4 "SKYSCRAPER"

TECHNICAL NOTES

(Continued from page 638.)

In the second place, it means that the output voltage at any tapping will depend upon the current which is being taken from it, and what you may call the "open-circuit" voltage will be quite a different thing from that when even a small current is being drawn.

One practical result of this is that if you have a number of valves taking their anode currents from the unit, and you disconnect one valve or remove it from the set, this will cause a rearrangement of the voltages on the other valves.

In some cases, as with a pentode or a screened-grid valve, this may be a serious matter. At any rate, it is always a wise plan to switch off the unit before you start disconnecting or removing any of the valves or, in fact, interfering with them at all.

Potential Dividing.

The relationship between voltage and output current in the case of an H.T. mains unit is entirely different from that in the case of a source which has very little internal resistance, such as a battery of H.T. accumulator cells or a good H.T. dry battery.

I say a *good* H.T. dry battery because this has a low internal resistance, whereas an inferior battery—or even a good one which is getting old—may have quite a large internal resistance. If the internal resistance is very low the output voltage will be virtually independent of the output current, and the greater the internal resistance the more the voltage will jump about as the current is varied.

Separate Control of Valves.

In the early days of wireless, when we used bright-emitter valves, we invariably had a separate filament rheostat for each valve. This was necessary in those days, because the emission from the filament varied enormously with temperature.

When, however, the dull-emitter valve came along and was soon adapted for the standard voltages, there was a tendency to dispense altogether with any form of filament control, since it was so much more convenient just to take a valve of the appropriate voltage rating and plug it in.

The H.F. Stages.

Still further developments in valves, such as the introduction of the screened-grid H.F. amplifier and the pentode, have, however, brought us back to some measure of separate control. For instance, in the case of a set in which one or more high-frequency amplifying valves are used, it is sometimes desirable to have the filament of each high-frequency valve under separate control. This may enable you to get much better results.

Control in Positive Lead.

The simplest way is, of course, to introduce a small variable resistance in series with each filament; and, by the way, this should be put into the *positive* lead, not the negative lead.

If you put the resistance into the negative lead its effect is not confined to the filament, but it affects also the high tension and grid bias, thereby having an indirect effect upon the whole circuit. So remember to put it in the positive lead.

Smooth Reaction.

Talking about screened-grid high-frequency stages, by the way, I dare say you have noticed that the proper working of a screened-grid set—and, for the matter of that, this applies to a good many types of set, but particularly to those with a screened-grid stage—depends largely upon the gradual and smooth operation of the reaction circuit.

In order to get the best results it is absolutely necessary that the reaction shall come into effect gradually instead of with a plop, and also that on reversing the reaction control, turning it in the direction to reduce reaction, the set *ceases* to oscillate at the same position of the control at which it previously *started* to oscillate. Overlap in this respect is sometimes called "backlash," since it corresponds to the loose motion of a screw.

Use a Potentiometer.

For smooth reaction you will often find it very desirable to use a potentiometer connected across the low-tension supply and to take a connection to the grid leak from a point on this potentiometer.

Any attention which you give to this question is well spent, because there is scarcely any part of the circuit upon which the successful reception of widely different signal strengths depends so much.

R.C. Coupling.

Resistance-capacity coupling has had a long run for its money and is, or was, the most widely used form of coupling, next to transformer coupling. The relative

(Continued on page 642.)

TECHNICAL NOTES

(Continued from page 640.)

advantages of R.C.C. and transformer coupling have been continually debated for years past, and as improvements have been made first in one and then the other, so each has got back into public favour.

Choke Coupling.

Lately, however, the choke-capacity form of low-frequency coupling has proved a very good runner-up; and, in point of fact, it has certain advantages over resistance-capacity coupling. The connections, by the way, are the same, but the advantage is that the choke has a relatively low D.C. resistance, and therefore only causes a comparatively small drop in the anode voltage when it is used as a coupler.

With R.C. coupling, as you know, this drop in voltage often is quite an important item and necessitates the provision of extra high-tension voltage in the H.T. supply in order that the voltage actually delivered to the anode shall be made up to the right amount.

This relatively low value of the resistance in the case of an L.F. choke enables it also to be used instead of decoupling resistances in places where, for one reason or another, it is important to keep down as much as possible the voltage drop in the component.

When the Set Goes Weak.

I often get letters from readers saying that the strength of signals is falling off or that the set has "gone weak," and wanting to know why.

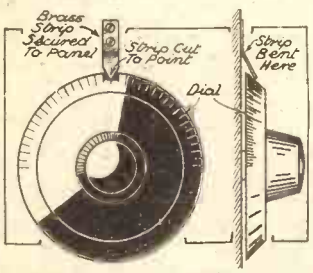
There are so many reasons why a set may "go weak" that it is quite impossible in the short space available to deal with them all, and I can only mention the most frequent causes and one or two general tests which you can make.

First of all, of course, if a valve has been in operation for a long time it may be losing its emission, and this will soon weaken the signals; but most probably, long before the signals are noticeably weakened, you will get distortion. If the receiver is fitted with reaction control you can soon see whether the set will oscillate or not.

It may be that it will not oscillate at all or that it only oscillates very feebly; and if this is the case it is quite possible that the high-tension supply unit is failing, in particular that the voltage to the detector valve has fallen too low, or that one of the valves is at fault, more particularly the high frequency or the detector.

AN EASY-TO-READ POINTER.

THE difficulty of obtaining accurate readings from the type of fast- and slow-motion dial which is raised from the panel is overcome by this easily made pointer, which enables careful tuning and fine readings to



You will find this pointer a great help towards accurate tuning.

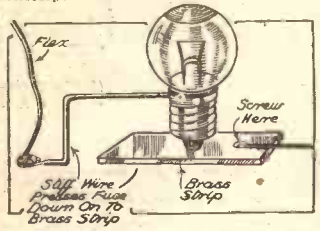
be taken, even when the dial is viewed from an angle.

A short strip of brass—the negative strip from a flashlamp battery is suitable—is cut to a point at one end and bent, as shown in the illustration, to an angle agreeing with the bevel of the dial.

Mount it on the panel so that the raised portion almost rests on the bevel—and there's your pointer!

TRY THIS FUSE HOLDER.

HAVING once been troubled with a faulty fuse bulb holder, I made, in a few minutes, a very efficient one with a short piece of stiff wire and a length of brass from a flashlamp battery.



An inexpensive and easily made fuse holder.

The wire was looped to take a small screw, and then cranked, after which a loop was made just large enough to screw the bulb into.

A hole was drilled in the strip of brass, and this was screwed to the baseboard and the wire and bulb set over it.

BATTERY THRIFT.

WHILE tracing a fault in the receiver, or while tinkering with some dodge or other, it is often practicable, if the set must be switched on, to use the lowest workable H.T. tappings and the highest workable grid bias.

Discrimination is needed, of course. But if you are satisfied that voltages have nothing to do with the trouble, you can make a search with the weakest and most distorted of outputs. Look how time tells up while one hunts about, say, for the cause of a crackle!

Then, too, short-wave dabblers who spend many a vain hour on the dial waiting for a big and easy loudspeaker signal need not go all-out on the "juice." If reaction and sensitivity are ensured, purity of reproduction isn't important until something does turn up; and then it isn't much trouble to switch off for a moment and resume normal voltage.

Another opportunity for thrift comes when we are listening for nothing but the time signal. Clocks all wrong, and perhaps ten minutes or more burning current for nothing! If tappings are arranged to give just some audible account of the time "pips," isn't that enough?

EASILY MADE JOINTS.

IT is a well-known fact about wireless that those wires most liable to break are invariably the most difficult to repair. This is certainly true of the "under-cover" connection of the tuning coil.

Here is a method which I find to be very efficient, where the joining of this very fine wire is concerned.

Obtain a small oblong piece of copper-foil or, if this is unobtainable, tinfoil will do. Bring the broken ends of the wire as near as possible and gently double the foil over the wires, as in sketch.

When the foil is pressed firmly with pliers it "moulds" itself round the wire, giving a joint that is perfectly satisfactory from the electrical point of view.

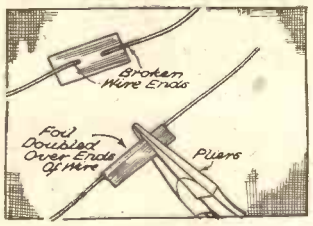
ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear.

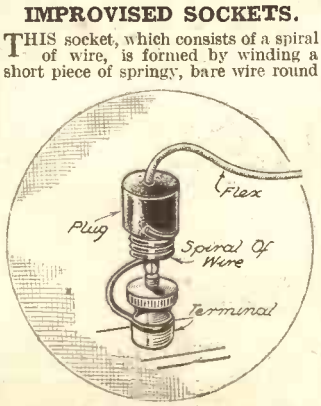
The best Wrinkle in the November 25th issue was sent by H. Jackson, 88, Wyley Road, Radford, Coventry, to whom a guinea is being awarded.



Satisfactory joints in fine wires can be made in a few minutes by the method shown above.

IMPROVISED SOCKETS.

THIS socket, which consists of a spiral of wire, is formed by winding a short piece of springy, bare wire round



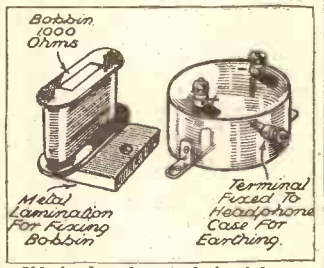
Here is an easily made wander plug socket which has many uses.

a rod of suitable diameter, slipping it off the rod and then clamping one end of the wire under the head of the terminal.

A socket made in this way can be arranged to fit any size or type of plug, and will make excellent contact if the wire is rather stiff and springy.

A USE FOR OLD LOUDSPEAKER BOBBINS.

MANY of us have old loudspeakers of horn and cone type in the junk cupboard, and possibly old headphones.



Old loudspeaker and headphone bobbins can be used very effectively as fixed resistances where small currents are being dealt with.

The bobbins of these can well be used as resistances where inductance is not a drawback, and, being of the order of 500, 1,000 and 2,000 ohms per bobbin, many different values can be made up by placing bobbins in series or parallel.

Centre tapping between bobbins is also an easy matter, and enables a fixed-potentiometer effect to be obtained.

The metal lamination is usually shaped as sketch, and provides a means of baseboard fixing, while if the metal case of a headphone is left affixed a means of screening is available.

HOME-MADE COIL CANS.

HERE is a method of making coil screens which are efficient from the electrical point of view and look quite "professional" if carefully constructed.

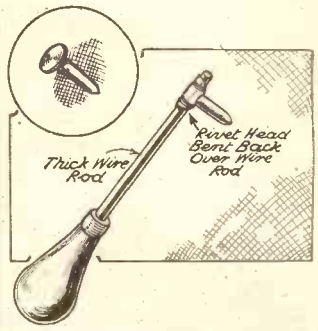
Make a can the size of the required screen of cardboard, cover it with foil such as is used for covering baseboards, make slots for the connecting wires, and a hole in the top for the threaded rod for the holding-down terminal head—and the screen is complete.

The holding-down terminal head may be used for an earth connection if a nut on the threaded rod is adjusted to the same height as the inside of the screen, to prevent the top being depressed when the terminal head is tightened up.

A HOME-MADE SOLDERING IRON.

A MOST useful little soldering iron may be made from a large copper rivet, a piece of thick wire and a handle.

Bend two opposite edges of the rivet



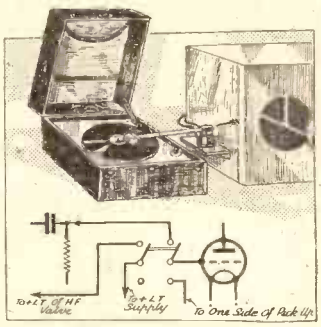
A really small soldering iron is a great asset. The one shown above can be made by anyone from a few odds and ends.

backwards, slide the rod up under the bent back-head and tighten it up to grip rod firm.

Place rod in handle and file rivet to a point, thus obtaining a small soldering iron.

USING A PICK-UP.

HERE is a scheme for using a radio set and pick-up along with a portable gramophone from a three or more valve set. The fittings required comprise a small shelf on the side of the cabinet, a D.P.D.T. switch and a pick-up.



This scheme enables you to use a portable gramophone and pick-up in conjunction with a radio receiver for record reproduction.

Fit the shelf on the set so that when the pick-up arm is put on the gramophone table the top is level. Bore one or two holes to thread the wires through the side of the cabinet, fit the switch on panel, and connect as follows:

First take off the wires from L.T. + to H.F. valve, and the one off the grid leak and condenser to detector valve. The other connection is the other wire of pick-up to 1½-volts grid bias.

REMOVING IRON FILINGS FROM A P.M. SPEAKER.

REMOVING iron filings which become stuck to magnets during filing or scraping operations can be a very exasperating job. Here is a simple way of removing them which has been used with great success:

All that is required is just a small portion of modelling clay, or similar substance, which is spread over the affected parts and pressed firmly on: then, when it is removed, the filings come off as well. Short of demagnetising, this is about the only way I know, and it has the advantage of being simple and above all cheap.

THE " DOUBLE X " THREE

(Continued from page 600.)

fitments that we decided to leave it out of the original design.

However, it can easily be added by all who desire to do so, and there is ample room for it on the baseboard.

By the way, we are very proud of the layout of this " Double X " set of ours. We believe it to be one of the very best pieces of work we have done. It is so seldom that symmetry, neatness, ease of wiring and the highest possible efficiency can be teamed up so strongly.

All Standard Components.

Not that we achieved it by accident! Many brains and much experiment have been concentrated on it. All of you can appreciate the appearance and sheer simplicity of the arrangement, but the technical efficiency of the layout——

No, we won't say that only the expert will be able to appreciate that, because it is this which contributes so largely to the good working of the set, and we are sure that all who build it will at once gain the impression that they are handling a receiver with an exceptional performance.

There are those who declare that the day of the three-valver is over, or nearly so. Well, we think the day of the inefficient set of any class is over. But to prove that it is not our method to overcome an initial inefficiency simply by piling on extra valves is one of our main purposes in placing this " Double X " before you.

Three good valve stages working properly are obviously equal to six sub-standard stages, and in the " Double X " you have three good valve stages—when you want them. When two will suffice to give all the amplification needed (and that will be often), the remaining one can be switched off by means of the Contra-Phase control.

You will note that the only cost of the Contra-Phase itself is that of the little switch that is incorporated in the potentiometer. You would have the potentiometer anyway, in a less-effective capacity.

All the other components as well are of a standard, easy-to-obtain, inexpensive character.

The construction of the set is such that anyone able to handle a screwdriver and a pair of pliers can tackle it. An evening should easily see the whole job done including the first tests.

A Bright Xmas Star.

It is not a coincidence that this article appears in our special Christmas number. We have been working hard on the " Double X " with Christmas publication in mind. The " Double X " will be our last star set of the year, and we hope and believe that it will be a star that will shine brightly in many homes during the Christmas festivities.

But to return to its construction. The quickest and best way to assemble all the parts is to purchase a complete kit from Messrs. Peto-Scott or one of the other kit suppliers that advertise in " P.W."

These kits are complete in every detail, including wire, screws and so on. You pay no more for them, and a whole lot of trouble is saved.

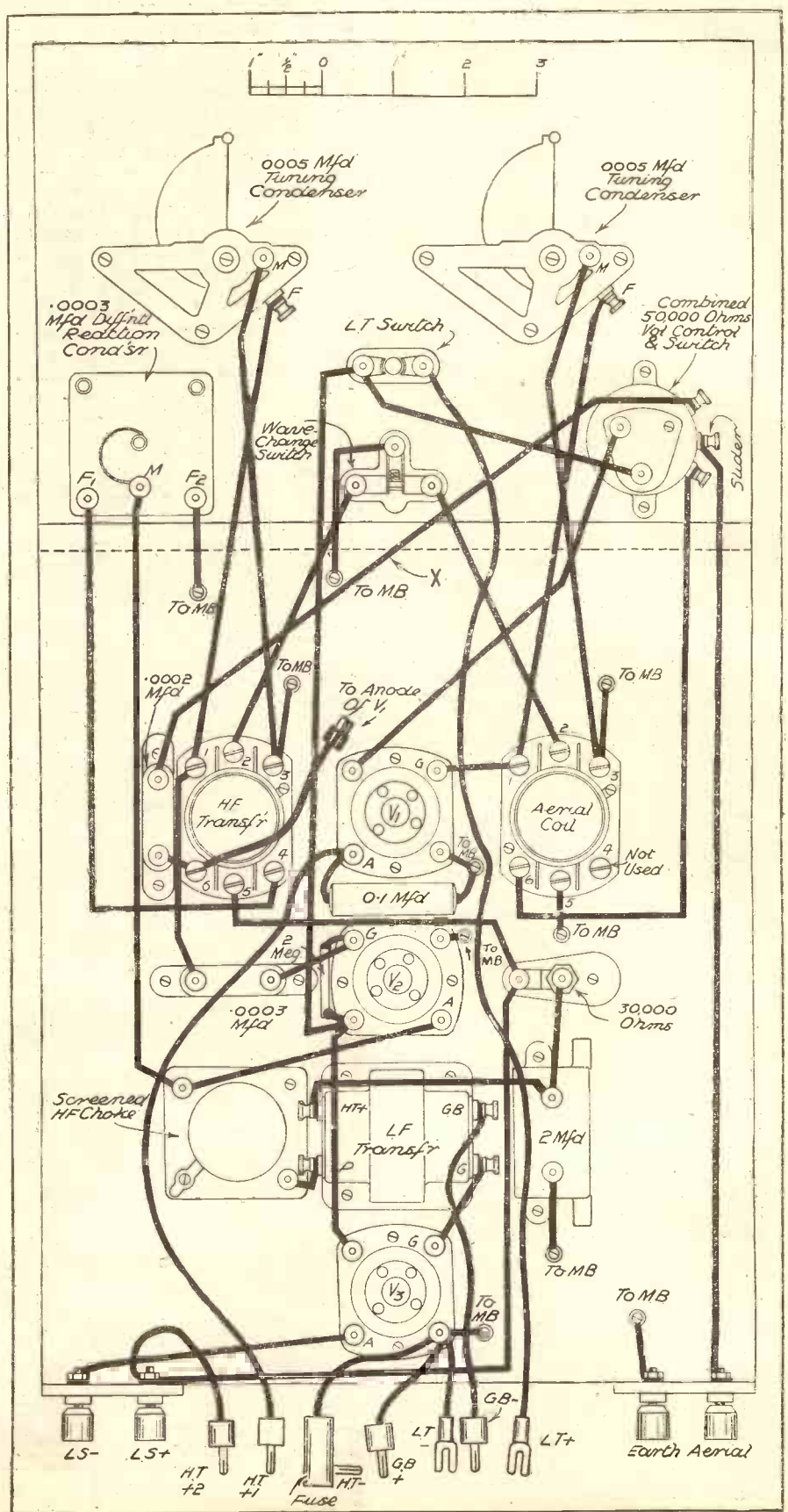
The point marked "X" on the various diagrams denotes the place where a series

(Continued on next page.)

THE "DOUBLE X" THREE

(Continued from previous page.)

resistance, of say, 1,000 ohms or more, may be inserted by those who live so close to the local station that they find the strength of the local too great at minimum volume. This in no way affects the use of the Contra-Phase, being but a limiting measure.



The complete wiring of the "Double X" Three is given in this diagram.

THE LISTENER'S NOTEBOOK

(Continued from page 628.)

fire in present-day variety, and there is more of the music-hall and less of the studio atmosphere about it, too. These are two of the most noticeable improvements of the new régime.

* * *

If Eddie Pola says it's black, then it is black. That's the impression you get after listening to this whirlwind compère. If he says the show is good—and he does that—then it is, and everyone agrees with him. After all, that's what a real live compère worth his salt should be able to do.

His second burlesque impression of an American variety broadcast was as big a success as his first: firstly, because he thought so himself; and, secondly, because he made everyone listening to it think so, too.

* * *

The Moderniques are living up to their reputation. Their impression of the famous Mills Brothers may have been a good impression, and it may not. I can't tell, because I'm not familiar enough with the famous Mills Brothers. That's the advantage these impressionistic shows have. It's a case of "Believe it or not," as Mr. Ripley says. But it really doesn't matter. The Moderniques offered good entertainment.

* * *

Jack Hylton reminded us of several American dance bands. I wish he wouldn't. He's much better as himself. Too many of our bands seem to want to ape the American type. But I can't tell why. However, Eddie said that Jack and his boys "were swell," so we must give them a pat on the back for a good performance.

* * *

The gramophone record of Burns and Allen was like the calm that follows the storm, and very welcome in an hour of hurly-burly that was carried along on a barrage of exuberant sales-patter. The surprise item wasn't as unique as it might have been. Interviews with film stars have been so long a B.B.C. tit-bit now that they have lost much of their flavour.

* * *

We had one in the "In Town To-night" series, didn't we? The idea behind this series is good, but only as long as there is general agreement about the importance of the personalities presented to listeners. The first of the series introduced a number of people who were total strangers to us. We don't mind hearing a celebrity make a remark, even if it is a fatuous one, but an ordinary remark from an ordinary person isn't of very much importance.

* * *

"Matinée," the seventh of the twelve plays for broadcasting, proved that radio-drama will be an unsubstantial thing if it turns its back on the stage proper to develop on its own lines. "Matinée" would never do on the stage—indeed, it was written specially for the microphone. It gave Lance Sieveking tremendous opportunities to show what can be done with effects and an echo-room.

It was all very clever, particularly the clockwork precision of the chorus—which couldn't be otherwise, really, as they were cut off always before they had a chance of becoming ragged.

* * *

It was really a play with and for effects. The story didn't seem to matter. The result was, in my estimation, a flimsy thing. I preferred the first part, for there were some quite bright lines, especially for Anne, the maid. I don't know who she was, as the "Radio Times," with its "the cast includes," isn't very helpful. I only recognised one minor character—the fishmonger.

* * *

The music throughout was bright and tuneful, and the words set to it were in unison with the general fantasticism of Mrs. Domus' dream. Anne coming in at her mistress' bidding on a rocket was rather amusing. What an idea for "Ariel" the next time "The Tempest" is produced!

THE BATTERY ECONOMISER

A Reader's Experience.

The Editor, POPULAR WIRELESS.

Dear Sir,—May I take this opportunity of congratulating the designer of the "Battery Economiser" recently described in "P.W."

The following figures may testify to the efficiency of this unit:

Test made with "Airsprite" and with Mazda super-power valve in output stage on West Regional News bulletin.

Without the "Economiser" the consumption of the set was 15 milliamps at 120 volts.

With "Economiser" in circuit the consumption varied between 5 and 7 milliamps.

The above readings were taken with reliable meter.

It will be gathered from the above that the H.T. should last at least twice as long.

Again thanking you,

Yours faithfully,

Stroud, Glos. "SATISFIED."

MIRROR OF THE B.B.C.

(*Continued from page* 618.)

Then there is "Play the Game"—book and lyrics by L. du Garde Peach. A satire on the transfer system in modern professional football.

John Watt is up to his eyes with the book and lyrics of "Meet the Prince," which is to be a sort of "song and dance" show based on a P. G. Wodehouse story. Lawrence Gilliam, Holt Marvell and Jack Strachey are writing the book, lyrics and music of "The Show Goes Over," which will deal with the troubles of a radio producer on the day of a big show. Denis Freeman and Mark H. Lubbock are also engaged on a romantic melodrama of South America.

Opinions of Scots Listeners.

Somewhat unlike their colleagues in London, the officials who compile the Scottish Regional programmes are very anxious to know what listeners think of their efforts, particularly in regard to radio plays, feature programmes of historical reconstructions and of the dramatisation of well-known Scottish books.

Here is a wonderful opportunity for listeners to speak their minds without fearing that their letters will be promptly consigned to the W.P.B. They can start next week when a repeat performance will be given to the play "Bandit," which was first broadcast about ten months ago.

Rugger Relays.

When Somerset defeated Gloucestershire last year for the honour of representing the West Country in the semi-final match for the Rugby Union County Championship, the foregone conclusion of many years standing came "unstuck," that Gloucestershire was certain of a place among the last four contestants.

The leadership of the South-Western group of counties between Gloucestershire, Somerset, Devon and Cornwall is always hotly contested, so that there will be keen interest in the game which is to be fought by Gloucestershire and Cornwall at Bristol on Saturday, December 9th.

At 8.5 p.m. the same evening an eye-witness account of the match will be broadcast in the West Regional programme.

Another Rugby football broadcast is in the North Regional programmes of the same day, when a running commentary will be given by Mr. Lance Todd on the Rugby League match between Salford and Leigh. It will be remembered that Mr. Todd was responsible for the broadcast description of the Rugby League final early this year.

THE LINK BETWEEN

(*Continued from page* 613.)

For Your Constructing Friends.

For those of your friends who fall into the home-constructor category the scope of your choice is practically unlimited. All the obvious things will already have occurred to you. But, again, why not go one better and give something original?

The presents that I intend to give to my home-constructing friends this year will all, I hope, be off the beaten track. I am planning to give such things as A.V.C. units, battery economisers, parallel-feed L.F. transformers, H.F. pentodes, double-diode triodes and so on.

Of course, if I had more money than I knew what to do with I'm afraid I should be sorely tempted to give a Pilot Author Kit for the "S.T.500" to every one of my home-constructing friends. But I am afraid that many of them would already have forestalled me! They all seem either to be making or to have made S.-T.'s "P.W." masterpiece. Still, it's a great idea, isn't it?

Here and There.

Radialaddin (Branches), Ltd., have just opened a new branch in Manchester. The address is 22, Corporation Street, and all the usual facilities, including that of taking radio equipment in part exchange for new models, will be available.

* * *

Messrs. Ward & Goldstone have recently received British and Dominion Government contracts for supplies of their air-spaced metal-screened down-lead. Isn't that a good enough recommendation?

* * *

So great has been the demand for Graham Farish Class B "driver" transformers that increased production facilities have enabled them to reduce the price from 12s. 6d. to 8s. 6d. Stuff to give 'em!

* * *

Our Gracie has had a Christmas party as only our Gracie could! Moreover, an H.M.V. recording microphone happened to be among the distinguished guests. Would anybody's Christmas party be complete without a copy of this unique record?

* * *

In time for Christmas, Marconiphone has recently released an entirely new battery portable. The Marconiphone Model "269," as it is called, is a winner. Make a special point of hearing it, and you will share my amazement. Literature is available under our postcard scheme. **(No. 67)**

* * *

The City Accumulator Co., Ltd., has appointed Mr. R. J. Durand to take charge of their West End showrooms at 4, Surrey Street, Strand, W.C.2. Although you may not be aware of it, his is a voice with which a great number of you are familiar. He was responsible on behalf of the R.M.A. for the announcements at the recent radio exhibitions at London, Manchester and Glasgow.

"P.W's." XMAS GREETINGS

(*Continued from page* 598.)

From SIR AMBROSE FLEMING, F.R.S.

"To all readers of 'Popular Wireless' I wish a Happy Christmas and a most Prosperous New Year.

"I always feel that there is a constant need for some invention, however small, which may add something to the question of avoiding interference and improving reception. At least a quarter of the population of this country must be directly interested in the improvement of radio receivers, and I hope that there may be some readers of 'Popular Wireless' amongst that number who will make such improvements to the benefit of the public and their own profit!"

Sir Ambrose Fleming.

THE A.C. "DOUBLE X"

(*Continued from page* 626.)

This is a normal and perfectly healthy way of obtaining maximum selectivity and is extremely valuable when heterodyne interference is experienced. It may be used quite satisfactorily on your local station if this is interfered with in any way (as, for instance, is the London National in South London), and, in fact, the reaction in the A.C. "Double X" is mainly useful for such selectivity purposes, being rarely required solely to enable distant stations to be received.

Provides Double Strength

The A.C. "Double X" obviously, then, has earned its title; it is capable of providing practically double sensitivity and double strength in comparison with normal receivers of the S.G.-det.-pentode type, and it is with the greatest confidence that we present it to your notice.

Built either in the form we show it, with power pack and loudspeaker incorporated, or with a separate loudspeaker, the set provides really excellent entertainment and a quality of reproduction that is really first-class.

The A.C.2Pen. is not so "pentodish" in its quality of output as most pentodes, and there is not the difficulty of speaker matching that is usually met with in this type of valve. The optimum load is of the order of 6,000 ohms, so that the usual "small-power" tapping of the ordinary loudspeaker transformer is usually not far wrong, and it should be tried as well as the standard pentode tap when the set is tested.

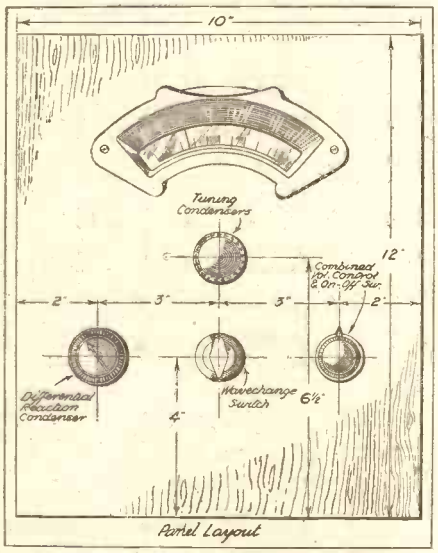
A special power pack has been designed for use with the A.C. "Double X," and this should be employed in preference to any other pack, for it is so arranged with the set that the correct voltages and currents are supplied. Moreover, it fits neatly with the loudspeaker into one half of the cabinet supplied for the set, forming an all-in table model that is not only handsome in appearance, but unusually powerful and sensitive. The output gives one the impression that a large radiogram is operating rather than a normal-sized table receiver having only three valves.

A special Metaplex chassis is provided for the set, and, apart from ensuring that all the wiring is correct, and that the points that are earthed to the Metaplex really do make good contact with it, there is nothing to worry about in the construction.

Ensuring Perfect Connection

One point is of particular interest, perhaps, and that is the bolt and nuts that are used to connect the two metal surfaces of the baseboard together. This bolt is run through the baseboard by the earth terminal, and it is done to ensure perfect connection between the top and undersides of the metal coating. This connection is essential if the set is to operate properly, for both surfaces of the board must be at earth potential.

THE PANEL DRILLING



The controls of the receiver present a neat appearance, and require few holes to be drilled.

NEXT WEEK

Replies to

S.T.500 QUESTIONS

By

JOHN SCOTT-TAGGART
F.Inst.P., A.M.I.E.E.

POPULAR WIRELESS
Usual Price 3d.

A GREAT NOTTS WEEK ON THE AIR

WHEN the Duke of Portland, as Lord-Lieutenant of the county, inaugurates Nottinghamshire week in the Midland series of "County" programmes on Monday, December 4th, many people will say that the most interesting of all the twelve counties within the Region has been "saved up" to give this fascinating string of broadcasts a good finish.

Nottinghamshire is not actually the last on the list. There is still another county which is to have its "week" in the New Year; but it is certainly one of the most famous, for which reason the programme builders at Birmingham have been confronted with an embarrassing wealth of material to choose from.

There will, of course, be a Pageant, as there has been in each of the other "County" programmes. This will be produced in the Birmingham studios immediately after the Duke of Portland's talk, and its author, Nevil Truman, has decided to make Nottingham Castle the centre of the county's history.

Second Only to London.

Mr. Truman has considerable experience in producing pageants, including one at Castle Acre Priory, Norfolk. For eleven years he has been secretary of the Nottingham Playgoers' Club, and he is now engaged on a history of stage costume.

The ceremony of William the Conqueror entrusting the castle to his son, William Peveril, forms the opening scene of the Pageant, which goes on to portray the Reform Bill riots of 1832 when the castle was burned, and other historic episodes, down to the opening by King Edward VII, then Prince of Wales, of the new building as an art gallery and museum.

Of the city of Nottingham itself there is more to choose from than can possibly be utilised in the whole week's programmes. For nearly nine hundred years it has been a "considerable" borough and second only to London to have a Mayor.

Forget its castle and you still have Sherwood Forest, which almost touched its gates, Robin Hood, and its lace. Nottingham, both city and county, must needs have a talk, and given, very properly by a Nottingham journalist, Mr. Josiah Wilson, on Thursday, December 7th.

Lace-making, the manufacture of modern pharmaceutical products, modern coal-mining and the manufacture of knitting yarn will all be the subjects of industrial broadcasts.

Impromtu Village Broadcasts.

Of the first, Lord Trent will speak on Monday, December 4th; Captain G. A. Hancock, M.C., President of the Federation of Lace and Embroidery Employers' Association, on Tuesday, December 5th; Mr. F. M. T. Bunney, on coal, on Saturday, December 9th; and Mr. Henry Hollins, on knitting yarn, on Friday, December 8th.

Process noises, as an accompaniment and illustrations to these talks, will be relayed from factories at Beeston, Nottingham and Pleasley, near Mansfield, and from a Bestwood pit.

It will come as a surprise to many people to learn that coal is actually mined within the city boundary of Nottingham.

Opportunity has been taken to include one of the series of "village" broadcasts during the "County Week" programmes. This will come from East Markham, and will be heard on December 7th.

Colonel Markham Rose will compère the programme, and will also relate the history of the place, which from its close proximity to the Great North Road was once a fortified manor-house.

It is the intention of the organisers of this programme to include more of the impromptu element than was permitted in previous "village" broadcasts, and it is to be hoped that the village wheelwright and a farmer and his daughter and young man will do justice to the great occasion.

Six Pounds a Year.

The wheelwright started his working life at a wage of £6 a *year*, rising at 4 a.m. and working until bedtime at 8 o'clock, when no doubt he was able to sleep well. His son and grandson work with him in the shop.

The women of the village, for whom the farmer's daughter will speak, include a post-mistress who has never had a real holiday out of East Markham, though she has twice been to the cinema, and an old lady of whom it is said that she can remember the days when smugglers were hidden in an attic so that they could escape the attentions of the preventive officers.

Coming to music, there is, of course, a feast. On Tuesday, December 5th, the Midland Studio Orchestra will give a concert of the works of Eric Coates, who was born at Hucknall.

Artistes who belong to the county are to give two concerts on the following day, and there will also be a relay of choral singing from St. Mary's Church, Nottingham.

On Thursday, December 7th, three Nottinghamshire artistes are giving a recital, and on December 8th, the Mansfield and Sutton Co-operative Choir will be heard.

ECKERSLEY EXPLAINS

(*Continued from page 593.*)

of having enough signal to get over the detector distortions that make people use the H.F. stage.

That is really why they use it, then! But we've got to find out some day if the detector curve is so curved, if it matters, if it is so much as people seem to think, and if for a cheap and sensitive set the detector and 2 L.F. is not the best of all.

But the bottom bend keeps bending
While the B.B.C. is sending,
So the whole effect is tending
To make those noises rending.
Seems the speaker needs a-mending—
With H.F. there's better blending,
'Cos the bottom bend's not bending:
Oh, I'm sorry for this ending!

THE S.T.500—HERE IS PROOF

(*Continued from page 621.*)

LIVERPOOL

"THE RESULT IS WONDERFUL."

[*From W. Bayliss, 29, Orchard Dale, Great Crosby, Liverpool.*]

"I thought you may be interested to know that I have made my 'S.T.500' into a radiogram, using a Garrard electric motor and a B.T.H. Junior pick-up. The result is wonderful. From quite moderate volume it can be increased to tremendous proportions, and even at its loudest point the music is exceptionally clear and undistorted, whilst the tone is all that can be desired. Now you have given your wiring for the radiogram I will try it out, but I doubt it being any better than at present. In any case I am more than delighted with the result of both the wireless and the gram."

"S.T.500" IN POLAND

Mr. John Scott-Taggart's star sets are built all over Europe by foreign readers who prefer his designs to those of their own countries.

The following letter is of special interest:

From Michał Livicki, Biała Str. 2, Warsaw, Poland.

"A year ago I built your 'S.T. 300' and afterwards the 'S.T.400.' Nevertheless, the best results have been obtained with your double separate reaction introduced in your 'S.T.500.'

"Following the description found in 'Popular Wireless,' I built the 'S.T.500,' but used a small power output valve. The selectivity, sensitivity and volume on both medium and long waves were so good that I decided to ask you the authorisation to describe your system in the Polish radio Press."

NOTTINGHAMSHIRE

"THE SWEETEST TONED SET I EVER CONSTRUCTED."

[*From W. Henry, B.A., 8, Lawrence Street, Sandiacre, Notts.*]

"A miracle! Two miracles!! My 'S.T.500' is finished and working faultlessly and wondrously. Thank you for the most powerful and at the same time for the sweetest toned set I ever constructed or handled."

AN INTERESTING LECTURE

That cheery and indefatigable radio propagandist and lecturer, Capt. H. de A. Donisthorpe, was recently in great form at Peterborough. In the course of a very enthusiastically received lecture he said:

"It will be interesting to the people of Peterborough to learn of the important Wireless Direction-Finding Station which was erected during the War at a place called *Dogsthorpe*, a few miles outside Peterborough, where I trained the wireless staff in direction-finding work. This station was utilised for the purpose of tracing the direction of Zeppelins, who used their wireless continuously through their raids on Great Britain. On one particular occasion the direction-finding apparatus actually showed that a Zeppelin was operating its wireless directly over this Peterborough station, and the wireless operator confirmed this by going outside the station and seeing the large airship overhead."

During the proceedings Capt. Donisthorpe received by wireless the following message:

"Donisthorpe, Dujon Hotel, Peterborough.

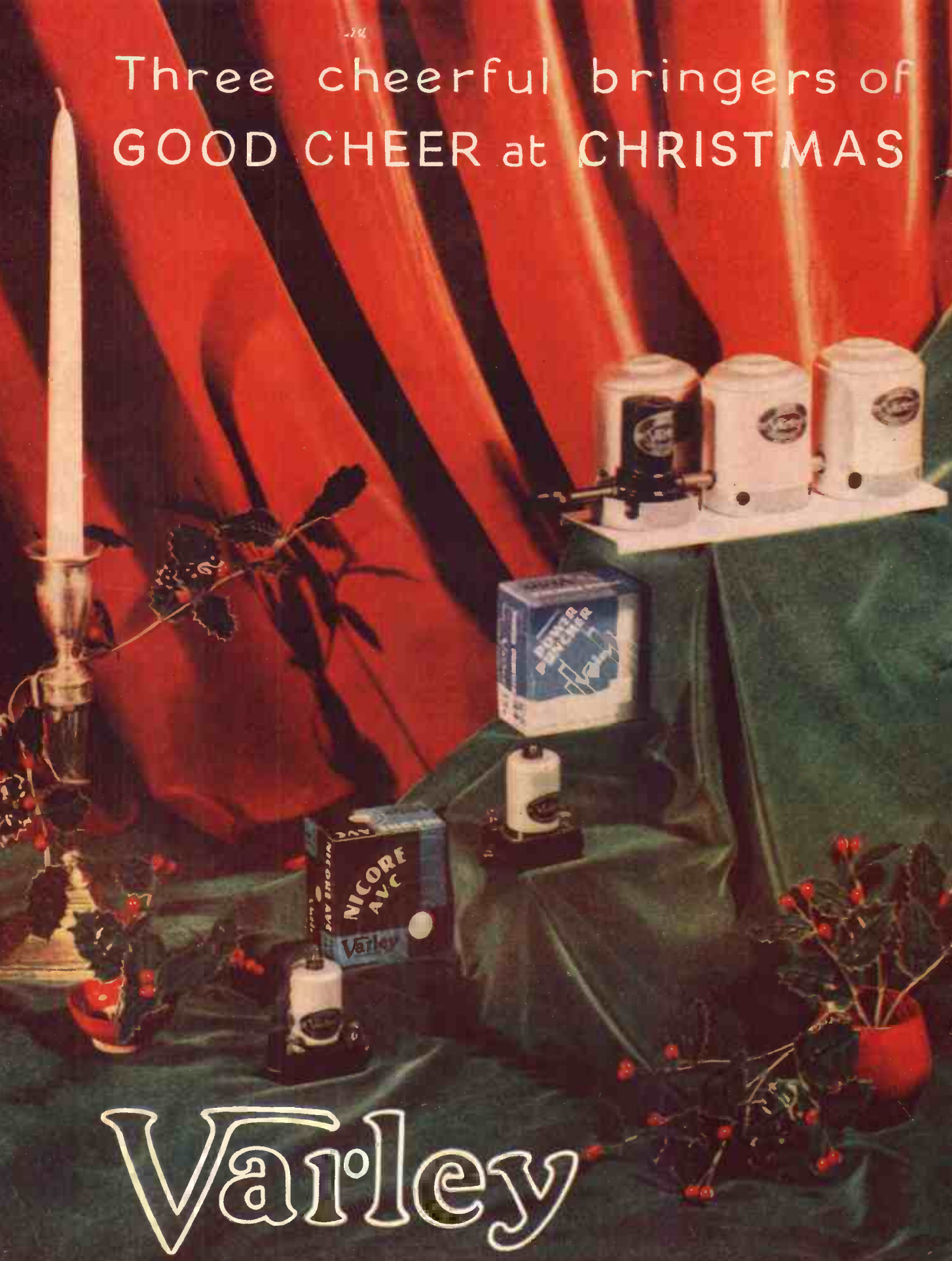
"My cordial greetings to you and your audience. Wish I could hear you myself, as my twenty-seven years of service with wireless has convinced me that I have far more to learn than I now know about this great art. Warm regards,

"DAVID SARNOFF."

The sender is probably the biggest man in radio to-day on the other side of the Atlantic. His first claim to fame was that he was the operator at a New York store who picked up the SOS messages from the Titanic. Since then he has risen to the greatest height of radio pre-eminence in America.

Presentation Book Token 7

Printed and published every Wednesday by the Proprietors, THE AMALGAMATED PRESS, LTD., The Fleetway House Farringdon Street, London, E.C.4. Advertisement Offices: Messrs. John H. Lile, Ltd., Ludgate Circus, London, E.C.4 (Telephone: Central 5352). Registered for transmission by Canadian Magazine Post. Subscription Rates: Inland and Canada, 17/4 per annum. Abroad (except Canada), 19/6 per annum. Sole Agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd.; and for South Africa: Central News Agency, Ltd. Saturday, December 2nd, 1933. S.S.



BLUE SPOT SPEAKERS

the gift that says

"QUALITY"

Music everywhere for Xmas

RUN EXTENSION SPEAKERS FROM YOUR PRESENT SET

Most sets nowadays are perfectly capable of working more than one loudspeaker. Why not get the full value from *your* set by installing Blue Spot Speakers in your Dining Room, Kitchen, Bedroom, etc., and have music everywhere. Christmas is just the time for adding to the gaiety of your home. Ask your dealer for details and be sure you insist on Blue Spot Speakers—the only way to get first-class results.

MOVING COILS - - 32/6—87/6

Mr. SCOTT-TAGGART'S FIRST CHOICE FOR THE S.T 500 WAS AGAIN BLUE SPOT

62 PM 67/6

WHEN you choose Blue Spot to express your Christmas "good wishes" you convey more than a gift that will give lasting pleasure. You pay your friends the subtle compliment of giving "the best"—a point just as much appreciated as the gift itself.

Everybody knows the name Blue Spot, and that it stands for all that is supreme in modern speaker design and construction. In every way Blue Spot justifies its claim to leadership. Its design is "advanced" in the true sense of the word. The materials and standard of manufacture could not be higher. The performance is as near to perfection as the best of everything can bring it. Whether you buy Blue Spot for yourself or for your friends you will be sure of complete satisfaction.

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POPULAR WIRELESS, December 9th, 1933.

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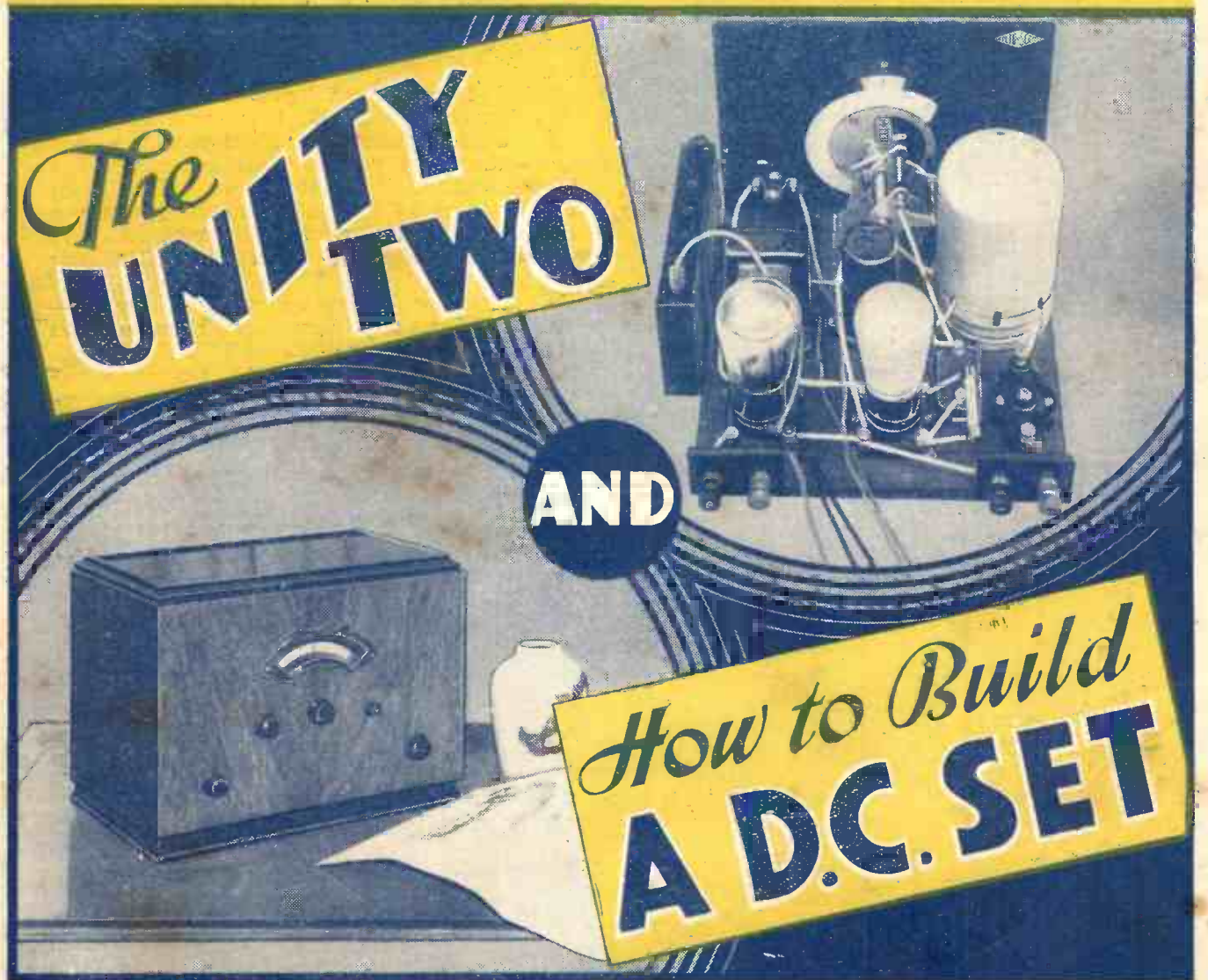
Radio Step-by-Step

Popular Wireless

TWO RADIO MYSTERIES SOLVED

No. 601. Vol. XXIV. December 9th, 1933.

EVERY WEDNESDAY PRICE 3D.



POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
Technical Editor: G. V. DOWDING, Associate I.E.E.
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Chief Radio Consultant: P. P. ECKERSLEY.
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MEDAL FOR SCIENTIST
ARABIC HANDBOOK
COMPONENTS ABROAD
GROWTH OF H.M.V.

RADIO NOTES & NEWS

CANNIBALS' LAUGHTER
SOCIETY NEWS
NOVEL BROADCAST
PIP-PIP

Hughes Medal Award.

PROFESSOR E. V. APPLETON has been awarded the Hughes Medal by the Royal Society for his researches into the effect of the Heaviside Layer upon radio transmission.

It will be recalled that Professor Appleton has specialised for many years in the study of the electrical conditions of the upper atmosphere, and that he discovered another layer, sometimes called the "Appleton Layer," above the Heaviside. He is making radio history.

Patriotism Run Riot.

THE British Empire Union protested against the preponderance of German music in the B.B.C.'s programme for Armistice Day, and asked the B.B.C. to eliminate it all. This is patriotic frenzy. Greatly as I love Britain, holding her to be the best place in the world to live in, I cannot follow anyone into the labyrinths of a mind which muddles music with international politics, even in wartime. Nurse Cavell said: "Patriotism is not enough." One corollary of this might be: "We need restraint and broad-mindedness as well."

"Slave of the Light."

WHEN Edmund Abd el Nur wrote asking for a signed photograph of Sir Oliver Lodge I mildly inquired—why, Edmund? Mr. Abd el Nur now explains that it is because his mother chose it. Hum! I never thought of that. He has been good enough to send me his book about wireless, and asks for a criticism.

The book is in Arabic, and the Arabic appears to be quite as curly-wiggy as one could expect in these straitened times. It appears to be very comprehensive, ranging as it does from crystal sets to television. I should love to know the Arabic for "push-pull." I congratulate Edmund on his industry; I reciprocate his friendly *démarche*.

Boost British Trade.

MR. L. J. FOXON (or maybe "Poxon"), P.O. Box 1082, Buluwayo, S. Rhodesia, presents another fine impression of the overseas radio man's wail. He cannot get components there. And he is aching to build some "W. L. S." sets, too.

He asks whether one or more reliable firms would let him open a components depot in Buluwayo, and states that as Salisbury is to go on "medium" this year there will be a big demand for wireless parts. Well, what could prevent him from doing so? All he needs are the premises—and the stock!

The Most Northerly.

SO far as I know, the radio shop of Mr. W. Johnson is the most northerly in Great Britain, and, moreover, it has this distinction—that in the summer the sun never sets upon it.

This emporium is situated in Lerwick, the capital of the Shetland Islands, and enjoys the "servicing of about 240 fishing vessel installations." So keen a dealer is Mr. Johnson that he actually visited Radio-lympia this year, a little jaunt of 1,200 miles there and back.

Small Beginnings.

GREAT oaks from little acorns grow. So I am informed by my small daughter, who is a frightfully swell botanist—so she thinks, bless her! Just consider, therefore, from what a teeny-weeny acorn grew the mighty H.M.V. business! In 1898 it had *twelve* employees. The records were made in one room in Maiden Lane, whilst the gramophones were put together in the kitchen of the same house.

I have heard a story about two young chaps who clung for years to a block of gramophone shares out of sheer obstinacy, and who eventually sold out for a fortune. It almost makes me feel like investing a quid in television. Almost.

Radio Relays.

I HAVE believed in these from their beginning, despite the howls of local radio dealers who feared destruction. Now I understand that there are some 106,686 relay subscribers to relay systems, which equals 1·7 per cent of the total number of listeners.

There is, moreover, no evidence to support the argument that relays kill the local retail radio trade. Take Hull—if Hull attracts you!—where before the relay business began there were less than 70 radio dealers; there are now 76, doing well. Other examples are before me. No; relays fill a niche entirely their own.

New Light on a Record.

IN reference to my notes about the Morse-sending record set up by an American, H. S. R. (Aberdeen) points out that the speed attained, about 57 w.p.m., ought not to frighten student telegraphists from the "key" because, firstly, the Morse code which was used is "American" Morse, the original code, which contains more dots than does the "Continental" Morse used here, and thus makes for speed.

Secondly, the key used is one which works sideways and can be made to send dots at any predetermined speed; and thirdly, the reference to the transmission being in "code" probably meant simply that it was by Morse, for H. S. R. says that the Americans say "in code" when they mean telegraphed, as distinct from telephoned, messages.

If Ariel Wrote This!

WELL, there would be no more Ariel, that's all! Listen to the American radio paragraphist on his top note: "Will Rogers' return to Good Gulf Sunday

(*Continued on next page.*)

LAWYER'S FEES FROM WIRELESS SPEAKERS

(Continued from previous page.)

nite was a rousing click. Starting show so far as the outside audience was concerned, he gained momentum and turned in a nifty session of contemporaneous gagging, not a little of it kidding the N.R.A. on the square."

Fancy kidding something on the square at nite! It sounds all rite, but why not on the skwair? I make you a present of "nifty." Perhaps P. P. Eckersley will explain it with a "rousing click."

"Music Hath Charms."

ACCORDING to missionaries, no truer line was ever penned by poet than that which reads "Music hath charms to soothe the savage breast." Moreover, they have found that the savage breast is also alleviated by laughter. Tickle a cannibal's sense of humour (if you know where he keeps it!) and he will be as mild as a vegetarian.

Thus it appears that broadcasting has a great part to play in the subjugation of savage peoples; but what particular brand of fun is the correct one to stave off a feast of "long pig" must be found by "trial - and - error" methods. Hard luck on the "errors," though!

A New Radio Society.

READERS in south - east London ought to know that a radio society has been formed at the well-known Goldsmiths' College, New Cross, S.E.5. Meetings are held every Monday at 7.30 p.m., and members of both sexes are welcome.

A popular lecture is given each week, frequently with a demonstration, and questions are invited at its close. Those who would like fuller details will please write to Mr. Albert L. Beedle at the college or call on him there any Monday evening.

Cautious California.

POLITICS are fiercer and more complicated in the U.S.A. than in this matured country. In order to protect itself from the possibility of libel actions, station K N X, Los Angeles, makes political speakers submit their speeches 48 hours in advance.

That is reasonable. The scream is, however, that the would - be speaker is told to attach to his draft speech a cheque for five dollars to cover the fee of the lawyer who vets it! How I should love to see our B.B.C. trying to collect a pound sterling for a lawyer's fee! Hold me up while I laugh.

Television Association.

TELEVISION manufacturers have asked the London Chamber of Commerce to support them in forming an association to promote and protect the interests of commercial television and to arouse the interest of the public by the dissemination of authoritative information about the subject, as well as to act together with a view to standardisation.

This looks like the beginning of the great advance. All that is now needed is the powder and shot in the form of television of "entertainment" standard.

Radio Club Note.

ALTHOUGH I am permitted to mention occasionally the advent of new radio clubs and to plead for the support of old but frail ones, it would not be fair to "Arielites" to turn these columns into a general reporting space for clubs all and sundry.

This week I have an embarrassing number of reports on hand, and I can spare space only to say that the Smethwick Wireless Society (Hon. Sec. Mr. E. Fisher, 33, Freeth St., Oldbury, near Birmingham) is still under full steam, and that the Radio, Physical and Television Society, 19, Lena Gardens, Hammersmith, W.6, is in full sail.

SHORT WAVES

A German professor tells us that worms can sing.
We regret that the secret is out, as it may get round to the B.B.C.—"Punch."

* * *

"There's nothing like a really first-class English radio set," declares an enthusiast.
Except, of course, another first-class English radio set.

* * *

A well-known American lady recently appeared at a fancy-dress ball as a loudspeaker. When she was presented with the first prize many people congratulated her, saying it was a remarkably good reproduction.

* * *

"The mayor of your town is a consistent prohibitionist, isn't he?"
"I'll say he is. Why, he won't even have a wet battery in his radio set."

* * *

"Oysters," observes a writer, "are difficult to open."
One method is to place them near a loudspeaker during a wireless talk and slip in wedges when they yawn.—"Punch."

A Musical Evening.

AN unusually interesting meeting of the Golders Green and Hendon Radio Scientific Society was held last month, attended by over 250 persons, including representatives of several other radio societies, the International S.W. Club, the Anglo-American Club and the B.B.C.

Mr. E. Harwood lectured on electronic musical instruments, demonstrated their sounds by means of gramophone records and played several classical pieces of music on the "Electronde."

The Aerial Orchestra.

SOME of these instruments produce electrical vibrations by mechanical means, the Neo-Bechstein piano being one such. It has no sound-board, and the vibrations are transferred to an electro-magnetic system, amplified and transformed into sound. The Vierling piano uses the strings as one plate of a condenser whose capacity varies, and thus in turn varies the frequencies of the associated circuits.

The Spielmann piano employs "light cells." The Trautonian, the Hellerton, the electric organ and the Electronde are worked by valves. The electric organ has about 400 valves. Ten or a dozen French churches and "Poste Parisien" are equipped with it.

The Craze for Novelty.

THE Americans are apparently at their wits' ends to find radio "turns" to slake the "thirst" of their public. Quite a new idea was provided by a citizen named Grady Cole, who put a ladder against a wall on a Friday, the 13th of the month.

He then invited men to walk under the ladder and questioned them about their superstitions. If they owned to none he offered them a hand-mirror, and it is recorded that most of them, superstitious or not, refused to break the mirror. All this took place before the microphone, of course.

"Obsession."

I THOUGHT that the fiat had gone forth, "No longer shall the time-pips be scrawled over a programme." I am corrected. At the climax of that fine play, "Obsession"—to wit, at 9.15 p.m. on November 21st—those impertinent pips were interjected, and they promptly brought us out of romance into reality.

It is amazing that such an atrocity is countenanced by a Corporation which is packed with artistic cranks. How would Sir John like the office-boy to shout "Pip-pip!" through the keyhole of his room just as he was about to conclude a contract for nine tons, seven cwts. and a bittock of "Foundations of Music," guaranteed unchipped, weathered and free from flaws?

A Bit of Ariel's Past.

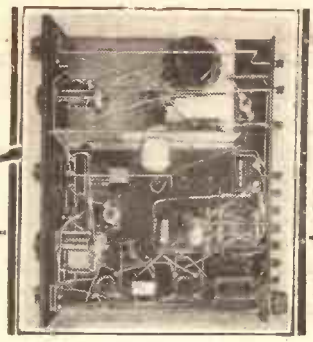
A CURIOUS reader asks me what was my most humorous radio experience. A difficult question for one who sees humour in almost all of life.

However! I remember that a new radio station was built before the war, and its receiver was quite dumb. I was concerned chiefly with fitting the lighting wiring, but I observed that the two radio engineers small-toothcombed the set from "earth" to aerial, and still it was dumb.

A senior engineer was fetched some 125 miles. He stalked in, took one look, and said: "If there are no signals there is no circuit. What's in this casing?"

The casing was unscrewed. *The leads from the receiver to the terminals into which the telephone lugs were screwed were not soldered on.* Three engineers, two days' work, £18 expenses! I laughed. **ARIEL.**

Replies to S.T.500 QUESTIONS



By JOHN SCOTT-TAGGART

CONVERTING "S.T.400" to "S.T.500."

Q. Do you advise the conversion of an "S.T.400" to the "S.T.500"? I am getting excellent results with the "S.T.400," but naturally wish to have the latest and best in sets.

A. I have had many letters from readers who have carried out the conversion and are delighted. The position, however, is not very simple because the two sets differ as regards the results they give. The "S.T.500" gives a wonderful output—even as much as 2,300 milliwatts if required. But if "power-valve" output is adequate to one's tastes, the "S.T.400" will be found a trifle more sensitive because of the two stages of L.F. In other words, on a fair strength of signal, the "S.T.500" will give louder and better results, but on a very weak signal I think the "S.T.400" would be slightly more sensitive than the "500."

I am assuming that the "S.T.400" is being worked at its most sensitive. From an operating point of view the "S.T.500" is definitely simpler and the reaction control is smoother and more effective. In fact, the H.F. stage is remarkably effective, and the stability of my latest set is better in totally unskilled hands than the "S.T.400."

As regards conversion of the "S.T.300" (my three-valve set), I would definitely advise a conversion to the "S.T.500" rather than to the "S.T.400." Converters will be delighted, I know.

Some readers who have "S.T.400's" will apply the aerial reaction system of the "S.T.500" to their present sets. This can be done in half an hour and at very small expense, and is emphatically worth while.

As regards new builders, I would emphatically advise them to make the "S.T.500" rather than the "S.T.400."

REVERSED REACTION COIL.

Q. My "S.T.400" produced good aerial reaction, but when the same aerial coil was used in the "S.T.500" an increase in the aerial reaction decreased signal strength. Why?

A. Obviously the reaction coil is wound wrong way round, and you are getting reverse reaction. (I assume that you retune slightly always after a change of reaction.)

You will now ask why you got reaction on the "S.T.400." The reply is that owing to capacity-reaction effects there are some positions of the "S.T.400's" controls which will give aerial reaction even with a coil which is inductively wrongly wound. You were, however, not getting the genuine reaction control on your "S.T.400."

Rewind your reaction coil the other way round or reverse the connections from the wires of the winding to the coil terminals. If you do not wish to risk breaking a wire, simply reverse the external leads going to terminals (1) and (6) on the coil. The wire which goes to (6) should go to (1) and the one you now have on (1) should go to (6).

The same thing should be done by any reader who has, by chance, wrongly wound aerial coil. (This is extremely unlikely if my recommendations are followed.) Almost anything can happen with coils not in my list, including wrong numbering of terminals.

LOW-WAVE TUNING.

Q. I find that there is some difficulty in getting down to the lowest wavelengths on the aerial circuit. Why is this?

A. You may have a large-capacity aerial and when the aerial coupler is full-right the aerial circuit tunes too high. The normal position, however, of the aerial coupler on the "S.T.500" is at about 10.30 o'clock, so to speak. The extra capacity obtainable by rotating the knob clockwise (to the right) will prove of no benefit at the bottom of the tuning dial. In practice the benefits of moving the knob to the right increase as wavelength increases. I know of no circumstances where you want to have the aerial coupler full-right for the reception of, say, Fécamp. The restriction of tuning range would therefore never arise.

Interesting points raised by readers concerning the "S.T.500" are dealt with on this page. The answers contain information of great value to all builders of the "S.T.500," and also to those who contemplate the construction of this magnificent receiver.

The questions are ones actually raised in letters to the designer, and the replies are written with his usual clear exposition.

Builders of the "S.T.300" or "S.T.400" must remember that the aerial coupler of the "S.T.500" has about twelve times the capacity of the aerial coupler of the "300" and "400." For normal purposes, therefore, it will be kept much farther round to the left. It is, by the way, a good plan to fix the knob (by means of the grub-screw at the side) so that when the knob pointer is vertical the condenser is about one-sixth in. This is a more natural normal position than nearly full-left.

The useful portion of the aerial coupler is the first bit, with the knob towards the left. The rest is for the longer wavelengths and occasions when interference is less, e.g. in the daytime.

REDUCING VOLUME.

Q. Even with both couplers full-left, signals from the local are very strong. What can I do about it?

A. If you live so close you can reduce the screen voltage (H.T. + 1 terminal) of the S.G. valve. This will also save your H.T. current. People rarely alter the screen voltage, but it is a very good plan to reduce it either when you experience conditions such as the above reader experiences or when you settle down to a programme. Screen-grid valves can be greedy fellows, and a reduction of screen volts will often save a couple of milliamperes. When tuning a weak signal, however, do not forget you reduced the screen volts, and therefore the sensitivity of the set.

Another method of reducing signals is to fit an extra aerial terminal next to "A" on the strip and between "A" and the baseboard edge. Bare the end of a three-inch length of bell-wire and connect to the new terminal. Now bare the end of a similar wire and connect this wire to A; then twist the two wires together for a few turns. You have made a tiny condenser between terminal A and the new terminal, which is now used as a spare aerial terminal to which you can fix the aerial in special circumstances. You can cut down or increase the input by simply varying the amount the wires are twisted together. The far ends of the wires should never touch. The wires are best connected to the terminals in the same way as other wires in the set, i.e. on the inside of the terminal strip.

CHOOSING A LOUDSPEAKER.

Q. What are your recommendations for loudspeakers for the "S.T.500"?

A. Definitely, I prefer a moving-coil speaker, if of good make. I prefer one which has terminals for Class B, as well as for triode. The speaker is then more versatile. If you buy a speaker with terminals only for Class B, you will be tied to Class B. Some moving-coil speakers, such as the Blue Spot, are provided with terminals allowing any kind of output arrangements.

THE OUTPUT TRANSFORMER.

Q. Why is the original set provided with an output transformer if you prefer readers to use a speaker with Class B terminals?

A. Because many readers have very good speakers and will be unwilling to scrap them. Those who have speakers of doubtful quality, or which cannot handle the big output from the "S.T.500," are advised to leave out the output transformer and use a speaker with Class B terminals. A full-

(*Continued on page* 688.)

THE MIRROR OF THE B.B.C.

THE BETHLEHEM BROADCAST

Mrs. Giles Borrett—Television Moves—An "Exiles" Programme.

By O.H.M.

THE latest news about the Bethlehem bells broadcast is that it will be built into a special programme to which both the N.B.C. and the B.B.C. will contribute. The programme will open a few minutes before eight o'clock on Christmas Eve with the singing of a special hymn. This will be sung both at Winchester Cathedral and in New York, and the mixers at Broadcasting House will fade out and in, using both as the prelude to the bells from Bethlehem.

Why So Small.

Progress is being made with the Board of Governors' investigation of the reasons behind the inadequacy of the size of Broadcasting House. The purchase or lease of several new properties within two years of the completion of the new building suggests a culpable lack of foresight somewhere. It may, however, be no one's fault; but in my opinion the Governors are right to make sure.

Mrs. Giles Borrett.

There is genuine and widespread regret among the staff at Broadcasting House concerning the departure of Mrs. Borrett, who achieved remarkable popularity during her three months as announcer. In addition to the usual farewell gatherings, there were several special parties in honour of Mrs. Borrett.

The Staff Bonus.

My information is that the Board of Governors of the B.B.C. have decided to allow the staff to have a Christmas bonus this year equivalent to a week's pay. This is particularly important, because it practically makes the bonus permanent. Anyway, it has been given in nine out of the ten years of the existence of the B.B.C., and there is no reasonable person who would begrudge it.

A Reward for Broadcasting House.

Commander Val H. Goldsmith, a member of the staff of Admiral Sir Charles Carpendale at the B.B.C., has been awarded the special gold medal of the Royal Institute of British Architects in recognition of the architectural merits of Broadcasting House. I wonder what Colonel Val Myer, the architect of the building, will have to say about this. Presumably Commander Goldsmith's reward is for his work inside the building. Anyway, he is the only one who has got anything out of it so far, if one excepts the knighthood which was given his chief, Sir Charles Carpendale, at the time the building was finished.

Clearance of Married Women.

The big clearance of married women employees of the B.B.C. continues. There will soon be no women on the staff with a husband presumably able to support her.

Television Moves.

Sir Harry Greer, Chairman of Baird Television, with his co-directors, Mr. H. Clayton, Major Church and Mr. J. L. Baird, who recently had a secret conference with Admiral Sir Charles Carpendale and Mr. Noel Ashbridge, of the B.B.C., are busy preparing what is to be said to the shareholders of the Baird Company at the annual meeting to be held on December 31st. There are rumours of an important announcement, but not in connection with the B.B.C. transmissions.

"How the Other Man Lives."

Mr. John C. Moore is spending a week in the West Region so that he can get before the microphone on Friday, December 15th, and tell listeners what he thinks of the area and perhaps the people who live in it. The idea is rather in the nature of an experiment, and the title of Mr. Moore's talk is "How the Other Man Lives."

An "Exiles" Programme.

Exiled Welshmen, all living in smoky London, will entertain their compatriots in a programme to be broadcast from the West Regional transmitter on Wednesday evening, December 13th. All the items will deal with the subject of the programme—"The Exile."

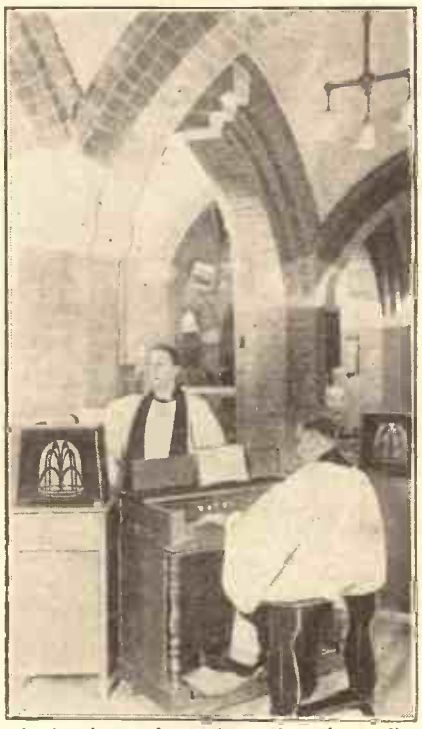
The Rev. Dr. Elvet Lewis (Elfed), a preacher of distinction, President of the Congregational Union, an ex-Archdruid and a poet, will read poems by various authors; David Ellis (tenor) will sing songs; and there will also be items by the St. David Singers, conducted by E. Kenneth Thomas.

The "Scrapbook."

On Monday, December 11th, Eric Maschwitz will present another of Leslie Baily's "Scrapbook" programmes. Mr. Baily originated this type of entertainment some years ago when he was working in the north, but that to be heard on December 11th will be broadcast from transmitters taking the National programme.

(*Continued on page* 687.)

RADIO IN RELIGION



A microphone, a harmonium, a five-valve amplifier and two moving-coil speakers provide the music for St. Margaret's Parish Church, Coventry, since the regular organ broke down. The Vicar considers the tone and volume as good as that of any full-size church organ.

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes, and on microphone personalities of the moment.

I'M afraid we in the south tend to overlook the wireless doings of the north. This may be because we read the southern edition of the "Radio Times." But it would pay us, I'm sure, to have a thought sometimes for the north.

* * *

How many southerners heard the selected scenes from "The Rivals" broadcast from the North Regional? The truth is, I was in no mood for "The National Character, No. 8" talk. In fact, there was nothing in the nature of light entertainment on the National before 8.15 that evening. So I looked for a better 'ole—and found it.

Of course, I like "The Rivals" as a play. The scenes played by the North Regional Repertory Players were the better-known ones, needing no explanatory notices from an announcer. They had the added quality of linking themselves up perfectly naturally.

* * *

The harpsichord was cleverly and effectively used, which seemed just right for this particular form of entertainment. The cast was good, and compared favourably with better known actors who broadcast from London.

These scenes were presented in connection with Mr. L. du Garde Peach's series of talks, "The Brain of the Playwright." They were so successful that a series of these miniature plays ought certainly to be considered as a possible new and distinct type of dramatic entertainment.

* * *

Listeners who like this type of thriller must have thought "Obsession" a gem. It is a type of play for which broadcasting is eminently suited, now that effects can be produced with such vividness.

Nothing is more indicative of the progress of radio drama than the realism of present-day effects. "Noises off" over the air isn't the indefinite and puny thing it sometimes is in a stage play. But for all this I don't care for the "Obsession" class of play. I prefer something with a more cheerful theme.

* * *

The political broadcasts continue to interest, and it is to be hoped that they have come to stay. Controversy has in the past raged very freely over these talks, but it would seem that an agreement can be reached satisfactory to all parties.

The farming talks, designed apparently as propaganda for the Ministry's marketing schemes, are of absorbing interest to many listeners besides farmers. The same might also be said of a number of topics which are loosely described as political.

* * *

I have never been one to cry out for greater showmanship in broadcasting, because I am always afraid it might lead to a lot of make-believe, and possibly deception. Broadcasting has to guard against deception. The Café Colette orchestra vexed me when it first came into being for posing, perhaps for a joke, as something it wasn't, and I find it difficult "to pardon the cheat his lie."

An item of radio fare should be able to stand on its own legs and should be judged on its own merits. For instance, a gramophone recital is a gramophone recital all the world over. A good showman might succeed in converting it into something else. And, as I say, I hate to be had!

(*Continued on page* 688.)

THE UNITY TWO

Compactness, economy, and ease of operation are salient features of this unique two-valve battery receiver. It is the ideal family set, for anyone can handle it, while its range of reception provides a surprising number of programmes.

Designed and described by the "P.W." RESEARCH DEPT.

FOR many purposes a two-valve set is perfectly adequate. Tens of thousands of listeners possessing elaborate radio equipment would find a set of that kind entirely satisfactory in its performance so long as it was of first-class, modern design.

We refer to those whose listening, after the first flush of ether conquest is over, is confined to the local stations, perhaps Radio Paris on Sunday, and every now and then one or other of the typical and more powerful foreigners.

And who do not want terrific volume.

For such listeners superhets, A.V.C. multi-stage outfits and the like are quite unnecessary. If they have to use batteries they actually spend more money, week by week, as their H.T. batteries run down and their expensive multi-electrode valves depreciate, than they need spend.

Economical In Upkeep.

The Unity Two would fulfil all their requirements and cost far less to build as well.

Such a receiver is also an ideal gift set for a home constructor to assemble and present to a relative or friend. It is not likely to go wrong and its upkeep is easy and most economical.

And, in any case, given a little experience and skill that are easy to acquire, it is surprising what can be done with a good "Two."

"P.W." has never adopted the policy of regarding a two-valver, or any set for that matter, as being of secondary importance. We believe there is still a definite niche for the "Two," and our "Twos" are therefore produced with as much care as any of our bigger designs.

Our standards are fixed and high. This Unity Two had to undergo exactly the same tests as those which are given to our "star" sets. And there are hundreds of "P.W." readers who have visited our laboratories to witness these and who can vouch for their thoroughness.

They, by the way, will be interested to learn that we have still further improved our set-testing apparatus. We believe it to be as perfect for its work as it is humanly possible to make it. With accurate meters we can exactly test the selectivity and sensitivity of a set under properly controlled conditions.

Thus the human element is eliminated. Actually, an aural test is no test at all except for general operating conditions. Even those with the most critical ears and retentive memories can be led astray by varying ether conditions, let alone by such incidents as colds in the head, which play havoc with one's powers of judgment in such matters.

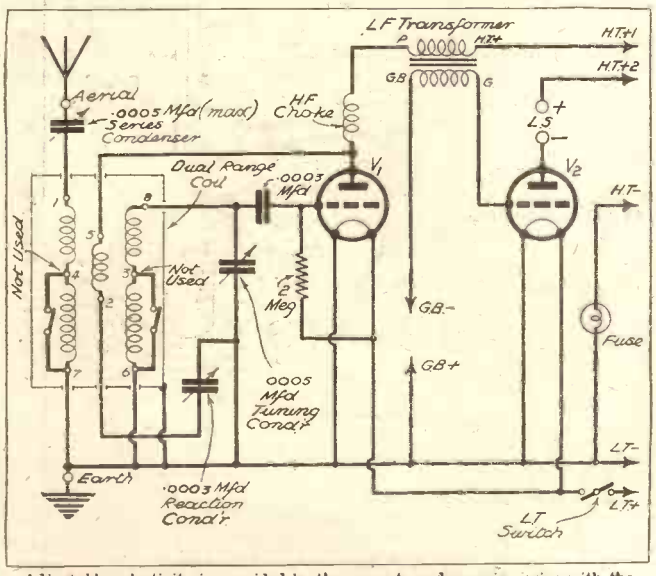
Gives Excellent Results.

When the human element does re-enter as a vital consideration it is in the user's operation of the set. It has then a direct bearing on the performance achieved.

Thus it is with the Unity Two. Those who acquire the knack of handling the quite normal reaction and tuning

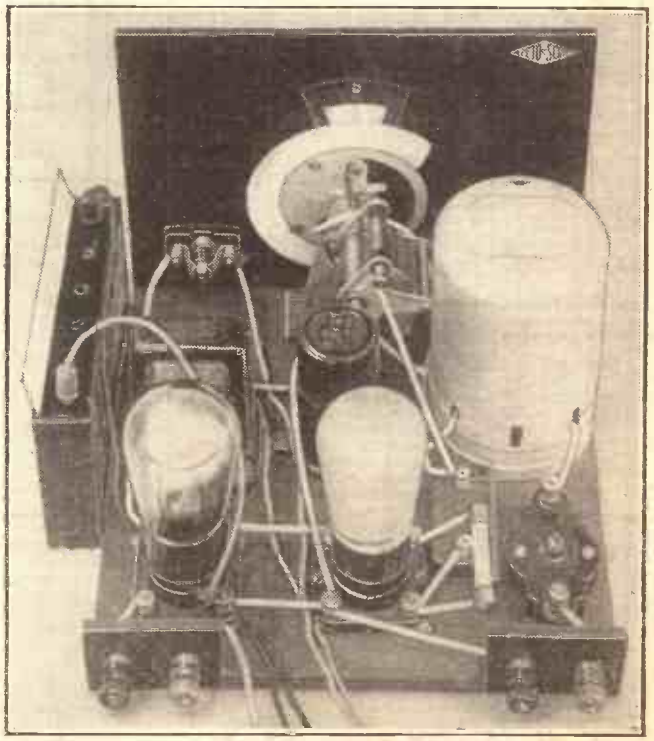
(*Continued on next page.*)

A SIMPLE BUT EFFECTIVE CIRCUIT



Adjustable selectivity is provided by the pre-set condenser in series with the aerial feed, while the aerial transformer carries the powers of selection of the set still further.

CONCENTRIC TUNING AND REACTION



The tuning and reaction controls are carried out by concentric knobs on the main condenser. The screened coil reduces the danger of direct pick-up of a local station by the tuned circuit of the receiver.

THE UNITY TWO

(Continued from previous page.)

adjustments will be able in moderately fair conditions to accomplish quite a deal with it.

On the other hand, the controls are so few and so straightforward that surprisingly effective results can be achieved by the complete tyro.

We handed our original model over to one such, and he experimented with it during an evening on a fair outdoor aerial situated eight or nine miles from London.

This inexperienced listener was delighted with the receiver and reported the reception of a dozen stations at adequate loudspeaker strength, and said he had no doubt that he could tune in more as his experience with it grew.

The circuit of the Unity Two is a detector functioning on the grid-current principle, followed by one stage of transformer-coupled L.F. amplification.

Concentric Operation.

The set earns its name because the reaction control is concentrically arranged on the tuning knob. This centralisation reduces the number of separate controls and makes for a very neat and symmetrical panel layout.

Also it enables tuning to be accomplished with one hand—if you want to—and you will find it quite easy to make the adjustments in this way. As the fingers alter the tuning the thumb is there gently to readjust the reaction for each new setting.

Variable selectivity is another feature of the Unity Two. This is carried out by means of a preset condenser mounted on the baseboard.

With this small component matching can be obtained for varying local conditions and for different aerials.

The parts are few in number and of an inexpensive character. It will, of course, be realised that there is not a great margin of magnification to play with. Therefore, the constructor will be well advised to select the parts with discrimination.

While "P.W." component lists do not necessarily always include every different make of component which is technically suitable (certain makes may have to be left out because of dimension limitations, etc.), they should at the same time be regarded as guides as to what not to buy as much as guides to definitely suitable

(Continued on next page.)

THE CORRECT VALVES

Make.	Detector.	Output.
Mullard	P.M.1H.L.	P.M.2A.
Cossor	210.H.F.	220P.A.
Mazda	H.L.2	P.220
Marconi	H.L.2	L.P.2
Osram	H.L.2	L.P.2
Hivac	H.210	P.220
Tungsram	H.210	P.220

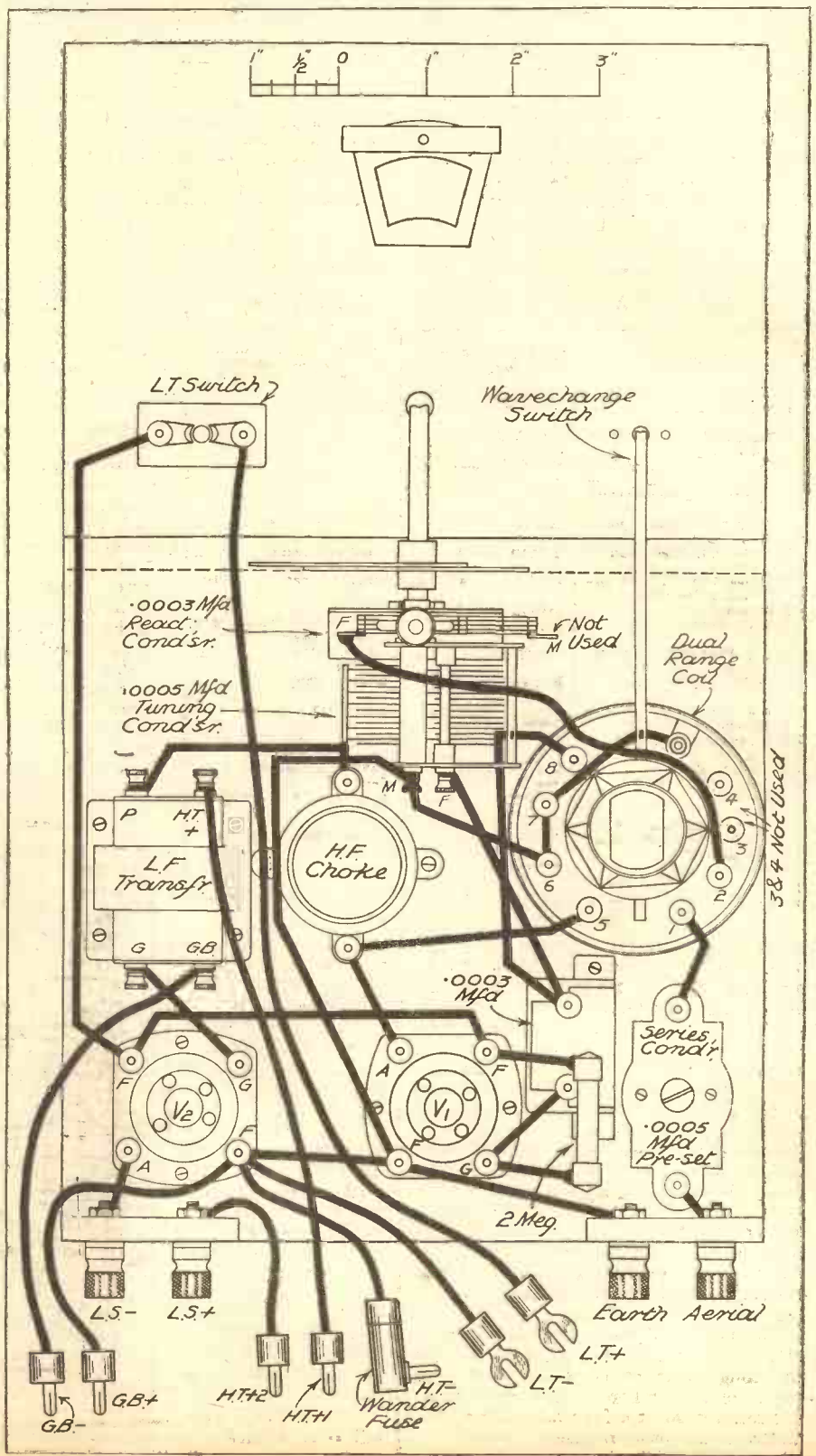
RECOMMENDED ACCESSORIES

LOUDSPEAKER.—W.B., R. & A., Blue Spot, Celestion, Marconiphone, H.M.V., Amplion, G.E.C., Atlas, Ferranti.

BATTERIES.—H.T. 120 volts,: Lissen, G.E.C., Ever Ready, Siemens, Marconiphone, Pertrix, Hellesens, Drydex, Ediswan, or Block H.T. accumulators.
G.B. 9 volts : Pertrix, Ediswan, Marconiphone, Lissen, Ever Ready, Siemens, Drydex, Hellesens.
L.T. 2 volts : Block, Lissen, Pertrix, G.E.C., Ediswan, Exide, Oldham.

AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," Radiophone "Receptru" downlead. Bulgin lightning switch, Graham Farish "Filt" earthing device.

EASILY MADE IN AN EVENING



This wiring diagram shows in an exceptionally clear manner the few connections that have to be made in the Unity Two. The reaction condenser unit is situated between the tuning condenser and the panel.

THE UNITY TWO

(*Continued from previous page.*)

parts. This is a very important point, and one which, in fact, is not always fully realised by constructors. They should regard the component list as an integral part of the specification of a set. Our component lists are not drawn up haphazardly, but are subject to very careful compilation.

For that reason we obviously cannot accept any responsibility for sets built with unspecified components.

Of special importance in this particular set, the Unity Two, are the coil, tuning condenser and L.F. transformer.

A panel diagram shows you how the panel components are mounted. The hole for the condenser aperture need not be cut out with extreme neatness, because the escutcheon will hide its edges.

Nevertheless, a certain amount of care is needed, or the ebonite may crack right across. Drilling is the best procedure for a job like this, and you have two alternatives. You can drill a lot of little holes round the marking or you can drill a fewer number of big holes. The first course takes longer, but makes a better job of it, and this is the one we strongly recommend.

Wiring Up the Parts.

A file can be used to clean up the edges. Get the holes for the wavechange switch correctly placed, or the easy functioning of the switch may be affected.

The baseboard parts almost lay themselves out. We cannot see how you can go wrong. And, to be quite candid, an eighth of an inch here or there won't upset the receiver, for it is far from being critical in that or any other respect.

But the wiring needs to be carried out with care. For this we advise a good insulated material. Those leads which connect to the coil must be well protected at the points where they pass through the "can." If you are at all doubtful about your wire here, then we urge you to slip small pieces of valve rubber, or something similar, over it to provide additional protection.

For the battery leads use rubber-covered flexible wire. The lengths of these leads will depend upon the position of the batteries. But keep them as short as you can. Remember that the longer the battery leads the greater chance there is in the distant future of short circuits between them through depreciating coverings.

Fix proper wander-plugs and terminals on these leads so that they can at all times be quickly identified and so that their connections to the batteries will prove good and reliable.

You will note that we include the fuse in the H.T. minus lead in the form of a wander-fuse. This is a fuse and wander-plug combined.

That point, the end of the H.T. lead nearer to the H.T. battery, is the best possible place for a fuse. We regard fuses as essential components of a wireless set, so don't think it is a refinement added at the last moment because it is in that position.

It only costs a trifle, but may save you a pound.

The valves are specified separately, and you will see you have a quite wide choice.

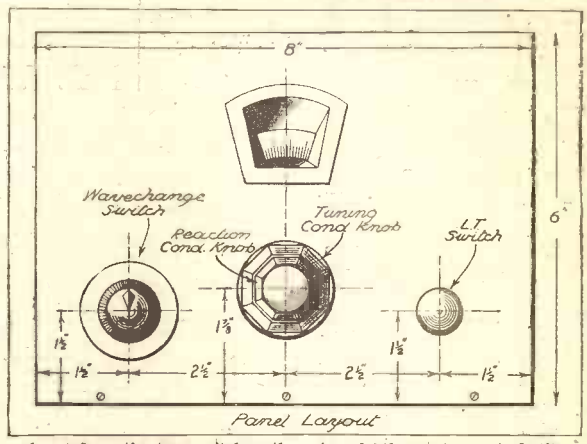
Give H.T. plus 2 the full H.T. voltage and about 60 volts to H.T. plus 1.

The grid bias will depend upon the power valve used, but for the types specified about 4½ volts will be wanted. A 9-volt G.B. battery will be quite large enough.

THE FEW COMPONENTS REQUIRED

Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.
1 Ebonite panel, 8 in. × 6 in. × ¼ in.	Peto-Scott	Goltone
1 Baseboard, 8 in. × 8 in. × ¾ in.	Peto-Scott	—
1 Combined ·0005-mfd. tuning condenser and ·0003-mfd. reaction condenser	British Radiogram, type 68	—
1 ·0005-mfd. max. preset condenser	Igranic	Telsen, Polar, Goltone
1 ·0003-mfd. fixed condenser	Graham Farish	Dubilier, Telsen, T.C.C., Lissen
1 2-meg. grid leak with wire ends or terminals	Dubilier, 1-watt type	Graham Farish, Telsen, Igranic, Lissen
1 Screened coil	Telsen, No. 216	—
1 H.F. choke	British General	R.I., Graham Farish, Telsen, Lissen, Varley
1 L.T. Push-Pull "on-off" switch	Ready Radio	Lissen, Graham Farish, W.B.
2 4-pin valve holders	Benjamin "Vibrolders"	W.B., Lissen, Telsen
1 L.F. transformer	Lissen "Hypernik"	R.I., Igranic, Varley
1 Wander-fuse	Belling-Lee	—
2 Terminal strips, 2 in. × 1½ in.	Peto-Scott.	—
4 Wander-plugs	Clix	Belling-Lee, Goltone
2 Accumulator tags	Eelex	Belling-Lee, Clix
4 Terminals	Goltone	Bulgin, Igranic, Belling-Lee
1 Yard of insulated sleeving	Wearite	Goltone
1½ Yards of 18-gauge tinned copper wire	Goltone	Lewcos, Peto-Scott
Flex, screws, etc.	Peto-Scott	—

A DUAL-PURPOSE CONTROL



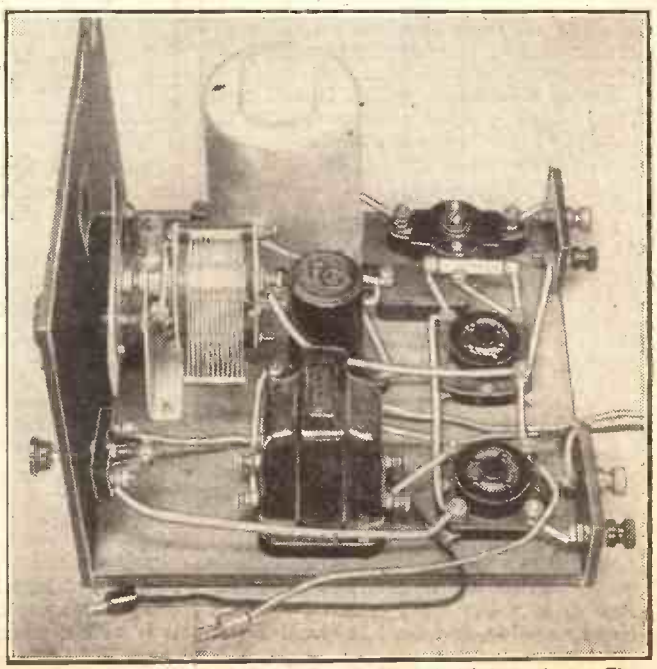
Apart from the two switches, there is only the centre control, the larger knob of which adjusts the tuning, while the smaller one "looks after" reaction.

While the detector H.T. adjustment is not critical it is worth while to try varying it a little. On this H.T.1 depends the sensitivity and smooth reaction of the set to some extent.

In certain cases you may find it advisable to go up to 90 or so volts, and in others to drop as low as 45. But if you find that such variations do not appear to make much difference to the results, plug in at 60 and leave it at that.

The power valve is not subject to H.T. adjustments of this nature. It requires the full H.T. voltage available within the limits of the recommended battery "sizes," and the grid bias is fixed correspondingly.

SIMPLICITY OF CONSTRUCTION



The main feature of the construction is its sheer straightforwardness. The two wander-plugs in the foreground plug into the grid-bias battery, which is accommodated on the side of the cabinet.

All the interesting news and views of current short-wave practice.

THE postbag shows signs of inflation, and I had better try this week to deal with some of the outstanding letters. First of all, I am asked by the Vice-President of the Anglo-American Radio and Television Society to say that a special offer of free membership is being made from now until January, 1934.

The aims of the society are "to aid DX enthusiasts, to give expert advice and to promote goodwill between nations." All amateurs who are interested are asked to write to Mr. H. B. Shields, 39, Hardman Lane, Failsworth, Lancs.

One Valver for Long Distance.

Next comes an epistle from "F. J. F." (Raynes Park), who used to be a frequent correspondent of mine. It is headed: "It's a long letter, but have patience—you may find something interesting. Stick it!"

Having duly "stuck it," I quote the following points: First, but for my persistent hammering away in these columns about single-valve sets, "F. J. F." would never have thought of developing such a set for long-distance short-wave work.

Second, "something very special" that he is evolving in the way of a one-valver employs refinements which are mostly of a constructional nature rather than circuit freaks. This just bears out my point that it does pay to look after the little details rather than try to be brainy.

Thirdly, he advocates aerial coupling of the "tapped-down" variety, with a *fixed* condenser in series with the aerial. This makes accurate calibration possible. Variable coupling is arranged by tapping on to different turns, but, as "F. J. F." says, each turn is a known quantity as regards selectivity and sensitivity.

The layout used is very sound, with the grid-coil holder as close as possible to the tuning condenser and the valve holder as close as possible to both of them. This doesn't invariably mean that the coil itself is close to the condenser—the holder is tilted so that the coil slants away from the front panel.

The fact that the circuit will oscillate easily with a one-turn grid coil shows that there isn't much wrong with it. Results speak for themselves.

There you are, "F. J. F." I've earned the congratulations that you tender to me at the end for wading through it all. I hope others will profit by your suggestions and drink in my very-much-abridged version.

AN AMBITIOUS AMATEUR OUTFIT

This ambitious-looking amateur transmitter is designed for C.W. or telephony operation. The unit on the left contains the crystal controlled oscillator and power amplifier stage, while the modulating equipment is in the other unit. The transmitter is conservatively rated at 10 watts, but if necessary it is capable of handling as much as 20 watts with about 80 per cent modulation.

Sydney Seven Sundays Running.

"J. B. M." (Glasgow) reports reception of V K 2 M E, Sydney, for seven consecutive Sundays now, on the "H.A.C." Three-Valver. He also mentions a new Brazilian station between P R D A and Geneva. The former, by the way, is run by the Radio Club of Brazil on 35 or 36 metres and should not be confused with the better known P R B A on 31·58 metres.

"W. L." (Teddington), on the subject of the R.A.F. stations on 73·5 metres, points out that they make quite good hunting, as some of the stations are in Iraq, India and China.

Finally, a Happy Short-wave Christmas to you all!

A GOOD FINISH FOR OAK CABINETS

Some practical hints on polishing.

By S. HOLMES.

MANY amateurs make their own cabinets these days, both for economy's sake and for the fact that they can build them to their own particular requirements. But when it comes to the staining and polishing they are often at a loss as to what method to employ to get that "professional" finish to the work.

French polishing, when all is said and done, is not a job for the amateur. It takes years of practice and requires a great deal of patience to get anything like a glassy—or should I say "classy"?—finish to an article like a radio cabinet.

Here is a method which, although it is cheap and remarkably simple to carry out, gives a finish which is quite equal to french polishing. We will assume that the work has been thoroughly smoothed up with glasspaper, etc., and all screw-heads filled up with plastic wood, so that everything is ready for the grain to be "filled."

Easy and Inexpensive.

Go to your chemist and get twopennyworth of plaster of paris—ask for "dental quality"—and a gill of best turps. Mix these two together until you get it to the consistency of a thick cream.

Now take a piece of clean rag and dip it in the solution and apply it to the work. Rub it into the wood smartly, using a circular motion, and don't be afraid to put plenty on.

When you have covered the whole of the work and rubbed it well in, put it aside for about twelve hours to dry. When it is dry it will look as if it has been whitewashed. But don't let this worry you; get some very fine glasspaper and rub as much of the cement off as you can, taking great care to get it out of the corners.

No matter how long you rub, you will not get it back to its original colour. But this does not matter; as long as you get it very smooth everything will be O.K. By the way, don't be tempted to use anything but very fine glasspaper for this, even if it takes longer. Coarse glasspaper will only scratch the wood and will spell ruin to your efforts. Finish off by dusting down with a soft, dry brush, and you are ready for the staining.

This consists of Brunswick black (which can be obtained from any ironmonger's) diluted with turps. The best way to apply it is with a piece of clean linen, and you may get the desired shade, either dark, light or medium, by the simple means of wiping down with a rag just moistened with turps.

The great advantage of this stain is that, no matter how you put it on, it does not smudge or look patchy. If a smudge appears in any place, just give it a rub with the rag and it will tone up with the rest of the work.

If you require a very dark finish it will need two coats of the stain, but you must allow the first to dry before applying the second. This will take only two or three hours, after which the work should be rubbed down again with fine glasspaper which has been used—again taking great care not to leave any scratches.

The Final Touches.

You are now ready to apply the finishing process.

For this you will require four ounces of white hard-spirit varnish. You will get this from any paint stores for sixpence, but be sure you get what you ask for. Ordinary clear varnish is useless for this job.

Pour some into an old teacup and stand it in a dish of hot water. After a minute or two it will be ready to put on, and it should be done with a flat brush, camel-hair for preference. Be careful not to go over the same place twice, and lay the varnish on in *one* direction only. As you put it on you will see the grain coming out like magic in all its rich colouring.

The varnish will dry quite hard in about four hours and leave a surface just like glass. Once you have used this method you will never use any other.

The SPIRIT OF CHRISTMAS IN BROADCASTING

By the VISCOUNTESS SNOWDEN J.P.

You have already been told something of the B.B.C.'s plans for the Christmas programmes and have probably made up your minds whether or not they constitute your ideal Christmas entertainment. Lady Snowden, past governor of the B.B.C., here suggests how the Yuletide programmes should be arranged.

WITH the approach of Christmas we all look forward with eagerness to the time of good fellowship which it brings, than which there is nothing lovelier in the earth. This is the Christmas spirit, the spirit of goodwill towards men.

Long ago the craftsman-poet, William Morris, said: "Fellowship is life; the lack of fellowship is death," and how right he was few there are who do not realise. Of all those conditions of mind which have meant misery in the hearts of men and women, so great sometimes that they have been tempted to destroy their lives, none is sadder nor more potent than the dreadful feeling of loneliness which at times besets us all.

Nobody should be utterly alone at any time, feeling that he has not a friend in the world and that nobody cares whether he lives or dies; but at Christmas-time it would be a positive crime if a single living soul should feel the lack of a friendly hand, a joyful greeting and the good cheer which "maketh the heart glad."

PLENTY OF GOOD CHEER

"The young people would dance to the brightest, jolliest dance tunes . . ." Here is Henry Hall's famous singing trio.

Gloom is Forbidden.

This is a Christian community, and for the Christian, to whom the coming of salvation in the form of a Little Child means so much, gloom is forbidden. To him above all others comes the command to copy the example of the wise men and the simple shepherds and give of his wealth or his poverty to help spread abroad the spirit of the Christmas festival.

The first-fruits of the spirit are love and joy, according to the Scriptures, and these twin emotions joined in the hearts of men and women should make of Christmas the unforgettable time of the year for all.

What can broadcasting do towards this end? It is possible through this latest of great scientific discoveries to reach the ears of all men simultaneously. We have never fully appreciated the wonder of this. We still take things for granted and think the age of miracles is dead; but it is not so.

Australia and India, China and South America, Japan and New Zealand, the two Poles and the Equator are as near as the next room when we listen to well-known voices speaking to us from these distant places as we relax comfortably in our fire-side chairs. The well-known Americanism, "I'll tell the world," becomes a casual daily act to the ministers of broadcasting in every land.

The Spread of Peace.

What contribution towards the spread of the Christmas spirit of peace and goodwill will our own B.B.C. make during the coming Christmas?

I confidently believe that its ministry will be of the best, and that it will do what it has always done—make every listener the happier for having heard its Christmas programmes. In my humble opinion, nothing that is broadcast throughout the year excels in interest the truly magnificent way in which all connected with the B.B.C. have invoked the Christmas spirit and sent it on its selfless mission to the six million homes which it can enter in this way.

I have not heard much about the coming Christmas programmes, but we all know that the King is again to broadcast a message to his people throughout the Empire. I am glad that this is to be, for the memory of last year's moving and impressive speech, when His Majesty, with a slight catch in his voice which everybody understood and felt, spoke to the four hundred and fifty millions of his subjects convoked for this great and unique audience.

But beyond this much-looked-for occasion, what should I like to hear this Christmas if I could choose part of the programme?

Hanging up the Stockings.

On Christmas Eve families unite to celebrate Christmas together. In merry company they enjoy Christmas fires and Christmas fare, Christmas carols and Christmas tales. The old custom of hanging up the stocking for Santa Claus is not quite dead, and in some parts of the country still the merry waits are heard piping their tunes and striking their triangles as they march from house to house, wishing everybody a Merry Christmas in anticipation of a handsome gift. It would hardly seem that broadcasting would have much chance on Christmas Eve.

But there are those whose friends are far away or dead, who look to the microphone for their joy, and with these lonely souls I could enjoy an evening of good music or of variety entertainment, whichever they prefer. In both cases I should want the very best artistes that could be obtained.

I should like my variety artistes to be witty without coarseness and bright without childishness, and there are plenty

(Continued on next page.)

BROADCAST TO THE WORLD

Troops bound for the East include a portable set among their Christmas parcels so that they can hear the King's Empire speech on December 25th.

HAVE YOU TRIED THESE?

After long experience in the production of valves for commercial receivers, a well-known set manufacturer has placed a full range of valves on the market for the benefit of the home constructor.

THOSE well-known and deservedly popular Lancashire electrical and radio engineers, Ferranti, Ltd., have for so long been noted for their transformers and their excellent range of complete radio receivers that one is apt to forget that not only do they make valves, but that those valves are available on the open market.

Some little time ago, when the Ferranti superhets were being designed, it was decided that they would make special valves for the sets they intended to market, rather than design the sets to suit existing valves.

The result was that a valve-making plant was installed, and the Ferranti valves (mains types) came into being. Such a step necessitated a further one—the placing of the valves on the market for replacement purposes—and from that it was an easy and natural further step to make the valves available to all and sundry, whether or not the purchaser was the possessor of a Ferranti receiver.

Seven Mains Types.

Thus to-day we have a range of seven Ferranti mains valves and a battery Class B valve from which to choose when we are building a new set or replacing any of the valves in an existing design.

The seven mains valves cover the chief requirements of the up-to-date mains receiver in excellent fashion, at prices that are in line with the standard B.V.M.A. rating, and including the first British heptode for superhet receivers.

Let us take this valve first. Nominated the V.H.T.4, it is of the usual 4-volt 1 amp. indirectly-heated variety, and is designed for use as a combined oscillator and first detector. The oscillator and detector portions in this valve operate separately, maintaining an excellent constancy of oscillation throughout the frequency range of the set.

In addition, the V.H.T.4 is of the multi-mu variety, allowing automatic volume control to be carried out with the greatest ease. The price is £1.

For Manual Control.

Next we come to the multi-mu screen H.F. pentode—V.P.T.4—which has a mutual conductance at zero grid bias of 2·6 ma./V. Normally, it is best to operate this valve with a grid-bias minimum of about —3 volts, when the mutual conductance is about 2·0 and the anode and screen currents (at 200 and 100 volts H.T. respectively) are 5·5 and 2·0 m/a.

The price is 17s. 6d., and the valve is excellent as H.F. or I.F. amplifier in straight or superhet receivers. It can, of course, be manually controlled or used in an A.V.C. circuit.

There are two detector valves in the Ferranti list—the normal triode, D.4, and the double-diode triode, H.4D. The former is a standard 13s. 6d. valve, with an impedance of 12,500 ohms and a slope of 3·3, while the H.4D. is the usual double-diode rectifier, with the incorporated triode section, being intended for A.V.C. receivers.

In this valve the triode section has an impedance of about 14,500 ohms and a mutual conductance of 2·7 ma./V. It costs 15s. 6d.

On the L.F. side there is only one mains valve—the L.P.4, the original P.4 having been withdrawn and superseded by this later type.

One Battery Valve.

It is a directly-heated valve, with a 4-volt 1-amp. filament and a low impedance of 870 ohms. The amplification factor is 4·7, so that the mutual conductance is commendably high, being 5·4 ma./V. With 250 volts on the anode the L.P.4 dissipates about 12 watts, so that its undistorted output is of the order of 2,000–2,500 milliwatts. The maximum anode current is about 48 milliamps and the grid bias about 37 volts. For automatic bias the cathode-circuit resistance should be 750 ohms. The price is 16s. 6d.

We now come to the two rectifiers, R.4 and R.4A. Both are of the full-wave type and have standard outputs. R.4 provides 120 m/a. at 350 volts, while R.4A is designed for 120 m/a. at 500 volts. They both take 2·5 amp. filament current at 4 volts, and cost 15s. and 20s. respectively.

The one Ferranti battery valve is the Class B type, H.P.2. It is of the zero bias type, and is designed to be operated by a driver valve of the order of the Cossor 215P. The quiescent anode current of the H.P.2 is 3 milliamps, while the maximum peak is 50 milliamps, providing a wide power range of output. The price is the standard one of 14s. for this type of valve.

K. D. R.

THE SPIRIT OF CHRISTMAS IN BROADCASTING

(Continued from previous page.)

of these to be heard. It would give me real pleasure if some of the old-fashioned songs could be included, say "The Lost Chord," "Grandfather's Clock," "Wait for the Wagon," etc.; I should like to meet the Buggins family again and hear how they are spending Christmas, and if Dickens' "Christmas Carol" could be read perfectly it would be delightful to have it in the programme.

Limpid Loveliness of Mozart.

After the fun of the concert and the news I should like some very good instrumental music, preferably a string quartet of first quality—there are several—and my mood would be responsive, I know, to the limpid loveliness of Mozart and the triumphant faith of Beethoven; I should then be more than willing that the rest of the evening should be given up to the young people, who would dance to the brightest, jolliest dance tunes that the B.B.C. Dance Band knows.

I will not affect to judge of the best place in the Christmas Day programme for the things I should like, but I could wish that a sermon by the Rev. W. H. Elliott might be included. I shall never forget the moving address he gave some years ago, simple, searching and sincere. Another such address would be a benediction.

I should also like to hear a first-rate performance of the "Messiah." I suppose it would be too much to ask for Bach's "Christmas Oratorio" in addition, even if I were willing to wait till Boxing Day. The National Chorus would find the strain too great; but perhaps the Royal Choral Society might be asked to share the work and give us one or the other of these two great works.

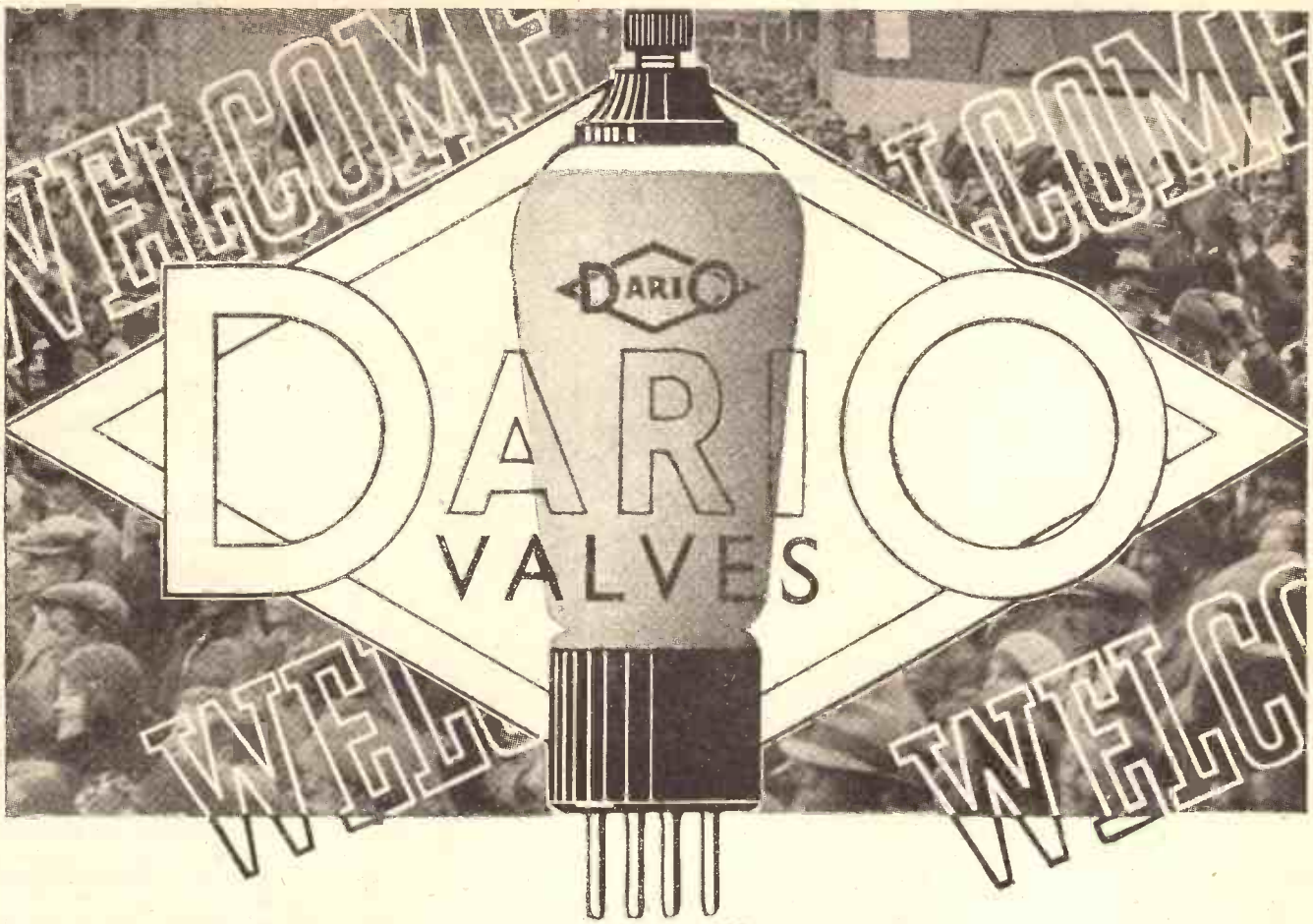
A Carol Concert.

Mr. Roger Eckersley will think me demented if he sees these lines, but in addition to the "Messiah" and the "Christmas Oratorio" I should like to hear Rutland Boughton's "Bethlehem."

Of course, there should be at least one excellent carol concert, and how splendid it would be if Sir Hugh Roberton's fine choir could be asked to show us how carols should be sung! I presume carols will be sung at the Sunday services, and in these we can join. I hope the carols will be both old and new, English and foreign.

IN THE FAR EAST

To remote India the B.B.C. short-wave transmitter carries programmes and messages of goodwill from the heart of the Empire.



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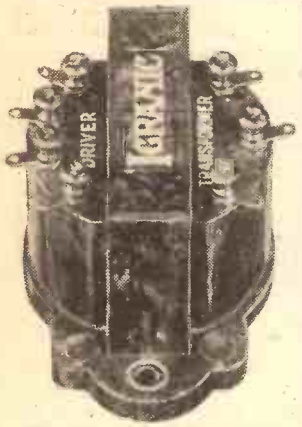
THE IGRANIC CLASS B TRANSFORMER

One of the newest additions to the Class B apparatus now available is the Igranic Driver Transformer. It is a compact component neatly enclosed in an artistically mottled bakelite casing.

Two ratios are available on it, and these are 1 : 1 and 1·5 : 1. The majority of Class B valve coupling requirements can be fulfilled by one or other of these. Which reminds me; this ratio business apparently upsets quite a number of constructors.

Used to the normal one to 3 and 4 step-up L.F. transformers, they apparently believe that little or no amplification is given by a stage of Class B, and that, therefore, a Class B set must necessarily give less volume than another set of a similar number of valves with Class A output.



The Igranic Driver Transformer for Class B operation is provided with two ratios.

But what they probably forget is that a Class B valve comprises (in the one bulb) the elements of two high-magnification valves. Not that this means double the amplification of one high magnification valve!

That's not the point. Look upon that Class B valve as one valve (albeit a special type of same), but one which provides high-magnification as compared with the relatively low magnification of most ordinary power valves.

In practice I reckon that a Class B Four, consisting of an S.G., Det., Driver, Class B, provides about the same overall volume as a similar four having resistance capacity-ordinary power for its last two stages. This, of course, is only a rough comparison, but it will give you some idea of what to expect and what not to expect.

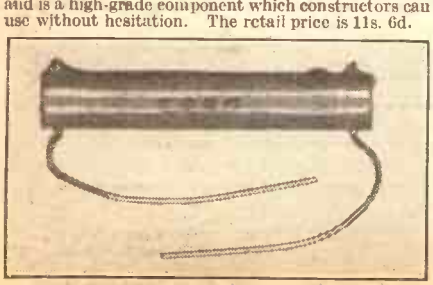
If you think a four-valver with two transformer-coupled L.F. stages would give greater volume, you would be right up to a point. But such a combination can seldom be worked full out without terrible distortion resulting. So it is that "two L.F. trans." sets are often terrible to listen to, and are always held down drastically, and are frequently instable in almost any condition!

If valves really suited to the combination are used the H.T. consumption will be great.

With Class B you can go "all out," obtain a magnificent volume and keep within reasonable limits of overall H.T. expenditure.

But to achieve first-class quality as well you must above all use good components. The driver transformer particularly is a vital item. A suitable ratio is a matter only of correctly disposed windings.

The windings themselves must, in the case of the secondary, be of low resistance, and the primary should possess good inductance. The Igranic driver transformer has these qualities in ample measures, and is a high-grade component which constructors can use without hesitation. The retail price is 11s. 6d.



This Watmel Resistance cost 1s. for values between 50,000 ohms and 1 ohm.

A WATMEL RESISTANCE

Just as much advance and care in design is to be found among the smaller components as in the larger pieces of radio apparatus.

As an instance of this we have the new Watmel "Hy-Watt" resistance, which appeals to me as being of unusually sound, scientific construction.

In the first place it is wound on a good-class porcelain material, and the resistance wire is welded to the connecting leads at each end. Therefore heat and corrosion cannot cause bad contacts to occur as sometimes happens, especially in composition types of resistances.

I recently examined one of these latter which had actually risen from its specified 10,000 ohms to over 1 megohm through some such cause!

The Watmel "Hy-Watt" is also coated with a special enamel and is baked at high temperature, so that it is quite moisture-proof and attains a high degree of consistency and reliability in operation.

It is rated at 3 watts, but can, as I have proved to my own satisfaction, stand a 600 per cent overload without breaking down.

And yet in all values from 1 ohm to 50,000 ohms it costs but 1s.

THE UNIVERSE PICK-UP

ONE of the things which puzzle me is why beginnings are usually so crude. Beginnings of everything, I mean. Take the early motor-car as an example. Was it necessary that it should be a gawky, graceless vehicle with its beveiled occupants sitting high up in a completely exposed position? Very luxurious and refined coachwork was not unknown to the Victorian.

And, in radio, think of some of the early examples of condenser and coil work. Makes one wonder whether the right people were manufacturing these objects, and whether they learnt general engineering as they learnt how to turn out better wireless apparatus, doesn't it?

Or those first gramophone pick-ups: even some of those selling at three and four guineas. Adapted telephone earpieces!

This vein of thought has been started by the Universe Pick-up, samples of which I recently had sent me by the makers, Cosmocord, Ltd., of Enfield, Middlesex.

Not that this pick-up is representative of the crude beginning of this class of article. On the contrary it represents the very latest technique, and so forms a vivid contrast to the early crudities. Particularly in that the bulk of its construction is in clean, strong bakelite mouldings. And the standard model costs only 20s.

It is one of the most adaptable pick-ups I have encountered, and I have much bitter personal experience of trying to fix awkwardly shaped and sized pick-ups on motor-boards of restricted dimensions.

But the "Universe" is shortish, and, moreover, merely by adjusting a grub-screw its base can be used in any position. An important feature, that, for what is the good of the best pick-up in the world if you can't squeeze it into a favourite radiogram cabinet?

And the head is off-set for good tracking. A volume control is built into the base.

Reverting to the head (the pick-up proper in which the needle is inserted), this swivels conveniently, with the assistance of a special ball catch, for easy needle changing, and an ingenious rubber-faced rest is provided.

The pick-up is very sensitive and its output is ample for two valves. Probably owing to the negligible metal used in its structure there appears to be less direct vibration than normally; and another good feature of its response is that a compensating characteristic has not been introduced with the often attendant drawback of noticeable and objectionable peaks.

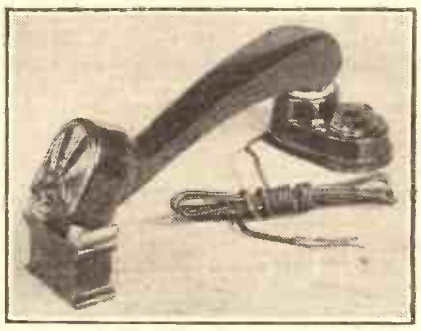
As a matter of fact, I consider this Universe pick-up to be quite exceptional in its performance.

There is a Super Model at 22s. 6d. which is adjustable as regards needle pressure by means of a compensating balance on the arm.

I have also tested a Universe Potentiometer which retails at 3s. 6d. (or 5s. 6d. with switch capable of handling mains current up to 3 amps.).

This is of the wire-wound type, and is available in 5,000, 10,000, 20,000 and 50,000 ohms.

It is a good component, smooth in adjustment and noiseless. I can recommend it to constructors.



Cosmocord, Ltd., of Enfield, are manufacturers of the new Universe Pick-up.

Weekly jottings of interest to buyers.

IN the hope that your Christmas shopping lists are not yet complete, here is a last-minute suggestion which will inevitably make a very wide appeal. It is one of those things which has a touch of genius about its conception, and why on earth nobody has ever thought about it before is just one of those questions that cannot be answered. Trust W.B. to be original!

There must be, literally, millions of commercial sets in use to-day, and in a great majority provision is made by means of terminals or sockets for external loudspeaker connection.

An excellent idea, but not one that is entirely without difficulties.

For best results it is desirable for the impedance of any external speaker to be matched up to the impedance of the output valve in the set with which it is used. If there was absolute commercial receiver standardisation in this respect it would be an easy matter for the speaker manufacturers, but unfortunately there isn't.

Solving the Matching Problem.

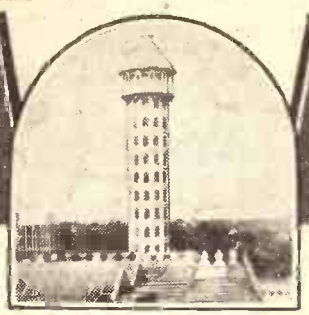
Then there is another point. In general it is rarely possible to obtain a speaker for external use with exactly the same sensitivity as the one incorporated in the set. That means to say that if you want level volume at the other end of the speaker extension leads you must adjust the set volume control every time you make a change from one room to another.

It has been left to W.B. to find a way out. With the introduction of their entirely new "Equilode" speaker—the first of its kind, I believe, to appear—the problem of extension speakers is virtually solved.

The W.B. "Equilode" speaker—intended solely for "extension" use—is provided with a switch enabling it to be

(*Continued on page* 690.)

The CRYSTAL PALACE TELEVISION TESTS



Following the lead of "Popular Wireless," it is interesting to note that the Baird Company has decided to use the Crystal Palace for future television tests. Below are details of the experimental transmissions now being radiated from the famous building, and advice on suitable receiver designs.

By F. BRIGGS.

IT is probably old news to readers that the Baird Company has arranged for a series of ultra-short-wave television tests from the Crystal Palace, but it will probably surprise them to hear that transmissions are already being radiated. They are being sent out on about 6 metres from one of the towers.

Readers will remember that it was the POPULAR WIRELESS 5-metre tests from the North Tower of the Crystal Palace, when a distance of some 200 miles was covered, that showed for the first time the possibilities of ultra-short-waves working from a well-chosen vantage point. And the Baird Company was certainly not slow to realise the value of the Crystal Palace Towers for the television transmissions and to follow in the steps of "P.W." and the intrepid G 6 Q B, by installing an ultra-short-wave transmitter there.

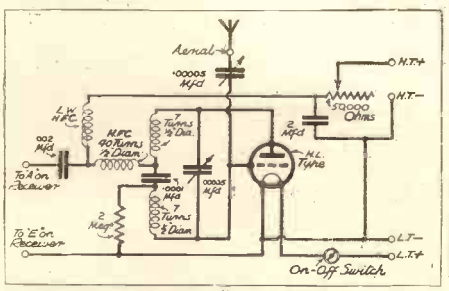
An Ideal Site.

The Crystal Palace is ideal for the purpose, as it is situated on the top of a hill, a splendid view being obtained for many miles in all directions. In an accompanying photograph you see one of the towers from which tests have been sent out.

The aerial used for the tests is quite small, being no more than ten feet long. It is suspended over the balcony in a vertical position on the north side of the tower. When it is realised that the height of the towers is about two hundred feet the true significance of the suitability of the site for ultra-short-wave working will be appreciated.

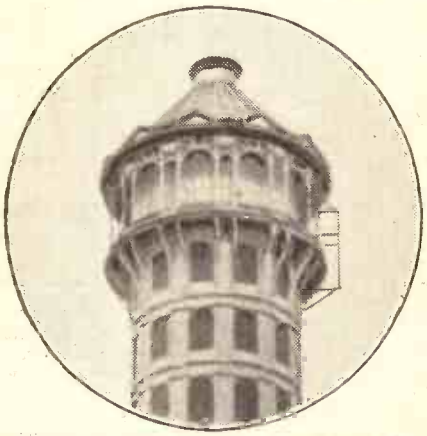
At the moment comparatively low power is being used, but it is hoped to increase this to several hundred watts shortly. The first pictures were only of the 30-line variety, but the detail will probably be gradually increased until 180-line pictures are achieved. If you have a 5-metre receiver you should not have the slightest difficulty in receiving the transmissions almost anywhere within a radius of twenty or thirty miles of London.

A SIX-METRE "SUPER"



Here is a suggested circuit for a superhet adaptor covering the 5 to 7-metre waveband. It is suitable for attaching to an ordinary S.G broadcast receiver.

THE AERIAL SYSTEM



The ultra-short-wave aerial system on the south tower can be seen very plainly from the ground. As you will observe from the above photograph, it is of the vertical type, and quite short.

In the St. Albans district the strength is particularly good, adequate headphone strength being obtained on an ordinary two-valve super-regenerative receiver. You will find the Baird transmissions near the upper tuning limit of your receiver, some way out of the top of the amateur band.

If you are able to receive these transmissions it should form an excellent opportunity for you to get the best out of your 5-metre receiver. Tuning is considerably sharper than the normal 5-metre amateur transmission, due, no doubt, to the fact that a properly stabilised transmitter is being used, instead of the more usual unsteady self-oscillator arrangement.

An Excellent Opportunity.

In the past ultra-short-wave enthusiasts have been more or less tied to the super-regenerative receiver because of these unstable amateur transmitters, which previously have been about the only transmissions available. The "Super" type of receiver is the only type capable of receiving such broadly tuned transmissions, spreading over, perhaps, several hundred kilocycles.

Now that the Baird Company has definitely started, there is an excellent opportunity for both television and ultra-short-wave enthusiasts alike to develop a really efficient 5–7-metre superhet. With the stabilised transmissions available half the problems are already solved.

Some type of ultra-short-wave converter seems to be the most promising line of investigation at the moment. A good line of experiment for those already possessing a super-regenerative receiver would be to turn it into an autodyne arrangement—not forgetting to remove the "super-regen" valve—and using an existing broadcast receiver for the rest of the system.

It would have to have at least one S.G. stage, and this would then become the intermediate frequency amplifier, being tuned to somewhere about 1,000 metres. Then would follow the second detector and L.F. stages.

Superhet Converter.

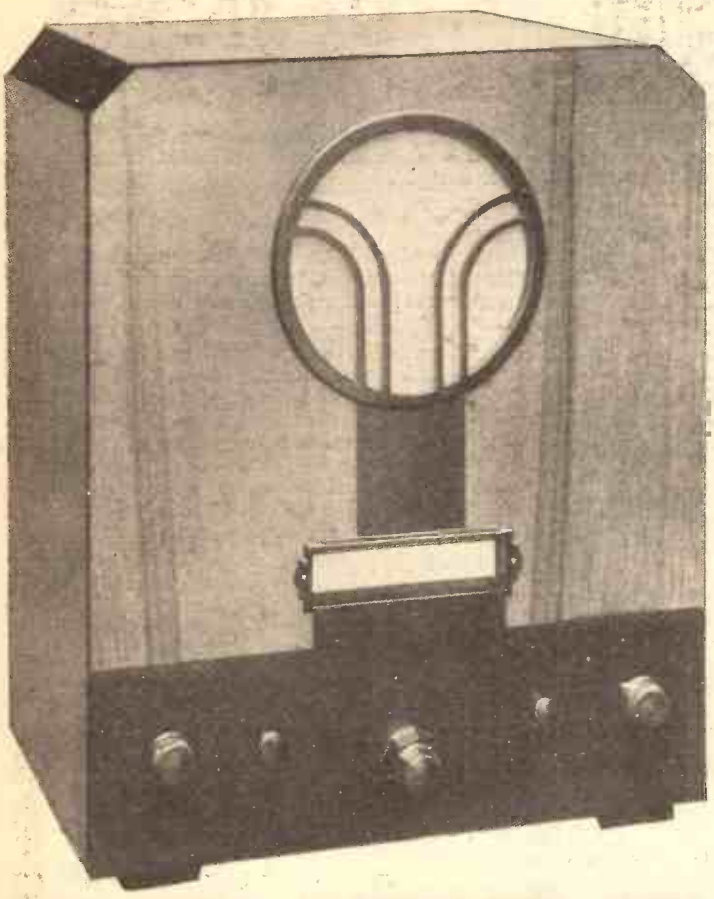
A suitable circuit for a special converter unit is shown on this page, and its similarity to a super-regenerative receiver, with the "super" valve missing, will be noted. The beat frequency, corresponding to something around 1,000 metres, is drawn off via the ·002-mfd condenser which leads to the aerial terminal of the broadcast receiver.

The performance of such an arrangement is very much an unknown quantity. So little is really understood regarding the very high frequencies that a certain amount of experimental work must be undertaken before any *definite* statements can be made.

These regular stabilised transmissions, however, should do a great deal to assist in the opening up of the ultra-short waves, and now that there is something to work on it is up to all experimenters, both shortwave and television, to see what can be done in the way of suitable receivers.

Mr. L. H. Thomas (G 6 Q B), who was in charge of the original 5-metre tests from the Crystal Palace last May, when "Popular Wireless" demonstrated for the first time the immense possibilities of ultra-short-wave broadcasts from its towers.

E.M. PLUS 4



Great New Development on the famous "EVERYMAN FOUR"

You remember the "Everyman Four"? Its amazing performance was obtained by using the most efficient coils that could be designed. Until now these coils have never been excelled or even equalled.

We set ourselves the task of adapting "Everyman" Coils to suit modern valves, and we succeeded. We claim, without fear of contradiction, that E.M. Plus Four Coils are the most efficient coils obtainable for modern H.F. amplification.

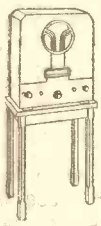
E.M. Plus Four Coils cost eight times as much to manufacture as any standard commercial coils. But, owing to their remarkable efficiency, the remainder of the set is simplified and the total cost is extremely low.

BETTER THAN A SUPER-HET

Compare the E.M. Plus Four with any other battery-operated straight set or super-het, using four, five, or even six valves. The E.M. Plus Four gives superior results without any of the usual super-het disadvantages.

Every valve contributes its full efficiency, so that signal strength is amazing whilst absence of complications prevent loss of quality.

Ease of handling, selectivity, signal strength, quality of reproduction, appearance, reliability—judge the E.M. Plus Four by any of these standards; compare it with any other set costing even twice as much, and you will choose the E.M. Plus Four.



Although the E.M. Plus Four is easy to build and operate, it is the only set that fully responds to the skill of the operator. The E.M. Plus Four is not only a set for domestic use; it is the set which every true constructor needs for serious work. Its scope is unlimited.

COILS OBTAINABLE SEPARATELY

For the benefit of constructors wishing to modernize their present sets, E.M. Plus Four Coils can be supplied separately at 27/6 per pair.

E.M. PLUS 4 MATCHED KITS

(Complete kit, less valves, including everything you need to build the E.M. Plus Four exactly to Specification, with full-sized chart and instructions).

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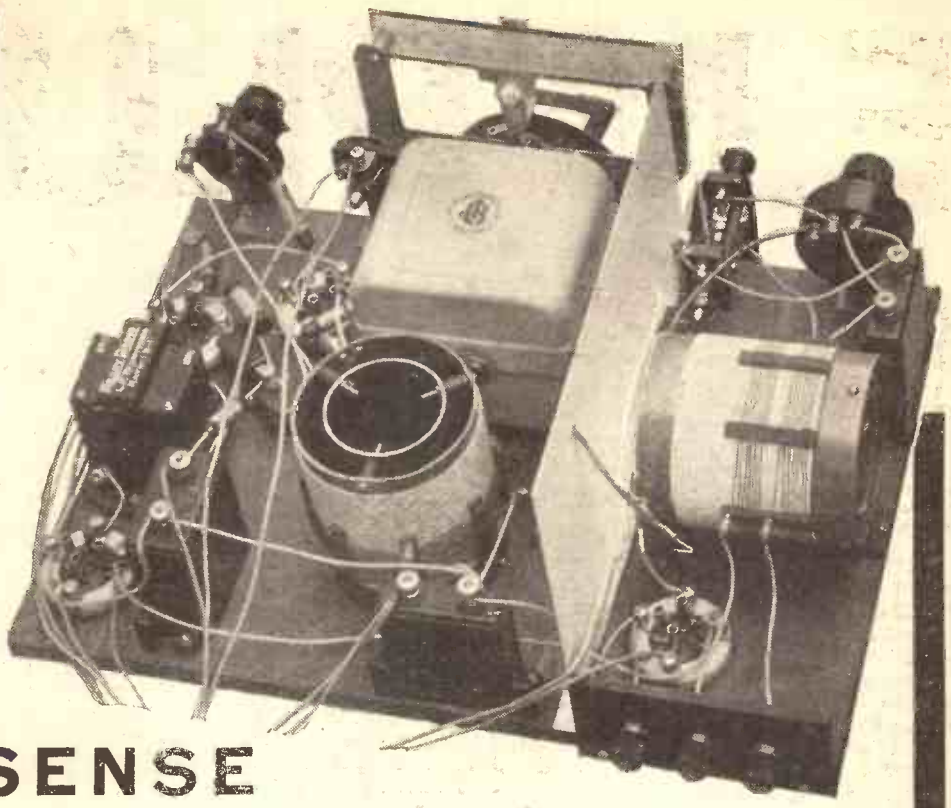
KIT

A serious contribution to radio Progress



SHEER COMMONSENSE

1. The length of a coil should not be greater than the diameter.

2. Small coils mean small single-strand wire and increased D.C. resistance and "skin effect."

3. Increased resistance means lower signal strength and selectivity.

4. Shields increase the distributed capacity and resistance.

5. Losses in metallic cores increase as frequency increases. (Therefore, heaviest on medium-wave band.)

6. Band-pass tuners do not pass all the applied voltage, and losses are often as much as 50 per cent.

7. In band-pass and multi-stage circuits slight discrepancies of tuning cause peaks of unequal strength with consequent loss of signal strength.

8. By compressing the long-wave coil into small dimensions the losses and distributed capacity are increased enormously.

9. Maximum voltage amplification is obtained with a tight magnetic coupling of low capacity.

1. E.M. Plus Four Coils are 3 ins. in diameter with a winding length of 2½ ins.

2. E.M. Plus Four Coils are wound with 27/42 gauge Litz wire, giving 90 per cent. greater efficiency than small single-strand wire.

3. E.M. Plus Four Coils introduce so little damping that signal strength and selectivity are extremely high.

4. E.M. Plus Four Coils are so designed that shields are unnecessary.

5. E.M. Plus Four Coils are air-cored, on low-loss formers, and give maximum efficiency on medium waves.

6. E.M. Plus Four selectivity makes band-pass tuning unnecessary, and maximum signal voltage is maintained.

7. The E.M. Plus Four special trimming device gives constant accuracy at every setting.

8. The Long-wave sections of E.M. Plus Four Coils are plain solenoids of large diameter.

9. The primary windings on E.M. Plus Four Coils are air-spaced and supported on ribs over the secondary windings.

THE SET WITH THE WIDEST WAVE-LENGTH RANGE

185-620 METRES
850-2100 METRES

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The Set for the man who wants something better. The only set for the keen constructor and true experimenter.

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FULL-SIZED WIRING CHART FREE

Our E.M. Plus Four folder contains full details of the complete set, with complete building instructions and full-sized chart. Ask your dealer for your free copy. If he is out of stock ask him to get you a copy. In case of difficulty post coupon.

ECKERSLEY EXPLAINS-

Passing from a brief mention of earth resistance, our Chief Radio Consultant discusses the remarkable and rapid improvement in valves from the early types with a store of gas in the "pip," which one heated with a match, to the multitudinous models of to-day.

I SHOULD like to add something to what I wrote about earths a few weeks ago.

I find that some people are confused about the term "earth resistance."

It is necessary to explain that you cannot measure earth resistance by sticking two pegs in the earth, passing a current between them and finding out the resistance of the earth by dividing the voltage applied between the pegs by the current flowing between the pegs. After all, you can make a good "earth" by using a counterpoise of wires *insulated* from the earth, and the "resistance," considered as D.C. resistance, would look like megohms and more, but the resistance looked at as resistance to the alternating high-frequency currents would be only measured in ohms.

A Capacity Path.

The high-frequency currents, in fact, can get to earth via capacity. That is why frequently you find, with an all-mains set, that an "earth" is not necessary separately as such, because the capacity between, say, filaments, filament transformer and mains, and hence earth, is big enough to pass all the currents away to earth quite nicely without any direct connection to earth at all.

I was thinking, the other day, what a marvellous improvement there has been in valves. It makes me feel very old to sweep the gamut of development with a single memory, but it makes me astonished to realise that this is not so much age as rapidity of development.

Those early valves! They *were* "soft." That is to say, they relied for their sensitivity upon having gas in their bulbs—just the right amount of gas, though, not just gas. And the gas was wayward—would hide itself occludedly in the metal or, the morning being fine, would come out and conduct any amount of electricity all over the place.

Soft and Sensitive.

In order to control it, however, there was a store of gas in the "pip" of the valve. If one wanted a softer valve for a louder signal one lighted a match and gently teased the pip with a wavy flame. The signals would come up like magic! The art was to leave off warming the pip at exactly the right time!

I guess that those early soft valves were, at times (rare times, maybe!), as sensitive as any modern valve on the market. The trouble was that they would never stay put. You could hardly expect all British listeners to tease their programmes into life on the edge of a match flame!

So the hard valve came in. The R valve was my first introduction to the relatively stable valve. One R valve, retroaction to the limit, a high aerial and a pair of phones was my entrance to broadcast reception in 1919. Then one added note mags and more R valves.

A Famous Amplifier.

The V.24 valve was a hard valve, and the Q valve was a hard valve and a detector of very high impedance. These valves were made like cartridges, with their electrodes on their sides and ends to avoid capacity effects.

VALVE NAMES WHICH VARY

A recent valve photograph which illustrates extremely well a point which our Chief Radio Consultant raises in his notes this week. If you are looking for a particular class of valve you will find its type in the ranges of almost every manufacturer. But you will be very fortunate if you find that its dimensions in one catalogue are the same as the particulars of another maker. Its name, too, will almost certainly be widely different.

H. J. Round's famous 55 amplifier had five stages of high frequency and a detector, and a magnification equal, I suppose, to about two high-frequency stages to-day: perhaps not that—but the 55 *was* stable.

Which brings me to that so terribly important point that the improvement in the valve has only been an improvement as higher magnifications have been obtained in terms of practical stability. Of course, stability concerns the circuits designed around the valve, but it would have been impossible to have designed these without the valve's co-operation.

Amazing Modern Valves.

These thoughts were prompted by some experiments I was doing the other day with a three-valve arrangement of my own. I was amazed to find what one can do to-day with three valves.

I know you will laugh at me for talking like this, because I have so often ragged people for doing just what I'm going to do. But I must tell you that I got a host of foreign stations in the heart of London on a frame aerial and three valves!

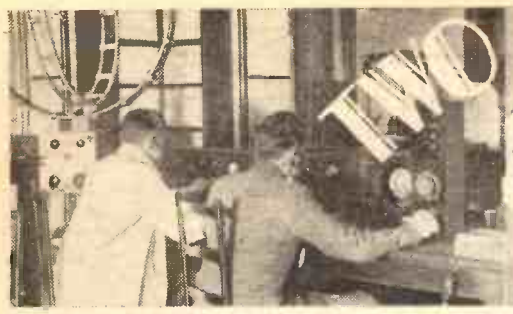
I must say we had been intelligent about the circuits involved, but we could have been supermen without a signal had it not been for the valve and its high mutual conductance, and its high impedance, and its excellent shielding, and its (output) efficiency, and so on and so forth.

I recollect, nevertheless, a valve, circa 1922, which in one bottle performed the functions of both high- and low-frequency magnification *and* detection. A three-valve set in one bottle! Then, when the craze for "reflex" circuits was on, we got quite a lot of sensitivity out of a few valves. But never quality. I stick to that.

Still Improving.

And the excellent thing about the valve is that it is developing not only towards greater sensitivity, but its output and quality-giving functions are not thereby lessened: they are, in many cases, in fact, increased.

All praise and all thanks to the valve makers. If they would now get together and agree upon the production of fewer types they would deserve a small but handsome medal (shielded type).



RADIO MYSTERIES SOLVED

In July, 1932, an expedition, under the direction of Professor E. V. Appleton, left England for the Arctic Circle to carry out experiments in connection with the Heaviside and Appleton Layers. Some of the conclusions arrived at by the research engineers are embodied in this article.

THE average owner of an ordinary broadcast receiver might easily imagine that all the major problems of radio communication had been solved. True, one occasionally suffers from the inconveniences of atmospherics and fading; but, on the other hand, a really good receiver seems easily capable of bringing most of Europe into its owner's home with a minimum of trouble. If, too, one sends a telegram to a friend in Australia the chances are that it will go by wireless, and the *certainty* is that it will be received in "next to no time."

Investigating the Sun's Influence.

It is, however, a fact that some aspects of radio exhibit puzzling phenomena which limit the extent of the service radio *might* render humanity. Chief among them is the problem of the way the Heaviside and Appleton Layers are produced and controlled by the sun's action.

It would, too, simplify the radio communication engineer's task if wireless waves did not experience so much difficulty in crossing the North Pole.

They show a strange reluctance to negotiating a "North Polar route," so, to discover why this was so and to investigate the sun's influence on electrification of the upper layers, the British Radio Expedition to the Arctic Circle was organised. Its leader, Professor Appleton, has explained to the Royal Institution that the expedition has solved both problems.

He showed records and slides definitely indicating that during magnetic storms, which occurred more frequently than not in Arctic latitudes, electrification at the lowest levels of the Heaviside Layer was increased to such an extent that wireless waves were completely absorbed in this region, so that the layers could play no part in helping them to travel great distances.

It will be remembered that in the case of General Nobile's polar flight in the airship Italia there were two periods, separated by about twenty-seven days, when wireless communication between the airship and the outside world was interrupted.

It is now clear that these were both periods of intense magnetic activity, in which we now know that wireless waves are absorbed and not reflected by the upper atmosphere.

The results of the British Radio Expedition, therefore, clearly indicate that if wireless is to be used in polar exploration note must be taken of this monthly sequence.

It would also be advisable to choose a year of sun-spot minimum and not a year of sun-spot maximum, as in the case of the ill-fated Italia expedition in 1928, since magnetic and wireless disturbances are less marked when the spots on the sun are few.

As regards the constitution of the layers, there has been acute differences of opinion—one party saying that electrification was due to the ultra-violet light of the sun; the other that it was due to bombardment of our atmosphere by streams of particles shot out from the sun.

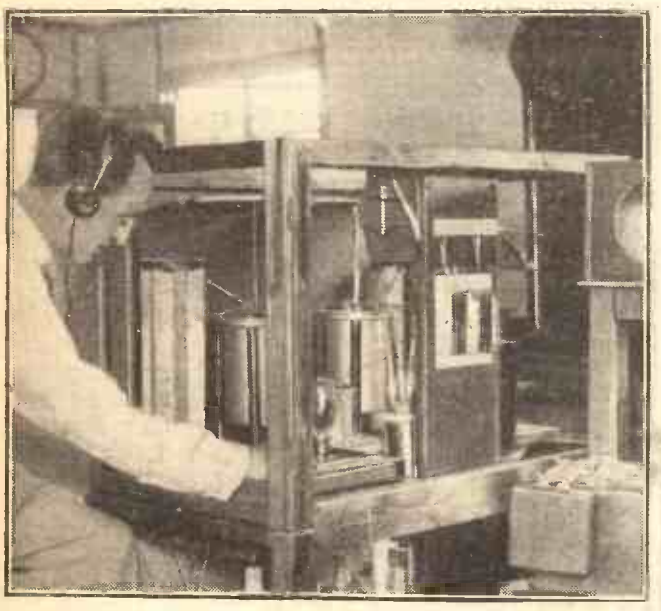
Professor Appleton said that the expedition had happily been able to reconcile both points of view. He considered that the results obtained showed conclusively that the main cause of the electrification in both layers was the ultra-violet light of the sun, and in magnetically quiet conditions this electrification was actually less in the Arctic regions than in England. This was to be expected on the ultra-violet-light theory because of the flatter angle at which the sun's rays struck the earth near the Poles.

Low Level Electrification

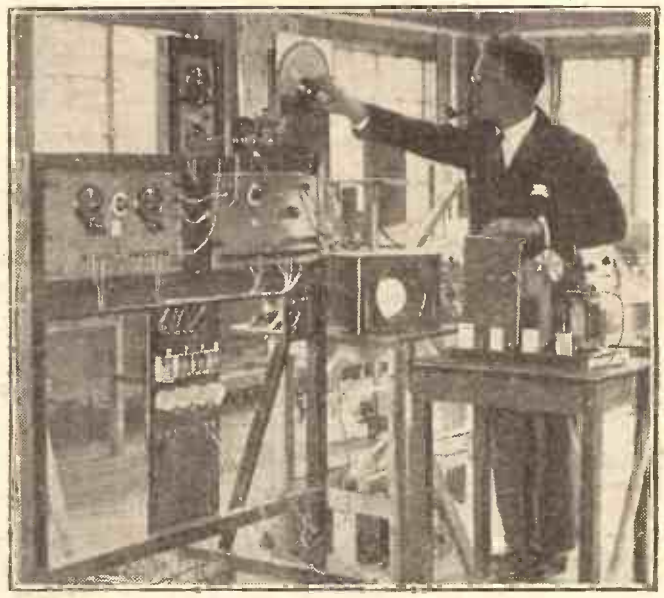
While the normal undisturbed conditions fitted in with the ultra-violet-light theory, the conditions which existed during magnetic disturbances and auroral displays could only be satisfactorily explained on the assumption that the electrification spread to abnormally low levels because of the influx of particles from outside the earth's atmosphere. Other symptoms which tended to bear out this influx were the magnetic storms and auroras themselves.

(*Continued on page* 689.)

TESTING THE UPPER ATMOSPHERE



RECORDING WIRELESS ECHOES



The picture on the left shows part of the 5-kw. transmitter which was taken north for the experiments, while Mr. Geoffrey Builder, Professor Appleton's chief lieutenant, is seen above with the cathode-ray oscillograph and recording camera.

How to Build A D.C. SET

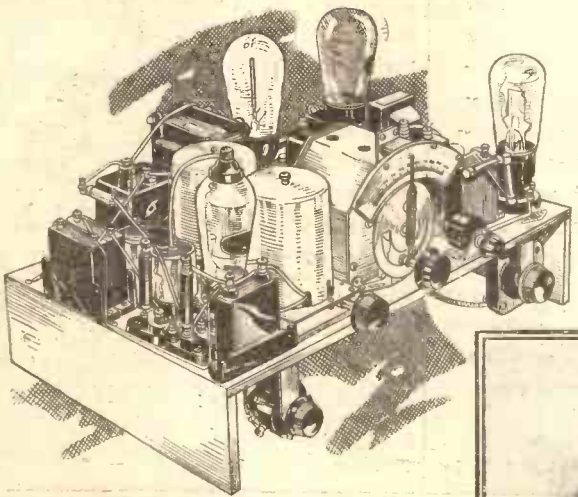
A compact all-mains direct-current receiver which incorporates multi-mu volume adjustment and employs automatic heater current control. Designed and described by K. D. ROGERS.

THERE is a great deal of talk in the valve world at the moment about universal 13-volt D.C.–A.C. valves: valves that are to "oust the 4-volt A.C. types" and to substitute the mixed assortment of present D.C. varieties. Whether it will come to anything for some time I do not know for certain, but probably 13-volt valves will be placed on the market in the fairly near future.

The current consumption of these new valves will probably be in the neighbourhood of ·3 amp., so that, except in voltage, they will not differ greatly from the 16-volt ·25 amp. valves already available, and as far as can be judged at the moment they should be interchangeable in the same circuit with the 16-volters.

The idea of choosing 13 volts as a heater pressure is to make them suitable for running off a 12-volt car battery for car-radio sets, but that hardly concerns us here. What does concern us is the fact that to all intents and purposes every 16-volt ·25 amp. D.C. set will be easily convertible into a 13-volt ·3 amp. universal set, with but the addition of a rectifier for H.T. (where A.C. mains are concerned) and a suitable mains resistance or barretter.

EASY STATION SELECTION



There are only three valves in this D.C. receiver, the fourth "valve" (second from the left) is the vacuum barretter that controls the heater current.

A Simple Changeover.

Where the set is to be used on D.C. a change of resistance or barretter is all that will be necessary should it be decided to go over from 16- to 13-volt valves, with possibly a valve holder change for a 7-pin pentode.

But—and this is important—it may not be realised that if you have not already got a mains set, and you have a D.C. electricity supply available, there is no need whatever to wait for the new valves before you build such a receiver.

The present ·25 amp. 16-volt D.C. valves are among the most satisfactory mains valves ever designed, and a set built with them should give every satisfaction, besides being completely adaptable for conversion to 13-volt valves when the 16-volters have served their useful life.

I stress this point because the release of information about the coming, at a date yet unfixed, of the new 13-volt valves may lead many set builders to regard their present D.C. sets as obsolete, or if they are contemplating the construction of a new set to hesitate in order to wait for the new valves.

There is no need to wait, as I have tried to point out. If it is a D.C. set you require the 16-volters will suit you as well as the yet-to-come 13-volters. If it is efficiency you crave in the D.C. set the results obtainable with 16-volt valves are not likely to be beaten by the 13-volters, for the change to come will be mainly in voltage and minor points of heater construction, and will not affect the characteristics to any very important extent. Possibly a screened pentode will take the place of the screened-grid valve, but that is not a serious circuital change.

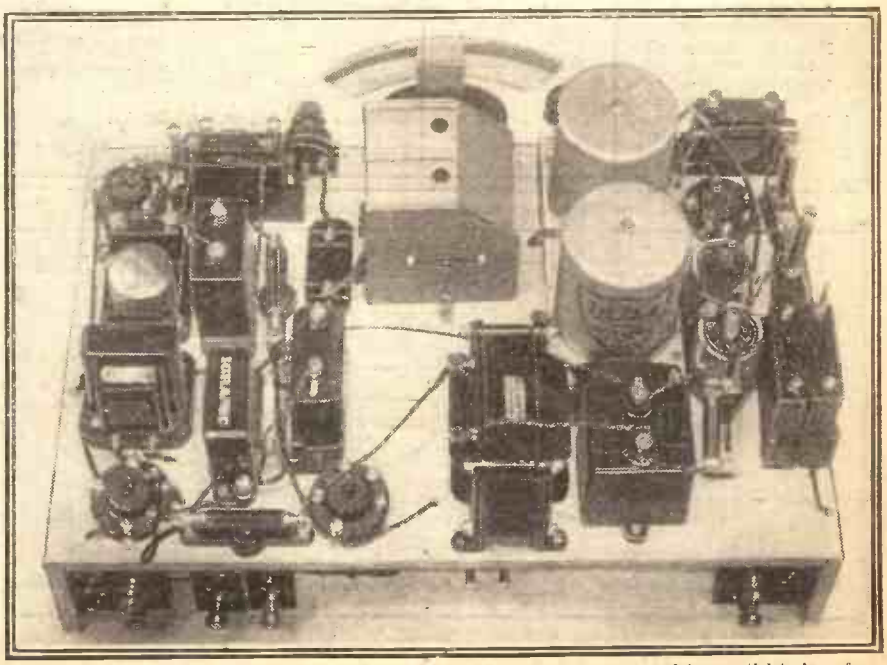
Used for 4,000 Hours.

The wattage consumption of the new valves on D.C. will be similar, so that you need have no qualms there. No, in view of the similarity in all important matters of the two types I would certainly not wait for the new valves if I were considering building a new D.C. set: especially as I know that, under a test of nearly 4,000 hours *actual use* at Tallis House, 14 of the 16-volt ·25-amp. Marconi and Osram valves have shown *no depreciation whatever*.

A year ago last March fourteen of these valves were started on an eight-hours-per-day, five-days-per-week working test in a bank of loudspeaking telephone amplifiers used for inter-departmental communication. They are on continuously for those eight hours per day, and at the time of writing, getting on for 4,000 hours later, not one of

(*Continued on next page.*)

THE HEATER CURRENT IS SMOOTHED



The large choke in the centre foreground is for smoothing the heater supply, and is essential to hum-free operation of the set.

HOW TO BUILD A D.C. SET

(Continued from previous page.)

the valves has given the slightest trouble, and no replacement has had to be made.

This is good testimony indeed; and if any of my readers wanting a D.C. set is still hesitating as to whether he will be doing right in choosing the 16-volt ·25 amp. valve he is a harder nut to crack than I have ever met. And when it is said by a radio journalist that means a great deal.

A Neat Barretter.

Some people, I know, have been put off the construction of a D.C. set because of the mains-resistance attachment that has so often appeared as an indispensable accessory. That is now not the case where the 16-volt valves are concerned, for Osram and Marconi provide a very neat and simple barretter for use with their valves, thereby supplying an automatic controller of voltage that is not only convenient in size but theoretically more satisfactory than the plain wire-wound resistance.

This barretter we have used in the design of the simple D.C. three-valve set illustrated here, and which has been specially designed with full knowledge of the possible changes in D.C. valves in the future. This set is not likely to be affected, let alone rendered obsolete, by any new valve introduction for a long time to come. Its design embraces the new 13-volt valve as readily as it does the 16-volters which are now available.

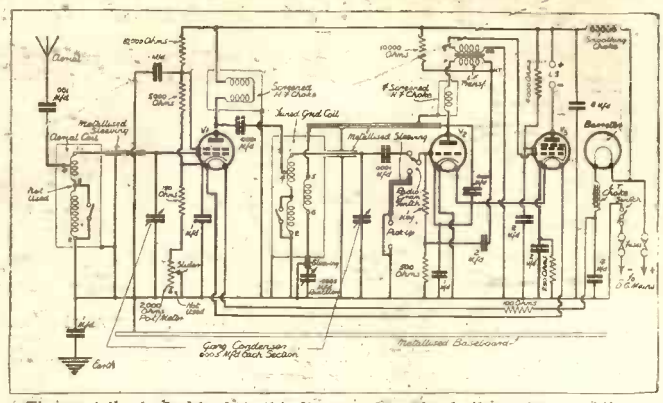
The circuit is simple, but completely up to date, including multi-mu volume control and a pentode output. A pick-up is provided for by simple radiogram switching, while the increasingly popular practice of incorporating the on-off switch with the volume control has been followed.

In its essentials the circuit is extremely straightforward, air-cored coils of well-known make being employed in a two-gang unit and tuned with a standard double-gang condenser. The usual voltage-feed potentiometer used with multi-mu S.G. valves is employed in the first stage, the conductance of the valve being controlled by means of variations in the cathode (biasing) resistance.

A limiting resistance of 150 ohms is connected in series with the variable control,

(Continued on page 676.)

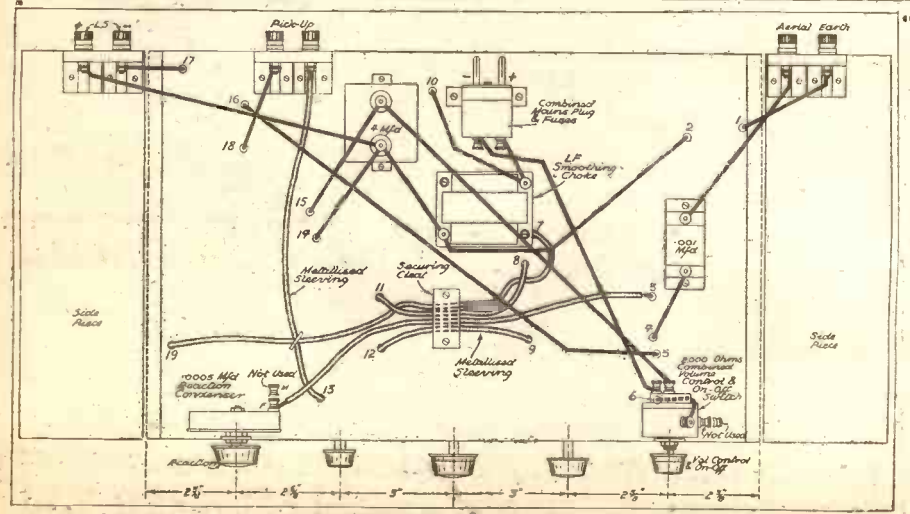
HOW THE CIRCUIT IS ARRANGED



The specially marked leads in this diagram show clearly the main connections which have to be shielded.

THESE COMPONENTS ARE RECOMMENDED FOR THIS ALL-MAINS D.C. RECEIVER

Component.	Make used by designer.	Alternative makes of suitable specification recommended by designer.	Component.	Make used by designer.	Alternative makes of suitable specification recommended by designer.
1 Cabinet	Peto-Scott	—	1 Special 100-ohm wire-wound resistance	Bulgin AR.100	
1 Metaplex chassis, 16 × 10 × 3½ ins.	Peto-Scott	—	1 10,000-ohm resistance with vertical holder	Graham Farish 1½-watt "Ohmite"	
1 2-coil unit	Lissen L.N.5161	—	1 5,000-ohm resistance with vertical holder	Graham Farish 1½-watt "Ohmite"	
1 2-gang ·0005-mfd. variable condenser	British Radiophone, type No. 605	—	2 4-mfd. fixed condensers	Dubilier, type BB	T.C.C., Igranic
1 Disc drive and escutcheon for above	British Radiophone, type No. 711	—	1 2-mfd. fixed condenser	Telsen W.223	T.C.C., Dubilier, Graham Farish, Igranic, Lissen
1 Binocular screened H.F. choke	Telsen W.340	Graham Farish	1 2-mfd. fixed condenser	Igranic	T.C.C., Dubilier, Graham Farish, Igranic, Lissen
1 Ordinary screened H.F. choke	Graham Farish, H.M.S.	Telsen, Bulgin, Wearite	1 2-mfd. fixed condenser	Lissen L.N.134	T.C.C., Dubilier, Graham Farish, Igranic, Lissen
1 L.F. choke	R.I. "Hypercore"	—	1 2-mfd. fixed condenser	T.C.C., type 80	Lissen, Graham Farish, Igranic, Dubilier.
1 L.T. choke	Wearite ·25 amp.	—			
1 L.F. transformer	Lissen "Hypernik"	Telsen, R.I., Ferranti, Varley	2 1-mfd. fixed condensers	Telsen W.227	T.C.C., Dubilier, Graham Farish, Igranic, Lissen
1 ·0005-mfd. reaction condenser	Telsen W.353	Graham Farish, Lissen, Polar	1 1-mfd. fixed condenser	Lissen L.N.133	T.C.C., Dubilier, Graham Farish, Igranic, Lissen
1 2,000-ohm combined volume control and on-off switch	Bulgin V.S.26	Lewcos	1 ·001-mfd. fixed condenser	Dubilier, type 610	T.C.C., Telsen, Graham Farish, Igranic, Lissen
1 Rotary change-over switch	Bulgin S.86	—	1 ·0001-mfd. fixed condenser	Dubilier, type 610	T.C.C., Telsen, Graham Farish, Lissen
4 5-pin valve holders	W.B. small type	Telsen, Benjamin, Lissen	1 ·0001-mfd. fixed condenser	T.C.C., type 34	Dubilier
1 50,000-ohm resistance with horizontal holder	Graham Farish 1½-watt "Ohmite"	Ferranti	1 ·0001-mfd. fixed condenser	Dubilier, type 665	T.C.C., Igranic
1 4,000-ohm resistance with horizontal holder	Graham Farish 1½-watt "Ohmite"	Ferranti	1 Combined mains plug and fuse holder	Bulgin F.15	—
1 150-ohm resistance without holder	Graham Farish 1½-watt "Ohmite"	—	3 Pairs of terminal blocks	Goltone	Lissen
			6 Terminals	Goltone	Igranic, Clix, Belling-Lee
			2 Reels of insulated wire	British Radiophone "Pull-back"	
1 1-meg. resistance with wire ends or terminals	Dubilier 1-watt	Telsen, Graham Farish, Varley, Lissen	2 Yds. screened wire	Goltone, type R34/966	—
			2 Brackets	British Radiogram, type 22	—
1 500-ohm resistance with wire ends or terminals	Dubilier 1-watt	Graham Farish, Varley	1 Bracket	British Radiogram, type 22A	—
1 250-ohm resistance with wire ends or terminals	Dubilier 1-watt	Graham Farish, Varley	2 Pieces Metaplex, 3 × 2 × ⅛ in.	Peto-Scott	—



The under-chassis wiring: when leads go through to the other side of the baseboard the holes are numbered so that the wires can be traced easily.

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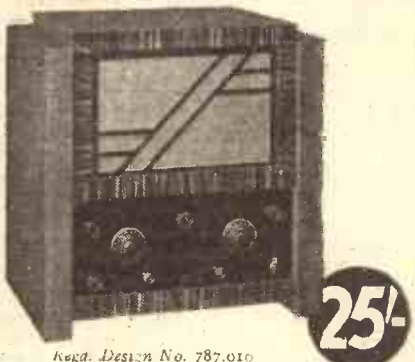

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ALL MAINS D.C. RECEIVER

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SEND ONLY **22/6**

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RECOMMENDED ACCESSORIES

1	**Peto-Scott Universal Cabinet** complete with SHELF and BAFFLE	£1	4 6
1	**Lissen 2-coil Unit,** type L.M.5161		17 6
1	**British Radiophone,** type 605, Variable Condenser		15 0
	R.I. Hypercore L.F. Choke		17 6
1	**Wearite** 25-amp. L.T. Choke ..		7 6
1	**Lissen Hypernik L.F. Transformer** ..		12 6
1	**set Specified Valves**	3	2 0

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HOW TO BUILD A D.C. SET

(Continued from page 674.)

so that the bias on the valve is never reduced to too low a voltage.

Isolating Aerial and Earth.

Series-aerial and series-earth condensers are used to isolate both aerial and earth leads from the D.C. mains circuits in the receiver. These condensers are essential in a receiver that may be used on D.C. mains that have the positive side earthed, for in that event the negative (chassis side) of the set will become at a potential above earth, and connection of the chassis direct to earth would result in a short circuit of the mains.

Similarly, if the aerial were directly connected to its coil, and it came into contact with an earthed body, there would be a short of the mains via the coil. Accordingly, the series condensers are inserted in the set so that all connections to aerial and earth terminals are completely safe.

There arises the question of the chassis itself. This is in contact with the negative main. It is better that way than isolated from it, for with isolation the metal chassis is liable to cause a certain amount of hum on bad mains. So it is normally advisable not to operate the set detached from its cabinet, or, if this is done, to make sure you do not touch the chassis *and* an earthed object while the receiver is "on."

This precaution only holds where positive-earthed mains are concerned; but it is best to be absolutely safe and to fix the receiver in its cabinet as soon as possible after the preliminary test.

This must be carried out external to the cabinet for purpose of trimming the condensers, but to the average constructor there is no danger in this if he remembers not to let any earthed object touch the chassis. As soon as the trimming is done the set can be packed away in the cabinet.

It will be noticed that the heater-smoothing choke is inserted in the positive-heater feed. This is found best in most cases as a hum preventer, but in some instances it may be found more advantageous to connect it in series with the negative feed.

The metallised baseboard chassis is obtainable complete or can be made up from sheets of Metaplex baseboard. In the latter case the top and bottom surfaces should be linked by means of a bolt running through so that the two sides of the baseboard shall be in contact. When the chassis is purchased ready made it is sprayed after assembly so that all surfaces are metallised and good contact should be achieved.

The 100 ohms resistance in series with the heater circuit is a supplementary voltage breakdown resistance to the barretter. This latter is supplied suitable for four or five valves, and when only three are employed the makers recommend a 100-ohms extra resistance to take the place of the fourth valve.

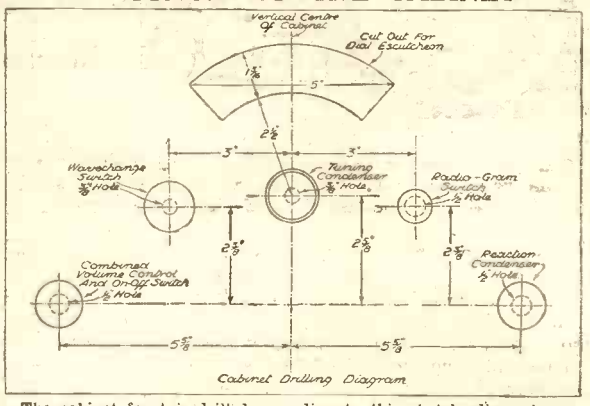
This resistance gives ample margin, of course, for the valve has a resistance of only 64 ohms, so that we add a resistance, bringing the total resistance of the heater circuit between that compounded by four and five valves. This gives the barretter an easy task, for it is designed to carry out regulation for either four or five valves, and we have supplied it with the equivalent of about four and a half.

Rapidly Constructed.

The layout and construction of the set are not difficult and can be rapidly carried out if the diagrams are carefully followed. Care should be taken that no unwanted "earths" occur, such components as valve

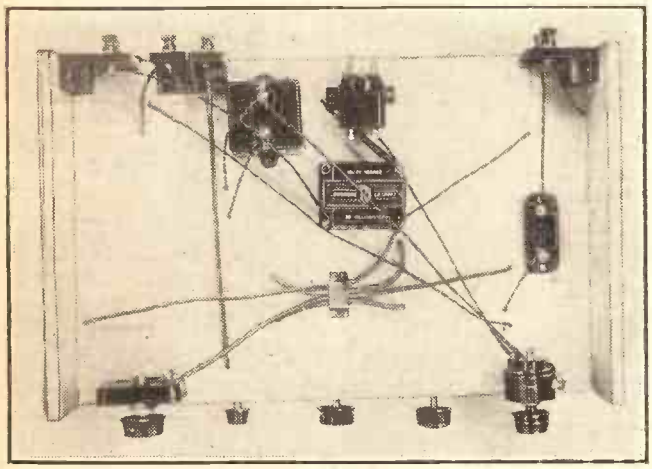
(Continued on page 689.)

THE FRONT OF THE CABINET



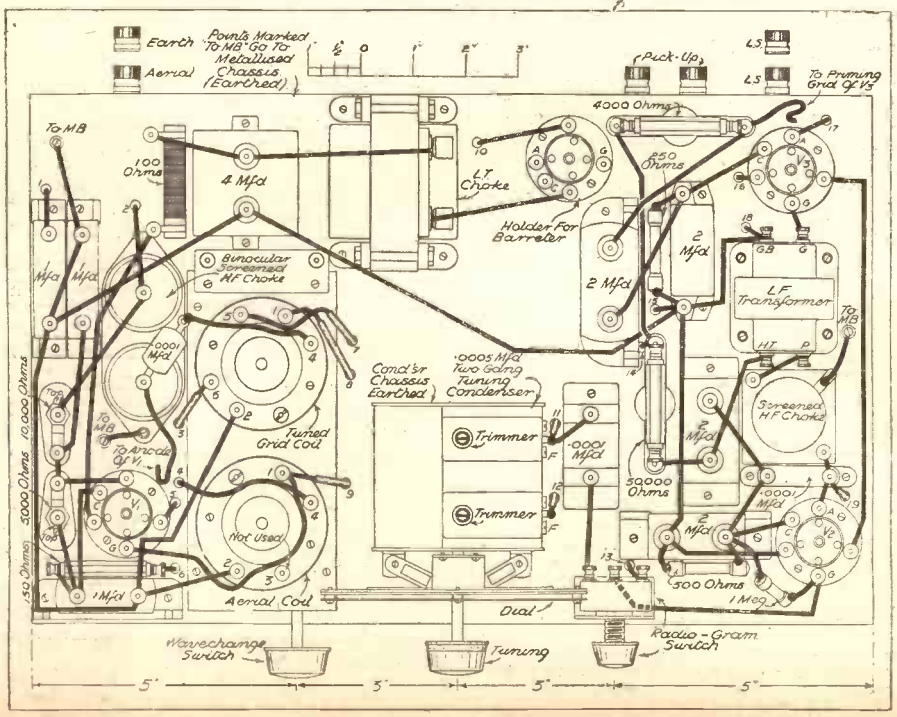
The cabinet front is drilled according to this sketch, dimensions being taken from the centre component—the tuning control. If desired, the cabinet can be obtained ready drilled.

UNDERNEATH THE CHASSIS



This photograph should be consulted in conjunction with the under-baseboard wiring diagram when the receiver is being constructed.

SHOWING THE MAIN WIRING OF THE SET



Most of the layout and wiring is carried out on the upper side of the chassis. The coil unit is raised by two small pieces of Metaplex so that the wavechange-switch knob is level with that of the radio-gram switch.

THE VALVES REQUIRED

1 V.D.S., Marconi, Osram, or Cossor D.V.S.G.
1 D.H., Marconi, Osram, or Cossor D.H.L.
1 D.P.T., Marconi or Osram. 1 Barretter, type 251, Marconi or Osram.

ACCESSORIES

LOUDSPEAKER.—Celestion, Blue Spot, W.B., R. & A., Amplion, Atlas, Marconiphone, G.E.C., Ferranti H.M.V., Ormond, Epoch.

AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," British Radiophone "Receptru" down-lead, Bulgin lightning switch, Graham Farish "Filt" earthing device.

TONE-CORRECTED VOLUME CONTROL

Did you know that the perfect "straight-line" amplifier of which you are so proud wanders from the narrow path of tonal constancy every time you manipulate the volume control? This authoritative article by M. G. SCROGGIE, B.Sc., A.M.I.E.E., establishes beyond doubt how tone is affected by volume and describes a method of remedying matters.

DID you know that even if every component in your receiver were absolutely perfect it could never reproduce the music of a large band or orchestra without distortion? No; this is not a hit at the transmitting end, for that is assumed to be blameless, too. Some components are advertised with "straight-line" amplification characteristics, looking almost as if they had been drawn with the aid of a ruler.

The Human Element.

Surely, if every part of the apparatus from broadcasting microphone to listener's loudspeaker were perfectly "straight line" (that is to say, equal in their treatment of all musical and speech frequencies), the result *must* be correctly balanced as to tone? But, as often happens, what has been left out of account is the human element. The ear is *not* a straight-line component!

Let us look into this a little more closely. Experiments have been carried out to find what is the least sound that can be heard by a person with normal hearing. These tests showed that notes of rather high frequency—1,000 to 2,000 cycles per second, being the octave just above the reach of a capable soprano—can be heard when the sound intensity is very small indeed.

Increased a Millionfold!

As the pitch of the sound is lowered the strength has to be increased very much to keep it just audible, so that at the lowest frequency usually considered for broadcasting, 50 cycles, nearly a million times as much sound power must be emitted.

The sensitiveness of the ear falls off at the very highest frequencies, too, but not nearly so much until we get above the frequencies used in broadcasting. You have probably noticed that a large organ with 32-foot pipes, giving a very low note, requires several horse-power to blow it. Nearly all of this is required for the lowest notes; the high-pitched piccolo pipes could be blown by an asthmatic dwarf.

MAKING IT CLEAR

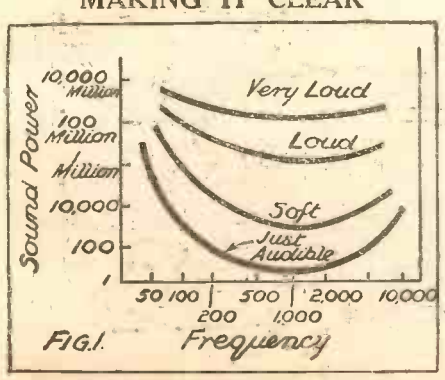


FIG. 1.

This diagram shows how reproduction varies with volume. If a 1,000-cycle note were produced by an intensity which made it just audible, a 50-cycle note would require a million times that intensity to make it equally audible!

DESERVEDLY POPULAR

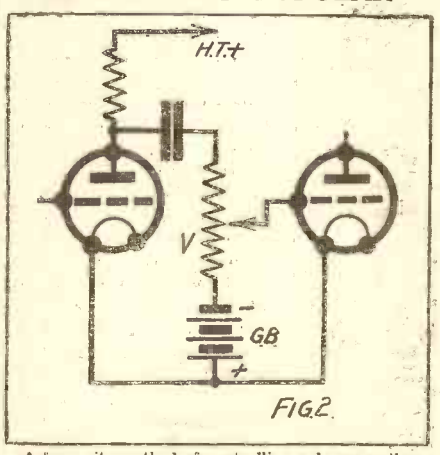


FIG. 2.

A favourite method of controlling volume on the L.F. side of a receiver is to employ a potentiometer as the grid resistance in an R.C. coupled stage.

But that is not all. The ear experiment has been pursued further by measuring the amount of sound required to give various definite sensations *above* the lower limit of being only just audible. It was then found that the difference in power between upper-middle and low notes gradually flattens out as the sound gets louder, so that when the sound is very strong only about 30 times the power is needed at the low end.

All Equally Loud.

Let us now look at it the other way. Suppose somebody runs over the pedals and keys of an organ, playing a very loud blast on each, and the power put into a 50-cycle note is 30 times that put into a 1,500-cycle note, and so on in accordance with the results of the experiment. Then it should, of course, be found that all the notes sound equally loud.

Now the same thing is done with every note made exceedingly feeble in some way—softer than any real organ could be played—so that the 1,500-cycle note is only *just* audible. They are all weaker in exactly the same proportion, and therefore, according to the experimental results, the very low and very high notes cannot possibly be heard.

The 50-cycle note, for example, is still only 30 times stronger than the 1,500-cycle, whereas it would have to be a million times stronger to be no more than just heard. All we can hear are a few notes between 1,000 and 2,000.

An Explanation.

If the strength is made slightly greater a wider range of pitch becomes audible, but it needs considerably more power to make the lowest pedal notes just faintly heard, by which time some of the others are beginning to get quite piercing.

These results are shown diagrammatically in Fig. 1. For instance, suppose our imaginary organ reproduces every note with a strength of 10,000. Those below about 90 cycles per second and those above 9,000 are altogether inaudible. Between about 300 and 3,000, on the other hand, they are heard at fair strength. The intermediate notes are more or less faint.

So we see, then, that the balance of tone or the range of musical frequency to which

(*Continued on next page.*)

CONTROLLING THIRTY HORSE POWER

That our ears are not equally sensitive to the whole range of sound is impressively demonstrated by the organ. Some 30 horse power is commonly expended in driving a cinema organ, and, since the small, high-pitched pipes can be blown by mouth, most of the 30 horse power obviously goes to actuate the low notes.

TONE-CORRECTED VOLUME CONTROL

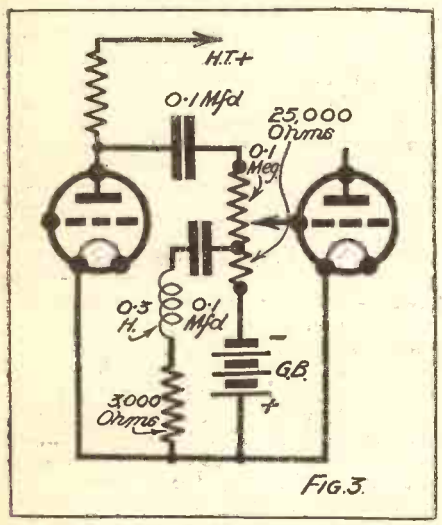
(*Continued from previous page.*)

our ears respond depends very much on the loudness. So it is not possible to get a true copy of the original on a reduced scale simply by making every sound less intense in the same proportion. The low notes, and to a lesser extent the very high notes, begin to fall off and even to become quite inaudible, although the middle frequencies are still quite pronounced.

An Interesting Experiment.

You can observe this, if you have a good receiver and loudspeaker, by turning on at full strength some programme which gives a wide range of frequency. A dance band is usually a good test, because there is a low, thumping drum or string bass and plenty of strident " brass " to represent the upper-middle frequencies.

MAINTAINING A BALANCE



If the usual L.F. volume-control potentiometer is modified by the addition of inductance and capacity, as shown here, a better tonal balance is maintained when volume is lowered.

Now turn down the volume control till the band is heard at " sleeping-baby " strength. The muted trumpets and other cacophony can still be followed quite distinctly, but the boom of the drum has probably disappeared entirely, unless it was exaggerated in the first event by a suspension resonance in the loudspeaker or some other disturbing factor.

Synthetic Bass.

The true balance would only be heard if the band were reproduced " life size," which is hardly a desirable state of affairs in an ordinary sitting-room.

That is why one so seldom hears *real* bass and has to make do with a synthetic substitute faked by loudspeaker or cabinet resonance. There is a vast difference between this tiresome boominess and the genuine rich bass heard first hand.

The object of this article is not to start a move towards reproducing bands domestically at the full original strength—far otherwise until the day when all our homes are built like Broadcasting House.

But it *is* possible to go some way towards maintaining a reasonable balance of tone when the volume control is turned low. Fortunately anything like an exact compensation would be beyond the power of the ear to appreciate, and certainly beyond the power of the loudspeaker to set forth.

Two Controls.

And this is a good point at which to offer the reminder that every set should ideally have *two* volume controls. Unfortunately both of these are called by the same name, whereas the first, which acts on the high-frequency part by valve biasing or aerial coupling, should properly be called a sensitivity or gain control.

This may be either manual or automatic, and its object is to compensate for the very great differences in the strengths of different stations as received. Having evened them all out to give full listening strength and no more, the true volume control, which should come after the detector, can then be used to adjust the volume to suit such circumstances as deaf aunts at the one extreme and slumbering infants or sensitive neighbours through thin walls at the other.

It is then that we want to compensate for the false balance of tone caused by reduced volume. The usual type of post-detector volume control lends itself readily to such a refinement.

Fig. 2 shows the circuit of a resistance coupling in which V is the volume control—recommendations vary from 0·1 to 1 megohm. Fig. 3 is the same arrangement with the addition of tone correction.

The added components are three in number: a condenser C, a choke L and a resistor R. If a 0·1-megohm control is used, C should be 0·1, L a H.F. choke of about 0·3 henry—a Wearite H.F.4 (or H.F.5) is suitable—and R about 3,000 ohms (which includes the resistance of the choke). The value of C affects the low-note part of the scale; L decides the high notes; and R determines the amount of correction.

Very Flexible.

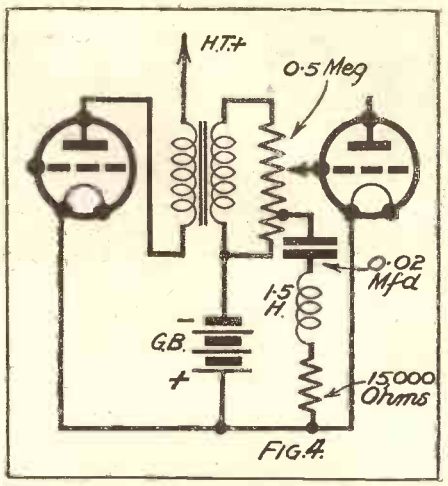
In fact, it is quite a good thing to use a variable resistance of about 5,000 ohms for R, and then you can adjust the correction. If R is too low the tone is over-corrected.

Then if you find there is satisfactory correction for low notes, but not enough for the high, the inductance of L is too small. But when the reverse is the case, C is too *large*. The order of these three components in the line of connection is of no consequence, but the upper connection needs some comment.

It is taken to a tap on the volume control, and a good position is about a quarter of the way up (in resistance). So there would be 25,000 ohms between the tap and the grid-bias end.

When the volume control is at its maximum position the sensitivity should be adjusted by some other means to give the full output of the receiver. Then any reduced loudness at which it is desired to listen is got by turning the volume control down.

TRANSFORMER COUPLED



The compensated volume-control arrangement described by the author is not only applicable to resistance-capacity coupling. Where an L.F. transformer is employed the arrangement shown above is recommended.

As the contact nears the tapping point the tone correction comes into action and is a maximum at that point. It is useful for some purposes to be able to fade out entirely, or nearly so, which is done when the part below the tapping is used. The degree of correction remains the same over this range of adjustment, which is no serious disadvantage, as it does not correspond to real listening volume.

Easily Adapted.

The method of getting at a tapping point depends very much on the make of volume control, most of which are now totally enclosed and difficult to get at. The Watmel type, however, is easy to take apart and to insert the end of a wire between the resistance element and the wire contact ring; when reassembled the parts are pressed into firm contact. The coupling condenser with a 0·1-megohm control should be not less than 0·1 mfd. If a transformer coupling is used, 0·1 megohm would be too low and 0·5 more in order.

In such a case the corrector and coupling condensers are divided by 5 and the resistance R and inductance L multiplied by the same figure. And for a 1-megohm control the factor is, of course, 10, giving a C of 0·01, an L of 3 henries, R of about 30,000, and a top 0·25 megohm from the lower end.

TRY IT ON ROY FOX

Next time you listen to Roy Fox and his band (seen above) try turning down the volume. As the amplification of the set is decreased you will notice that the low-tone instruments like the drums disappear long before the high-pitched " brasses."

RADIO STEP-BY-STEP

OUR SPECIAL SUPPLEMENT for BEGINNERS

Why Stations Fade

WHEN the programme from a distant broadcasting station suddenly starts to fade away, returning once more to its original strength within the short space of a minute or so, have you ever wondered why it happens?

Every listener has met with this queer phenomenon. The set is properly adjusted to the wavelength of one of the continental stations. The programme comes through at great volume. You listen to it with enjoyment for *a little while*, and then, without the controls being touched, the volume gradually decreases to a whisper and, however carefully you readjust the controls, you are unable to bring it back to its former strength.

Outside Your Control.

Don't blame your set, because this type of fading is quite outside your control. One of the peculiarities of fading is the fact that it becomes more frequent as the wavelength gets shorter.

DECREASING STRENGTH

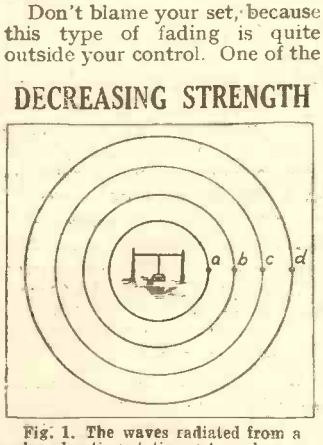


Fig. 1. The waves radiated from a broadcasting station get weaker as their distance from the transmitting aerial increases. Thus the strength of the waves at "a" is greater than at "b" and much greater than at "c" and "d."

To put it another way, programmes sent out from stations on what is known as the long-wave band (above 1,000 metres) do not show any marked tendency to fade. On 300 metres the majority of long-distance programmes exhibit all the symptoms already mentioned. And on the still shorter wavelengths, especially those round about 30-40 metres, rapid fluctuations in strength are inseparable from the programmes picked up.

But fading, although irritating to the listener, whose one desire is to receive the programme for its entertainment value, is closely linked up with something which forms the basis of all reception over vast distances.

It is this something that supplies the answer to many knotty questions. For instance, it explains why we are able to hear American broadcasting stations over thousands of miles when our only means of receiving them is a small set employing two or three valves.

It explains how broadcast programmes can span a greater portion of the earth, in spite of the earth being round and not flat.

Sydney, Australia, can be heard in London on a simple one-valve set, and yet approximately one half of the earth's mass lies between Australia and Great Britain.

Reliable Service Area.

How is it that these things are possible when sometimes we have difficulty in obtaining clear reception from one of our own Regionals at 40 or 50 miles?

The explanation is very interesting indeed. Every ordinary broadcasting station is designed to give a good reliable programme service over a certain area. If the programmes sent out are to have any real entertainment value they must not vary in strength from one day to another, except, perhaps, to an inappreciable degree.

The listener must be able to switch on his set at any time during the station's transmission hours and hear the programme he wants with adequate volume and free from fading.

This kind of service is only possible when the listener is residing within the *service area* of the station he wishes to receive.

The waves radiated from a transmitting aerial spread out in ever-widening circles, creating small currents in receiving aerials in their path. Fig. 1 represents a transmitting aerial, and the circles a, b, c and d distances from the station.

Ground and Sky Waves.

The waves, in spreading out, get weaker and weaker the farther they are from the broadcasting station. The strength of the currents picked up at "b" would be less than at "a," at "c" less than at "b," and at "d" less than at "c." Hence a listener at "d" would get much less volume than a listener at "a," assuming an exactly similar aerial and set in each case.

THE REFLECTED WAVE

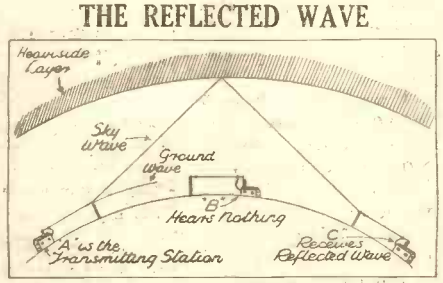


Fig. 2. The sky wave from "A" is reflected by the Heaviside Layer and picked up by "C." But "B" hears nothing because he is not in the path of the reflected wave or within range of the ground wave.

If "d" is the limit of the station's service area, then listeners residing outside the circle "d" could not be guaranteed a reliable programme service.

If reception is to be reliable—the currents picked up by the receiving aerial must be due to the transmitting station's *Ground Wave* (also called the direct wave or ray).

The waves radiated by a broadcasting station follow two courses: One component or part follows the earth's surface. This is the Ground Wave. The other goes shooting off into space and is called the *Sky* or *Indirect Wave* (or Ray).

Above the earth's surface there is a gaseous conducting layer known as the Heaviside Layer. The Sky Wave, on meeting this layer, is reflected back towards the earth.

Referring to Fig. 2, "A" is a broadcasting station. Its Sky Wave meets the Heaviside Layer, is reflected back and picked up by "C." "C" may be a thousand or more miles away. The ground wave spreads out but weakens until it is inaudible at, say, 150 or 200 miles from "A." Station "B," halfway between "A" and "C," hears nothing, because he is out of range of the ground wave and not in the path of the reflected wave. The area between the point where the ground wave is inaudible and "C" is known as the *skip distance*.

LOCAL SCREENING

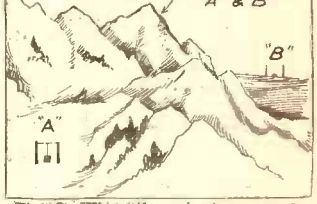


Fig. 3. When there is a range of hills or some other form of shielding between a broadcast transmitter and a receiving aerial the ground wave may get absorbed.

Above the Heaviside Layer is another one named after Professor Appleton. Very short waves penetrate the Heaviside Layer but are reflected by the Appleton Layer. Others which are shorter still penetrate both Layers and shoot off into space.

The Heaviside Layer is constantly changing in height and density. Consequently the reflected wave also varies. This gives rise to fading, since the strength of the sky wave at "C" in Fig. 2 is dependent upon the reflection from the Heaviside Layer.

(Continued on next page.)

RADIO TERMS
A PRACTICAL REVIEW
BY G.V. DOWDING, ASSOCIATE I.E.E.

This section of Radio Step-by-Step is much more than a mere list of definitions. It is a complete survey of radio presented in compact form, giving simple theoretical explanations and packed with useful practical facts. It constitutes a perfect accompaniment to the other articles in the Supplement, both by providing summaries of the subjects covered and by building a fascinating bridge between theory and practice.

AMPLIFIER (L.F.).

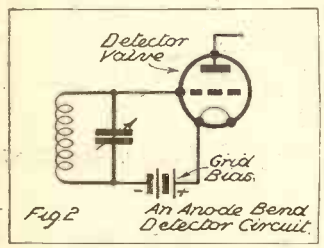
L.F. amplifiers are still quite frequently employed to build up the outputs of radio sets to increased volumes, although in general the tendency is for radio apparatus to be self-contained. The days of even the L.F. amplifier as a separate unit appear to be numbered.

AMPLITUDE DISTORTION.

When various strengths of the same frequency receive different treatment, that is amplitude distortion.

The note of a trumpet rises and falls in loudness as the musician varies the form of his blowing. If these volume fluctuations are to be represented faithfully by a loudspeaker there must be no amplitude distortion in the low-frequency section of the set.

FOR DETECTION



A suitable circuit for anode-bend rectification. A bias of approximately 3 volts is usually required.

ANODE.

One of the electrodes of the thermionic valve. It is often referred to as the "plate."

ANODE-BEND RECTIFICATION.

A method of changing the high-frequency energy developed in the aerial (and as, perhaps, subsequently amplified by H.F. valves) into low-frequency current suitable for operating telephone receivers or a loudspeaker.

The "bottom bend" of the grid-volts/anode-current characteristic curve of the valve is used. The grid is given a negative bias, and it is important to note the effect of this.

Carefully examine the Fig. 1 curve. Such a curve is obtained merely by noting how much anode current flows when various values of negative volts are imposed on the grid. (The H.T. voltage remains fixed.)

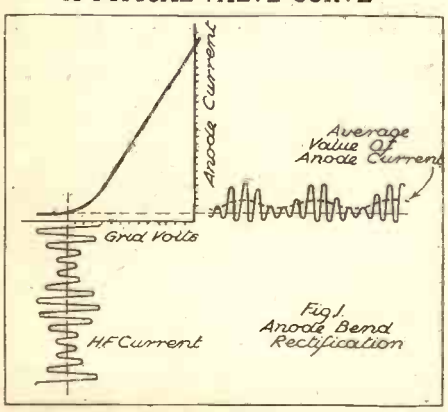
You will note that the "curve" is straight over the major part of its length, but bends towards the horizontal at the bottom.

If a fixed grid voltage (grid bias) corresponding with a central point of the curve is introduced, equal positive and negative grid voltages occurring successively at high frequency above and below that grid-bias point will have no effect on the average value of the anode current.

But if the grid is biased to a point on the bend of the curve the positive H.F. fluctuations will have a greater effect on the anode current than the negative ones.

So the average value of the anode current will rise and fall at a frequency corresponding with the low-frequency modulation of the H.F. current. Fig. 1 illustrates this clearly.

A TYPICAL VALVE CURVE



This is the grid-volts/anode-current curve of a valve suitable for anode-bend rectification. For best results the grid bias should be adjusted so that the operating point falls on the bottom part of the curve.

A single anode-bend detector circuit is shown at Fig. 2.

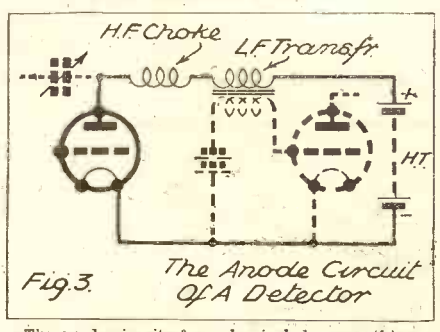
Anode-bend rectification has two advantages. Less H.T. current is used than with the more popular grid-leak method; and because there is little or no grid-current flow, less damping is imposed on the grid circuit, and thus greater selectivity is obtained. But the need for grid bias and the fact that it is not so sensitive are points against it.

A valve of fairly high impedance, i.e. 20,000 ohms or so, is usually recommended for anode-bend rectification.

ANODE CIRCUIT.

Sometimes referred to as the plate circuit, this comprises that part of the valve circuit connecting the anode of the valve to the H.T. supply, and thence to the filament or cathode, as in Fig. 3. In this case (Fig. 3) an H.F. choke and the primary winding of an L.F transformer are in the anode circuit.

THE ANODE CIRCUIT



The anode circuit of a valve includes everything which is in the path of the H.T. current on its way from the anode through the H.T. battery to the cathode.

ANODE CONVERTER.

The name given to an electrical converter designed to produce high tension from, for example, the 6- or 12-volt accumulator on a motor-car.

ANODE CURRENT.

The current which flows in the plate circuit. It is rated in milliamperes (thousandths of an ampere).

ARMATURE.

That part of an electrical motor or generator which rotates. Is also applied to the moving member of the electro-magnetic system of certain types of loudspeaker.

ARTIFICIAL AERIAL.

An alternative to the ordinary type of aerial, consisting of suitable inductance, capacity and resistance to provide equivalent electrical characteristics. Is used mainly for testing transmitters.

ASTATIC COIL.

A coil wound in such a way that its external field is limited.

ATMOSPHERICS.

Alternatively styled "X's" or "statics," these are interfering noises due to lightning or other natural causes. They are heard as crackles and gratings. But if such noises cease when the aerial and earth are disconnected, then some other reason for their existence must be suspected.

AUDIO-FREQUENCY.

A frequency of anything up to about 20,000 cycles. More often referred to as low frequency, or just L.F.

AUTO-TRANSFORMER.

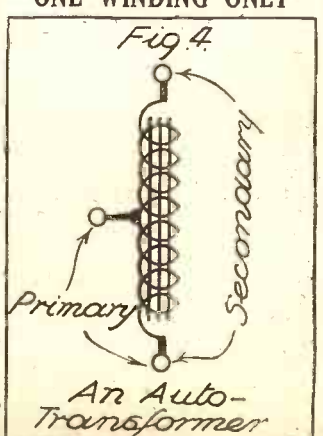
An H.F. or L.F. transformer in which the one coil serves as both primary and secondary windings (Fig. 4). Any coil, even of either the simple H.F. tuning or iron-core L.F. choke type, having one or more tappings, can be used as an auto-transformer.

The ratio is determined by the numbers of turns included in the primary and secondary circuits. It can be used as either a "step-up" or "step-down" transformer.

"Tapped Output Chokes" are used as auto-transformers especially in connection with Class B amplification.

(*Continued on page* 682.)

ONE WINDING ONLY



An auto-transformer consists of one winding only, different ratios being obtained by arranging suitable taps.

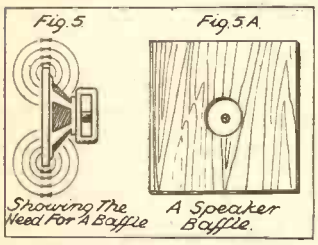
RADIO TERMS

(Continued from page 680.)

BACK E.M.F.

A voltage or electro-motive force set up in opposition to a flow of current.

IMPROVING THE BASS



Adding a baffle to a speaker has the effect of improving the low-note response. Without the baffle the sound waves from the front and back of the cone tend to cancel out, meeting over the edge of the chassis.

BAFFLE.

A screen to ensure that a loudspeaker diaphragm properly radiates. The high notes tend to leave the diaphragm in the form of a beam, but the low notes also bend round.

In the absence of a baffle low notes bending round from the front of the diaphragm meet those bending round from the back and are neutralised. That is why a speaker without a baffle (or a properly designed cabinet) may sound high pitched and reedy.

The simplest kind of baffle is a substantial piece of wood with a hole cut in the centre to accommodate the loudspeaker diaphragm. The wood should be thick, to prevent resonance (¾ in. or 1 in. at least), and the larger it is the better the baffling. Three feet square is a reasonably good size.

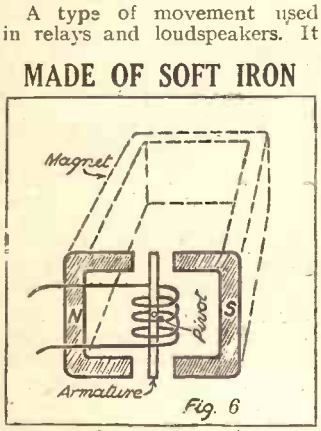
There must be no gap between the wood and the diaphragm edge or surround.

The baffle can be made in the form of a fire-screen.

BALANCED ARMATURE.

A type of movement used in relays and loudspeakers. It

MADE OF SOFT IRON



The soft-iron armature is mounted centrally between the two magnets, and it is free to move about a pivot.

would be true to add that it is sometimes seriously misused in loudspeakers! There is a great deal of misdirection and confusion in connection with it, and we have yet to see a text-book in which the principle is properly explained from a practical point of view.

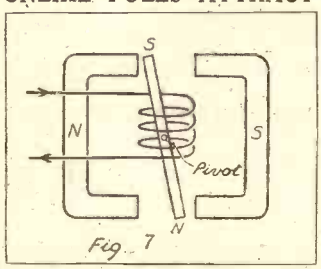
The theory of the balanced armature is straightforward enough, and it is a very pretty theory. The armature is of soft iron and centrally pivoted. It is placed between the pole pieces of a permanent magnet and through the centre of a coil of wire.

Like Poles Repel.

The pole pieces of the magnet are shaped so that a portion of each acts on opposite ends of the armature. This is clearly shown in Fig. 6.

When no current flows through the coil the armature is central. A flow of current makes this soft-iron armature into a magnet, and when the flow is in the direction shown in Fig. 7, the one end becomes a

UNLIKE POLES ATTRACT



When a current passes through the coil in the direction shown, the top of the armature becomes a S. pole. Therefore, as unlike poles attract, the armature swings over to the left.

south pole and the other a north pole, as illustrated.

Unlike magnetic poles tend to attract and like poles repel. Therefore the north pole of the permanent magnet attracts the south pole of the armature (which is also repelled by the south pole of the permanent magnet), and the south pole of the permanent magnet attracts the north pole of the armature, which swings over as shown.

No Reversal of Flow.

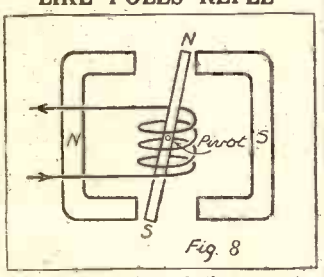
When the current through the coil is reversed, the polarity of the armature is changed, and it swings over in the other direction, as shown in Fig. 8.

That is the theory. But in fact it does not always work like that in practice. More often than not a balanced-armature loudspeaker is directly connected in the anode circuit of the output valve.

And there is no reversal of flow in the anode current of a valve. There is a rise and fall above and below an average value, this rise and fall being the low-frequency fluctuations representing speech and music.

This fluctuating current is often spoken of as A.C., but, although it conforms to many of the laws of A.C. and possesses

LIKE POLES REPEL



If the direction of the current through the coil is reversed, the upper end of the armature becomes a N. pole. Like poles repel, so the armature swings over to the right.

many of its characteristics, it is not true alternating current—in that it does not reverse its direction of flow in the circuit.

It is a unidirectional current that fluctuates in value.

Now let us see how our balanced armature is affected by this current.

When there are no speech or music fluctuations a steady current of, say, 8 milliamperes flows from the H.T. battery (Fig. 9).

Held by a Spring.

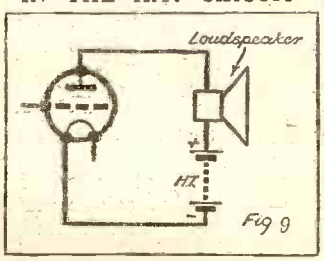
Obviously, this current will affect our armature. It pulls it over in the direction determined by the direction of current flow through the coil.

To overcome this, the armature in practice is held back by a spring.

When the current fluctuates at L.F., we have seen it rises and falls in value. This causes the magnetic pull on the armature to rise and fall, and so it vibrates and is thus able to operate a diaphragm and cause air waves to be radiated.

But in the absence of a *reversal* of current flow the full-balanced armature effect, with its reversals of magnetic poles, cannot occur. The only *balance* is a magnetic-cum-mechanical balance, as is plain to see.

IN THE H.T. CIRCUIT



When the loudspeaker is inserted directly in the anode circuit, the steady H.T. current tends to hold the armature to one side. A spring is usually provided to counteract this.

A balanced-armature loudspeaker cannot work in accordance with the above outlined theory unless an output filter or transformer is used. (Fig. 10.)

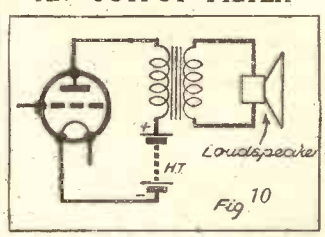
In this latter case the loudspeaker receives a varying current from the secondary winding of a transformer, and there is no "biasing" current tending to pull the armature over strongly all the time.

Alternating Current.

You see, the secondary winding of the transformer is quite unaffected when there is only a steady, unvarying current flowing through the primary winding. But variations in the strength of the current flowing in the primary induce an alternating current in the secondary: a current which rises from and falls to *zero* (see Alternating Current), and not one which rises above and falls below an *average*, as does the current flowing in the anode circuit of the valve.

A balanced-armature type of speaker will work quite well in the direct anode circuit connection, providing it has a spring adjustment enabling the armature to overcome the steady bias of the average current flow.

AN OUTPUT FILTER



With a true balanced-armature loudspeaker it is desirable to use an output filter, such as a transformer, and so isolate the speaker from the anode current.

As a matter of fact, the principle has been adapted by some loudspeaker manufacturers in a very clever manner, so that very good results in such circumstances are obtained, but in other cases so-called "balanced-armature" speakers hardly deserve the name.

Clear-Cut Performance.

Apart from these, the balanced-armature loudspeaker is in general deserving of attention in the case of the less powerful types of sets, despite the advance made by the moving coil.

It is sensitive, is particularly good on the higher notes, and is capable of giving a clear-cut performance.

Indeed, even now a good balanced-armature speaker is to be preferred to some of the cheaper moving coils, and probably it is destined to survive for a long time yet.

In some cases loudspeakers of this type are able to reproduce very fair proportions of the bass and should therefore be fitted with properly dimensioned baffles and cabinets.

RECEIVERS of RENOWN

THE COLUMBIA "C.Q.A. BATTERY FOUR" RECEIVER

Model 1001

THE "C.Q.A. Battery Four"—the title of this, the newest of the Columbia receivers—is as unusual as the performance of the instrument itself. What does C.Q.A. mean to you? If you are hearing it for the first time you may imagine that it is just another mysterious catch word made to do duty for a name when new names are so hard to find! But some of you will doubtless be aware that C.Q.A. means constant quality amplification, or Columbia's own method of ensuring that, whether the volume at which you receive a programme is loud or soft, the quality of the transmission remains constant.

Quiescent Push-Pull.

Now, this is something of the greatest importance. It has been achieved in this receiver by the use of two pentodes in an improved form of quiescent push-pull, and it is brought into action by the ordinary use of a volume control.

Consider, then, the advantages. You can regulate the volume of your programme to suit any particular occasion, and at the same time rest assured that you are always getting the very best and purest reproduction. The use of quiescent push-pull means that you are effecting a permanent saving of H.T. battery current, since the amount of current taken varies proportionately to the volume of the programme (the softer the volume the less the current consumption). Finally, these remarkable results are procured without any additional controls or "gadgets" through the ordinary operation of the receiver.

Contrariwise, then, the results of the "C.Q.A. Battery Four" are as unusual as its name!

Three-Stage Receiver.

The receiver is a three-stage one making use of four valves—a variable-mu H.F. valve, a transformer-coupled detector and two pentodes in push-pull, coupled to the detector by a 1 : 10 ratio L.F. transformer. The output transformer is mounted on the loudspeaker unit, this being of the permanent-magnet moving-coil type. In practice it has been found that an undistorted speech output of as much as 1¼ watts is obtainable. At the same time, the H.T. consumption averages only 9 milliamps, varying between a quiescent current of about 6·75 and a peak current of somewhere around 14. This is, of course, a remarkable figure for a receiver making use of pentodes in the output stage. But then the receiver *is* remarkable!

The cabinet of the "C.Q.A. Battery Four" is of Columbia design and workmanship. That is the same as saying that it embodies the best in modern cabinet practice without departing from the high standard of refined simplicity for which Columbia is renowned. But it allows the receiver to be completely self-contained, with the chassis at the top and the batteries on a shelf below. The speaker has been mounted so the full effects of a baffle approximately 18 in. by 14 in. are obtained.

TECHNICAL SPECIFICATION

CIRCUIT.—An H.F. band-pass receiver, with variable-mu H.F. valve; transformer coupled to detector, which is coupled to the output push-pull pentodes by a shunt-fed 1 : 10 ratio L.F. transformer.

SPEECH OUTPUT.—1¼ watts undistorted.

H.T. CONSUMPTION.—Quiescent 6·75 ma. Average 9·0 ma. Peak 14·0 ma.

CONTROLS.—Wavechange-gram switch. Tuning control (concentric with which is the on-off switch). Volume control.

PRICE.—11 guineas complete with valves and batteries.

SELF-CONTAINED

In this photograph the battery has been partly removed to show the arrangement of the loudspeaker and the battery leads.

Approaching a test of this new Columbia instrument, we first take a look at the three controls—and there are only three—on the front of the cabinet. In the centre is the tuning control which drives the three-gang condenser, indicating the wavelengths on an illuminated scale. The on-off switch, which breaks all three battery circuits—H.T., L.T. and grid bias, is mounted concentrically with the tuning knob.

On the left is a three-position wavechange switch which cuts out the long-wave coils for operation on medium waves, and in the "gram" position connects the pick-up terminals into circuit. The position of the switch is ingeniously indicated by the illumination of the appropriate scale, while in the "gram" position both scales are illuminated.

Triple Action Volume Control.

The remaining control, on the right, is worthy of special attention, for it provides a triple-action volume control. Briefly, the working is as follows: When the control is at the maximum, sufficient reaction is introduced (with none of the potentiometer resistance in play) to cause oscillation. Turning the control towards minimum, the potentiometer resistance is gradually introduced and the screen voltage on the H.F. valve is as gradually reduced. Finally, in order to provide operation on the most powerful signals, the aerial is slowly shorted to earth. And not for one single instant is quality impaired.

There you have the "C.Q.A. Battery Four"—a receiver which on the face of it couldn't help giving good results. But the "hope-for-the-best" days have long since departed, and the test bench alone is the proof of quality to-day.

Remarkably Fine Results.

On test, then, the new Columbia receiver was found to give really excellent results. And this means really excellent results under conditions which have been made stringent enough to pick out the outstanding performances from the merely good results. The sensitivity was better even than we had expected, and we were able to test the effects of C.Q.A. itself on many of the Continental programmes as well as on all the British stations. And for this purpose the selectivity gave every satisfaction.

When it comes to handling a C.Q.A. receiver there can be no question of constant quality amplification remaining but a name. Even a moderately discriminating ear can discern the advantages as the volume is regulated between its wide limits.

Thanks to the H.T. battery, which has been designed to work with the Marconi valves, the matching of the pentodes was perfect, and the figures we have given above for current consumption were maintained throughout the tests and can definitely be said to constitute a saving in battery costs.

The "C.Q.A. Battery Four" is a receiver of unusual distinction. The association with it of the name Columbia should make it a receiver of unusual renown.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos.

Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

HOW TO FIND WHICH MAIN IS NEGATIVE AND WHICH IS EARTHED.

L. G. (Liverpool).—"Is there an easy way of telling which is the negative main of a D.C. supply?

"In addition, can you give me details of a good method for finding which of the mains, positive or negative, is connected to earth, as I believe it is one way for some houses and the opposite way for the others?

"Please explain fully, as I don't want to get a shock."

Your last proviso, L. G., is a very natural one. Nobody likes shocks! But we hope that you realise that it is not safe for anyone not experienced in electrical matters to interfere with house wiring.

The following tests are those usually employed but they should be carried out by a person of experience if all danger is to be avoided.

To find which main is negative, make a simple electrolytic cell by dissolving a couple of pinches of salt in a tumbler of water. Insert into this water two bared leads from the mains, securely fixed to *opposite* sides of the tumbler, but nearly touching under the surface of the solution.

In one of the leads (it does not matter which) there should be placed a lamp, of the ordinary household type, to limit the current flow in case of an accidental short circuit.

When the switch is placed in the "on" position it will be found that bubbles will rise from the ends of the wires under water. And one of the wires will be seen to bubble much more freely than its fellow.

The wire which has the excess of bubbles is the negative.

Now for the second test. All that is necessary to find which of the mains is the earthed wire is to wire up a household lamp as follows:

Connect one of the wires going to the socket in which the lamp is placed to earth. (A water-pipe or buried earth plate will do, and a "bayonet" socket for baseboard mounting is ideal for the lamp.)

Join the other side of the lampholder to a flexible wire, which can be touched in turn on the negative and positive mains wiring.

It will be found that when the flex is flicked on one main nothing happens. But when it touches the other the lamp will light.

The main which, when touched in this way, does *not* light the lamp is the one that is earthed.

It will thus be seen that the tests are quite easily carried out; but don't forget that the electricity supply company may have made it a condition of your supply that the wiring is not interfered with except by a qualified electrician.

TESTING FOR A BREAK.

T. S. W. (Southampton).—"May I refer to R. V M.'s (Billingshurst) problem in November 4th, 1933, 'P.W.,' when the programme suddenly drops to a whisper? My set is giving the same trouble as R. V. M.'s three-valver, except that mine, once faded, stays faded. It very seldom bursts forth into volume again until I switch the set off by means of the on-and-off

(*Continued on next page.*)

"P.W." PANELS, No. 147.—POZNAN, POLAND.

Most of the Polish stations are well received in this country, but Poznan is difficult to find, even on a powerful set, unless conditions are exceptionally good. His power is only 1·9 kilowatts.

* * *

The wavelength is 334·4 metres, which is about halfway between the Brussels No. 2 and Poste Parisien dial-readings. In addition to the name of the station, the words "Polskie Radio" will help to identify its transmissions.

* * *

Poznan is about 728 miles from London.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

push-pull switch and then switch on again, when it will burst forth into full volume again.

"I have examined the switch, and it is making splendid contact. As you have stated in the November 4th issue, I have made a thorough examination of all leads and their contacts, and all contacts are clean and wires unbroken.

"I have also prodded the set wiring with a penholder (wooden), but all connections are tight and no wires touching.

"How can I test my components with phones and battery to see if the fault is here?"

The test referred to is easily carried out as follows: One tag of the phone should be connected to one terminal of a dry cell, and two flex leads should be connected, one to the remaining phone tag and the other to the remaining terminal of the dry cell (a flashlamp battery is quite satisfactory).

It should be noted that a loudspeaker may be used in place of phones, if desired.

These two flex leads, if now momentarily touched lightly together, will produce a strong double click in the phones, one click when they make contact with each other and another when they are separate again. They may thus be used for testing for continuity in leads, etc., since the loud double click is ample evidence that everything is satisfactory.

The case of a bad fault, such as a break between the terminal and the plug or socket on a coil holder to which it is connected may now easily be detected, since, if one flex lead is connected to the terminal and the other to the side of the holder to which the terminal should make connection, absence of the double click is positive evidence that the component is faulty.

On the other hand, if one of the flex leads is connected to the socket of the coil holder and the other to the plug, if a double click is heard there is a short circuit across the holder.

Similar tests may be made with valve holders, both for testing for a connection between each terminal and its socket and for testing for short circuits between the sockets.

Variable condensers may also be tested by this method, a short circuit between the plates giving rise to the usual double click, which should *not* be present in the usual way.

(It is, of course, essential to see that all leads are removed from the components under test and also that no coils are in position in the coil sockets when these are tested.)

Complete circuits may also be tested for continuity in this manner. For example, if the aerial-tuning condenser is in parallel with the coil in a simple tuned aerial circuit, one flex lead placed on the aerial terminal and the other on the earth terminal will give a certain test for continuity between these points.

It will be seen from the foregoing that this method may be extended to tests for almost any component or circuit where it is desired to find a complete break. But in a case like yours, where the break is only partial and intermittent, the test is not quite so simple. Whereas a complete break would show up instantly, a bad-contact break will have to be "stimulated" into activity, and generally this can be done by gently prodding any suspected wires or connections or by shaking the component in question.

(Continued on next page.)

DO YOU KNOW—

the Answers to the following Questions?

There is no "catch" in them; they are just interesting points that crop up in discussions on radio topics. If you like to try to answer them, you can compare your own solutions with those that appear on a following page of this number of "P.W."

(1) What are the principles by which a Westector Economiser can effect a great saving of H.T. battery current?

* * *

(2) The Government receives more than half of every ten-shilling licence fee. About what proportion of the remainder is spent by the B.B.C. on (a) Programmes and (b) Engineering?

* * *

(3) If a differential reaction condenser is "reversed" in action, giving an increase when turned to the left, instead of to the right as usual, how can it be cured?

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

If there is a joint in it which is loose enough to give trouble when the set is in action in the ordinary way, such a test carefully carried out should certainly show it up.

But in this case, to prevent the battery being run down too quickly, connect a good-quality high resistance between the phones and battery. This will still enable clear clicks to be obtained, but will prevent wastage of the battery current.

A SHORT-WAVE ONE-VALVER.

G. E. F. (Gt. Bowden, Leics.).—"In which number of 'P.W.' was the 'W. L. S. Short-wave One-Valver' described? And is it obtainable now?"

The "W. L. S. Short-Wave One" was described in "P.W." dated April 16th, 1932. We regret to say that this number is now out of print.

An excellent short-wave two-valver was described in our November 18th issue, and, if this cannot be obtained locally, application may be made direct to the publishers.

The address is The Amalgamated Press, Ltd., Back Number Department, Bear Alley, Farringdon Street, London, E.C.4. Price 4d. per copy, post free. If, however, you prefer to wait for a "P.W." one-valve short-waver it will not be long, as a design is now going forward in our Research and Construction Department.

LOUDSPEAKER TOO CLOSE TO THE VALVE?

M. R. (Chelmsford).—"I think I have seen in your paper a reader's complaint that his set would gradually work itself up into a fierce howl.

"I can't find it now amongst my old numbers, but I am having the same trouble, and should be very pleased if you can tell me how to stop it.

"It is deafening, and sometimes happens twice in an evening, without any reason that I can see. The only way to stop it is to switch off and wait a minute. Please say what can be done."

The gradual building up into a louder and louder howl is characteristic of a microphonic valve.

It is generally the detector that causes the trouble. And the cause is that the valve gets slightly shaken in its holder, possibly by the sound waves coming from a loudspeaker which is placed too close to the set.

If the loudspeaker is not a fixture in the set, move it a little farther away.

If, however, this is not practicable, you must protect the valve from the vibrations. A well-sprung valve holder, instead of a rigid one, is often a complete cure. But sometimes it is better to shield the valve by encasing it in an old valve box or similar protective covering, preferably lined with cotton wool.

Prevent it from being shaken when in action, and the valve should give no more trouble.

THE ANSWERS

TO THE QUESTIONS ON PAGE 685 ARE GIVEN BELOW.

(1) When the Economiser is used the valve is originally over-biased to reduce current. This is no drawback when the grid voltage input is small; and when a large input has to be handled some of the valve's output is rectified and automatically applied to reduce the excessive grid bias, and thus restore the valve's power-handling capabilities as long as necessary.

* * *

(2) The B.B.C. spends about 2s. 6d. of their share of every 10s. fee on programmes, and nearly 1s. on engineering upkeep, including plant and engineers' salaries.

* * *

(3) By reversing the connections to the two sets of fixed vanes.

* * *

DID YOU KNOW THEM ALL?

"POPPING LIKE A MACHINE GUN."

"PUZZLED" (Leith).—"Could you inform me what you think would be the best way to remedy the fault in my set?

"The set is a four-valve one: first valve an S.G. with anode and aerial tuning. It is a made set, not a bought one, and I don't know the make. Well, the fault is, when I put correct leads from set to H.T. battery the set goes popping like a machine gun, and no other music or speech is heard.

"When I alter leads to different H.T. voltages, it goes O.K.; but when you go to tune-in the anode dial it howls, and when you take your hand away the station fades away, too, more so on the lower band of the dial.

"When set was working as described I tested to see the milliamps the set was taking with a Pifco All-in-One Radiometer, and found the needle would not stay stationary."

This form of instability may be merely a lack of proper decoupling, or it may be due to faulty construction or spacing.

We should find it much easier to diagnose the fault if you had stated whether the set had been going correctly before, and whether the H.T. battery is new or old and had been giving satisfaction before it was tried on this set.

An old H.T. battery is quite sufficient to cause the trouble; and of course bad layout or wrong wiring might be the culprit. (You can decide whether that is likely by comparing the results now obtained with those which the set gave before.)

If, however, it is merely a need of decoupling, this can easily be remedied, as follows:

Insert a resistance (preferably an Ohmite or similar reliable type) of about 30,000 ohms in the H.T. lead which feeds the detector valve.

(Probably there is a separate lead for this purpose, but if not you can easily get an experienced friend to alter the set to provide for separate detector H.T.; or else write to the Technical Query Department describing the present connections of the detector valve's plate circuit, so that the necessary alterations can be described.)

When the resistance has been inserted in the lead, connect a large fixed condenser of at least 1-mfd. capacity (preferably of 2-mfd.) between the set-side of this resistance and L.T. —. That is to say, one condenser terminal to the H.T. + terminal in question and the other condenser terminal to L.T. — or to earth, or other convenient point that is joined to L.T. —. This will cure the trouble if it was due to lack of decoupling.

MIRROR OF THE B.B.C.

(Continued from page 658.)

It will deal with fragments of twenty years ago—just little things, perhaps, but typical of the year before Europe was plunged into war. The pages of the "Scrapbook" will be turned by Bransby Williams.

Relay From Nottingham.

Part of Handel's "Messiah," performed by the London Symphony Orchestra, conducted by Sir Hamilton Harty, will be relayed for Midland Regional listeners from the Albert Hall, Nottingham, on Saturday, December 16th.

Northern Ireland listeners will also hear a part of the same work on the previous evening, when it will be performed by the Belfast Philharmonic Society.

It is worth mentioning that Ireland has the credit of introducing this oratorio to the world. It was first performed in Dublin on April 13th, 1742, with Handel himself presiding.

Further Christmas Features.

On Friday, December 22nd, the Cornish Nativity play, "Bethlehem," will be relayed from St. Hilary for National listeners, who earlier in the day will have heard a relay from the fortieth annual banquet to the little Londoners, relayed from the Guildhall.

On the same evening Regional stations will give "The Kentucky Minstrels" Christmas show, which Harry S. Pepper is producing, and which will be repeated the following night as part of the National programme. Quite enough here already to keep us at home on one or two nights, according to our tastes!

The programmes for Christmas Eve (Sunday, December 24th) will include the usual carol services relayed from King's College, Cambridge, and St. Mary's Church, Whitechapel.

On Christmas Day itself there will be a morning service from Christ Church Cathedral, Oxford. The outstanding part of the programmes, however, will be the afternoon transmission leading up to the King's broadcast from Sandringham.

Later, listeners will have the choice of hearing a revival of "Heigh Ho! The Holly" and the pantomime, "Sinbad." There is also to be a broadcast of an act of one of the Gilbert and Sullivan operas, by the D'Oyly Carte Company itself, before the dance music starts up in the studio.

Surprise Items.

There was never anything in the wireless programmes quite so fascinating to listeners as the surprise items of a few years ago. Their element of uncertainty until they had actually begun, which was the essence of their constitution and gave them their name, was all part of the joy of listening.

Because people did not know what was in store for the next fifteen minutes or so they were anxious to hear it. Had the details of the particular item been published in advance a good many listeners would have given it a miss.

Surprise items increased in popularity at a speed which was truly terrific. John Macdonnel,—who originated them, worked like a Trojan to find more and the B.B.C. doing its best to fulfil the demand, provided him with assistance, and changed the name to the more ambitious sounding "Diversions."

All went well for a time, but the pace had been set too hot. The result was that the standard deteriorated as good ideas became weak and exhausted, and so "Diversions" just died, or rather killed themselves.

Since then various attempts have been made to resuscitate the idea of surprise items by the inclusion of topical features in the programmes. These items have been announced in the ordinary way over the microphone, although in many cases they were arranged too late for inclusion in the published programmes. Quite a number of items of this sort have been broadcast during the last few months.

Now the idea is being taken up by the various Regions. In the Midland Region a start will be made on Monday, December 11th, under the title of "Stop-Press."

A quarter of an hour will be given over to the feature, which is to be repeated on every Monday night throughout the winter, with the exception of Christmas and New Year's Days.

Short-dated announcements will be made, whenever possible, of what listeners can expect to hear, such as a "turn" by a star artiste visiting the Region, or a talk, or an outside broadcast on any event which has suddenly become red-hot news.

Microphone Tours.

The North Region intends to work on somewhat different lines. Instead of bringing people to the microphone, the microphone will be taken to places and to events of which the average listener knows nothing, and to which he would not normally have access.

"Microphone Tours" seems to be just the right title, especially as to all intents and purposes they are to be mystery tours to listeners until they actually get started.

The North Region has many activities eminently suited to this type of microphone treatment and which cannot be included in the ordinary programmes. "Microphone Tours" start on the North Regional wavelength on Friday, December 15th.

REPLIES TO S.T.500 QUESTIONS

(*Continued from page 657.*)

page wiring diagram of the set was given in POPULAR WIRELESS dated November 4th, page 397.

Q. I have obtained a Class B speaker, but do not know how to connect the three terminals.

A. Two of the terminals (no doubt the outer two) go to the terminals L.S.— and L.S. +. It does not matter which goes to which. The third terminal (the middle one) is connected to H.T. + 3 on the terminal strip of the set (see page 397, POPULAR WIRELESS, November 4th).

Consult the maker's instructions regarding which are the Class B terminals.

Q. In your "Rapid Guide" you say wire (67) goes to the upper terminal F2 of the reaction condenser. The upper terminal is marked F1 on the drawings.

A. This misprint should mislead no one, as all the drawings are correct. All builders should note the correction given on page 536 of POPULAR WIRELESS dated November 18th, 1933.

Q. Can I use an S.G. valve of the P.M.12 type?

A. Readers who have such valves can most certainly try them. They will get better results with the "S.T.500" circuit than with any other, but I advise the later type of S.G. valve, such as the P.M.12A., 220S.G., etc. These valves will give full aerial reaction with the anode coupler at zero, whereas with the older types one has to have the anode coupler part of the way clockwise.

THE LISTENER'S NOTEBOOK

(*Continued from page 658.*)

The Roosters must never be allowed to become extinct, even if war does. That wonderful spirit of camaraderie among the troops, by which alone men were able to survive those eventful war years, is something that must be preserved.

Percy Merriman and his little band of old soldiers present a programme of items all of which faithfully portray this spirit and make a good argument for the contention that old soldiers should never die. An annual appearance before the microphone, which seems to be the rule or privilege of the Roosters, is absurdly inadequate.

* * *

Rex Evans' show, "Variety on Trial," atoned for a good deal of what is becoming stale in the week's programmes now. It was cheerful. Elizabeth Pollock, especially as Sybil Thorndike, was perfect. John Tilley was excruciatingly funny. I laughed real laughter over him. I liked Elisabeth Welch, too, and certainly better than I do most soft-voiced singers

* * *

It is about this time of the season that excessive listening to the wireless begins to tell its tale. Those of us who refuse to indulge in discriminate and intelligent listening, as we are often urged, are feeling a bit grumpy and dissatisfied with the week's fare.

I confess that I am of that number. I find little satisfaction, for instance, when I reflect on all that has come over the air during the last few weeks. I even felt dissatisfied with Mais' weekly talk—especially with the one from Seattle. Admitted, the only fault was the bad conditions of the relay, but I wasn't in a charitable enough mood for making allowances.

* * *

It is much the same feeling one used to experience in one's schooldays. The eighth or ninth week of the term was always one that had to be navigated with care and tact. Things generally went wrong that week, and only because everybody was feeling a bit bored.

So it is with listening to broadcasts. We are getting a trifle stale. The talks, you notice, have all reached Number 8 or 9 in the series. I've said before in these notes that talks should never contain more than a dozen to a series. I still think the same.

TWO RADIO MYSTERIES SOLVED

(Continued from page 672.)

Supporting experiments presented by Mr. Watson Watt in the Library of the Royal Institution after the lecture well illustrated the behaviour of these incoming particles when influenced by the magnetism of the earth.

Streams of electrons in a vacuum tube were shown to strike a model of the earth near the magnetic Poles and to avoid the tropics by being caught up and deflected by the earth's magnetic field. The very complicated paths followed by the electrons —often looping back on themselves— realistically imitated auroral displays.

In another experiment devised by Mr. Watson Watt the wireless methods used in the Arctic Circle expedition were imitated by a model in which sound waves travelling at 1,100 ft. per second took the place of wireless waves travelling at 1,000 million ft. per second. The electrified layers were represented by a board by which the sound waves were reflected.

As the board was moved up and down its height above the ground was measured by the delay imposed on the waves in returning to the transmitting and receiving station below it. The "splitting" of echo signals, which in the case of electric waves causes fading and distortion in long-distance communications, were also strikingly reproduced.

The actual receiver used by the Arctic Circle expedition was shown in operation in measuring the height of the layers over London, using pulses of energy emitted from King's College, Strand. Professor Appleton also showed a film prepared by the National Physical Laboratory (Radio Research Station, Slough) further illustrating these wireless-echo measurements and the variability of the layers.

HOW TO BUILD A D.C. SET

(Continued from page 676.)

holders and horizontal resistance holders being placed upon a strip of thin card before being screwed down on the chassis.

Wiring should be carried out with good rubber-covered wire, such as that specified in the components list, and not with the ordinary wire and sleeving. This latter is not always safe where the voltage is to be above 100 volts, and should not be used for mains sets if there is any chance of high-voltage leads touching earthed points.

It should be noted that the reaction condenser and the volume control are mounted on metal brackets, and the spindles of these controls are used as earth connections via the brackets. In the case of the radiogram switch the spindle is *internally* insulated, so that the switch mechanism is isolated from the bracket.

The Shielded Leads.

Part of the wiring, including the pick-up lead that has to cross the underside of the baseboard, should be carried out with shielded wire, as shown in the diagram. This is then clamped down to the baseboard with a strip of aluminium or brass.

Check up all wiring very carefully as mistakes in mains receivers can be very trying. Next week the first test and operation of the set will be described.

THE LINK BETWEEN

(Continued from page 666.)

matched up to any set. As a matter of interest the makers guarantee that there is no set from which it will not work perfectly as a moving-coil speaker extension. They further claim that suitable adjustment of the switch arm provides a volume-control effect independent of the set volume control.

A further useful feature is that the switch at the back is provided with an "off" position for switching out the extension speaker only.

The price of this new W.B. speaker is 33s. 6d. in chassis form and 48s. 6d. in a walnut-finished cabinet of characteristic W. B. design. For the Christmas season "Equilodes" are available in special "Christmas gift" cartons.

Important Change of Address.

I have been asked to call attention to the fact that the head office of the Edison Swan Electric Co., Ltd., has recently been transferred from Queen Victoria Street to 155, Charing Cross Road, London, W.C.2, to which address all future communications should be addressed. The new telephone number is Gerrard 8660.

Will our wholesale and retail friends kindly note that business at the trade counter at 228, Upper Thames Street, is being carried on as usual?

Two New Mullard Rectifiers.

The Mullard Wireless Service Co., Ltd.—well to the fore, as usual—has recently announced the release of two new full-wave rectifying valves, the I.W.2 and the I.W.3. They are both of the indirectly-heated type, and are rated to give rectified outputs of 60 milliamps at 250 volts and 120 milliamps at 350 volts respectively.

The great advantage of an indirectly-heated rectifier, of course, is that when it is employed in a receiver fitted with an indirectly-heated output valve, the cathodes of both receiving and rectifying valves heat up at exactly the same rate, so that sudden H.T. surges are eliminated and the need for a thermal-delay switch is dispensed with.

Both of these new Mullard rectifiers are fitted with standard four-pin bases.

Important R. & A. News.

That great minds think alike has just been brought home to me in a most convincing manner by a letter that has arrived from Messrs. Reproducers & Amplifiers, Ltd.—that very famous Wolverhampton loudspeaker manufacturing concern.

It arrived on the very next day after I had written the first item for these notes, and it was to advise me of an entirely new R. & A. innovation designed with almost the same idea in view as that of the Whiteley Electrical Radio Co., Ltd.

Naturally, I am quietly rejoicing. To be honest, nothing pleases me more than genuine enterprise on the part of our own radio manufacturers, and that two such prominent speaker concerns should have tied for first place in the fulfilment of a long-felt want is gratifying in the extreme.

I wish them both the very best of luck, and I am confident that the demand for these new "universal" speakers will amply reward their enterprise.

Before leaving the subject, may I add just a final word or two about the new R. & A. model?

It is to be known as the R. & A. "Multex," and is available in cabinet and chassis form at 45s. and 30s. respectively. The cabinet, incidentally, is walnut finished.

The R. & A. "Multex" is fitted with a transformer which is truly "all-purpose," and it can be matched up to any output valve, whether high or low-impedance triode, pentode, Class B, Q.P.P. or straightforward push-pull. Thus it is pre-eminently suitable either as an extension speaker or as an original speaker for use with any type of set. How things have changed since I was a lad, when the only "matching" that we knew anything about was that of earphones to a suitably sized pudding basin!

New Multitone Booklet.

An interesting book which tells you practically all you want to know about the theory of Class B amplification has just been published by the Multitone Electric Company.

It is available free of charge to "P.W." readers under our postcard scheme. **(No. 68)**

For Battery Users.

I am advised by the General Electric Co., Ltd., that supplies of their new V.P.21 are now available.

The V.P.21 is of outstanding interest in that it is the first H.F. pentode for two-volt battery sets. Now what about it, battery users?

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way—just quote the number or numbers.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

The Output Stage.

IF you are thinking of duplicating or improving the output stage in order to get greater volume—or in order to *handle* effectively a greater volume output from the set—you should certainly consider the use of a push-pull arrangement of two output valves. This arrangement is, in my opinion, very much better than using valves in parallel in the ordinary way; and, in fact, it has such very definite advantages that, although it has gained greatly in popularity during the past year or so, it is surprising that it is not used to an even greater extent than it is. More recently we have had various modifications and elaborations of the push-pull system, but the general principle remains the same.

Push-Pull Arrangement.

The simplest arrangement is with a centre-tapped secondary to the coupling transformer between the output stage and the previous stage, the ends of this transformer secondary going to the grids of the two push-pull valves.

The anodes of the two push-pull valves are connected to the ends of a centre-tapped primary of the output transformer. The centre tap on the secondary of the next-to-last transformer is connected through the grid-bias battery to earth, so that in this way the one grid-bias battery supplies the grids of both of the push-pull valves.

The centre tap of the primary of the output transformer goes to high-tension positive, and therefore supplies the anode voltage to the plates of both the valves.

Its Advantages.

There are many advantages about this push-pull system. One advantage is that, since you have an arrangement somewhat similar to full-wave rectification, the anode current flows in opposite directions through the two halves of the centre-tapped primary of the output transformer, and therefore there is virtually no magnetising of the core of this transformer; the result is that the effective inductance is much greater than it would be if there were a D.C. current flowing in the winding. It is in consequence of this that the push-pull arrangement enables you to get a better response in the lower register.

Low-Frequency Instability.

Another point is that there is much less tendency to low-frequency instability and also a much bigger grid swing can be used, owing to the fact that the valves are in opposite phase and so the conditions which would make for distortion tend to correct one another and cancel out.

The push-pull arrangement is, as I mentioned, much better than valves used in parallel, and, in fact, it is often said that by adding one valve to the output valve—by the push-pull arrangement, of course—you get as much benefit as you would by

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

adding two or three valves on another arrangement.

Selectivity.

Owing to the trend of radio developments, we are always in need of more and more selectivity, and that is one of the points which most frequently crops up in readers' letters. In their desire to sharpen up the selectivity of sets many readers go to endless trouble with the aerial, shortening it and adjusting its length, but, as a matter of fact, a good deal can be done by means of a preset condenser in the aerial lead.

IMPORTANT

Will readers please note that the Presentation Book Token No. 8 for Mr. Scott-Taggart's

MANUAL OF MODERN RADIO

appears on the back cover of this week's issue of "POPULAR WIRELESS."

Readers who reserved their copies of this book on October 21st last will now have collected eight Gift Tokens. They should affix these to their Gift Voucher and forward the completed Voucher according to the instructions thereon—enclosing the necessary remittance, according to whether they have reserved the Standard or the De Luxe edition of the Manual.

SEND AT ONCE !

There will be tens of thousands of copies of the Manual to send out and applications will be dealt with in strict rotation.

The earlier you send your completed Voucher, the sooner you will receive your copy of the Manual.

The MANUAL OF MODERN RADIO cannot be obtained in any other way than by affixing the eight Tokens to the Gift Voucher, and sending the necessary amount to cover the carriage, packing, insurance, etc.

Those readers who did not reserve their copy of the Manual until October 28th will still have one more token to collect ; those who reserved on November 4th, two more. These tokens will appear in the issues of "POPULAR WIRELESS" dated December 16th and 23rd.

Please Read the Instructions on Your Voucher

Completed Vouchers, together with the necessary remittance, should be sent to "POPULAR WIRELESS," Presentation Book Dept. (G.P.O. Box No. 184a), Cobb's Court, Broadway, London, E.C.4.

This is extremely convenient for adjusting the effective length of the aerial, and the only point is that if you are using plug-in coils it may be that you will need to use a larger tuning coil in order to get in the medium wavelengths.

Band-Pass Units.

One of the really best ways of improving selectivity, however, is to use a band-pass coil. As you know, there are various types of band-pass units on the market, but you can use plug-in coils for the same purpose provided you take care to screen the variable condensers and the coils from each other.

In the ordinary arrangement you have

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

the coil, say number 60, with variable condenser of, say, ·0005-microfarad connected across it, and another circuit of exactly the same dimensions, these two connected together at one point only, namely, at one end of each of the coils, this point being also connected to earth.

Inasmuch as the two circuits touch at only one point, any coupling between them is brought about by inductive coupling between the coils, and the arrangement may, therefore, be considered as a loose-coupled tuner or—if, as already mentioned, the tuning condensers and coils are kept carefully screened from one another—it may be regarded as a band-pass circuit.

NEXT WEEK

THE

"VOL-PEN" TWO

Full details for building this powerful and compact receiver.

ALSO

INSTALLING YOUR D.C. RECEIVER

Excessive Coupling.

This question of the screening is most important, because if you get too much coupling between the circuits you will *not* get band-pass results; in fact, you will simply have two coupled tuned circuits, which is not at all what you want.

It is sometimes an advantage to insert a fixed condenser of, say, ·01 microfarad, between the common point of the two coils and the common point of the two condensers—that is, common to both circuits. The side of this condenser which connects to the two variable condensers will also go to earth.

The aerial may be brought to a tapping on one of the coils, whilst the other coil is left untapped. You may wonder what is the use of this condenser. Well, although it may sometimes reduce the signal strength slightly, it has the effect of making the band-pass arrangement work more smoothly over a larger tuning range.

THE WIRELESS LEAGUE

The annual general meeting of members of the Wireless League will be held on Friday, December 15th, at 3.15 p.m., at 12, Grosvenor Crescent, Hyde Park Corner, London. The chief business will be to receive the annual report and statement of accounts, and the election of committee for the ensuing year. In the chair will be Sir Arthur Stanley, Chairman of the League, and all members are cordially invited to attend.

A B.B.C. ANNOUNCEMENT

New Wavelength Changes.

THE B.B.C. announces that, in accordance with the Lucerne Wavelength Plan, the following will be the frequencies and wavelengths to which the British transmitters will change on January 15th, 1934:

STATION	Kcs.	Metres
Daventry National (5 X X)	200	1,500
North Regional	668	449·1
Midland Regional	767	391·1
Scottish Regional	804	373·1
London Regional	877	342·1
West Regional	977	307·1
North National	1,013	296·2
Scottish National	1,050	285·7
Belfast	1,122	267·4
London National / West National	1,149	261·1
Aberdeen	1,348	222·6
Newcastle	1,429	209·9
Plymouth / Bournemouth	1,474	203·5

The B.B.C. is attempting to make other arrangements for Aberdeen, and therefore the wavelength on which this station will work, as shown above, may be modified.

It will be noticed that with the possible exception of Bournemouth, which moves from its present wavelength of 288·5 metres (1,040 kcs.) to 203·5 metres (1,474 kcs.), the changes in the wavelengths of the British transmitters are small. It is unlikely, therefore, that they will cause difficulties to listeners using modern receivers.

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Post this at once in an unsealed envelope (½d. stamp) to:—
"Children's Classics," Daily Sketch,
196, Gray's Inn Road, London, W.C.1.

It is understood that by filling in this form a reader incurs no liability whatsoever. The set of books can only be sent after the Presentation Voucher is completed and returned with 15 Tokens to the "Daily Sketch."
(Do not send any money with this.)

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POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
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AERIAL TROUBLES
B.B.C. MONEY
THE "LIKKA"
RADIO SURVEY

RADIO NOTES & NEWS

A "TRANSDUCER"
BROADCAST TRIALS
CANNED PROGRAMMES
MERELY COINCIDENCE?

These Terrible Aerials.

THERE have been several instances recently of landlords writing to the papers about wireless firms fixing aerials to roofs, chimney stacks, etc., without permission. But I have no doubt that the tenants gave them the permission. Does, then, the tenant have to seek his landlord's permission, assuming that the tenancy agreement does not mention it?

He might perhaps be expected to do so out of courtesy; but I see little difference between putting a hook in the wall for supporting one end of a clothes-line and putting a hook on a roof to support one end of a much lighter line—an aerial. Why some people are so touchy about aerials beats me.

The Clothes-Line.

AND mention of a clothes-line reminds me that somewhere in Scotland somebody is in trouble because he stretched his aerial across a street or public way, in defiance of an old ordinance which forbids citizens to hang a line over a public way or to hang clothes thereon.

The problem which confronts the authorities is whether the "line" means a clothes'-line only, or any line which might be used for clothes, flags, telephone, telegraph, power—or as an aerial.

I wish them the joy of their task, rejoicing meanwhile that I never got nearer the Bench than to pay a fine for forgetting to renew a dog licence.

Is the B.B.C. Subsidised?

I WOULD not inflict another paragraph about this on you were it not quite an important point. I have already demonstrated from its own Charter that the B.B.C. is subsidised by Government grants, but E. H. (Whitefield) still thinks that I am wrong. He compares the B.B.C. with an insurance company which receives a part of the premiums collected by its agents, and suggests that the company is not thereby subsidised by its agents.

That is fallacious, because the agents collect *on behalf of the company* and retain their commission, whereas the Post Office collects the licence fees on its own behalf and would still do so if broadcasting were abolished, though it would not collect so many. Never mind, E. H.! We will agree to differ.

A Sporting Offer.

AS we have observed before, the American ether has been turned into a mere battleground, with dollars as the objective. Crooners thrown in as bait!

During October a company was announcing through K M O X, St. Louis, that money orders for liquor could be placed "right then," money to be refunded, plus six per cent interest, if repeal of "prohibition" did not come. The scheme was entitled "Money Back Likka." The man who sent me this information believes that American-English is purer than English-English! May he be enlightened!

OUR SPECIAL FEATURES

POPULAR WIRELESS has always regarded its regular features as the backbone of the journal. After innumerable early experiments, during which time many contributors were given opportunities of showing what they could do, a band of regular writers, each pre-eminent in his own sphere, was gradually gathered together.

Since then Ariel has earned thousands of friends with his intimate, characteristic topical notes. Dr. Roberts has created a very great following for his more technical feature, and "W. L. S." has achieved the proud position of being the foremost writer of short-wave notes.

Broadcasting and Programme events are covered by "O. H. M." and "The Listener," and the importance of their respective features can be gauged by the number of times extracts from their writings have been reproduced, with and without permission, in other journals.

Our Technical Editor's informative and interesting comments on new apparatus are probably the widest read items of this nature in radio journalism to-day and the "Radiotorial" feature has also proved immensely popular.

Finally, G. T. Kelsey's "Link Between" is one further "P.W." example of the facility with which a skilled pen can present informative material in a divertingly interesting manner.

POPULAR WIRELESS IS PRE-EMINENT

A "Live" Short-Wave Club.

THE International Short-Wave Club informs me that the membership fee has been reduced to 4s. per annum for members who join within a certain period. For that sum you can enter one of the most far-flung fraternities in the world.

Mr. Arthur E. Bear, the club's European representative (10, St. Mary's Place, Rotherhithe, London, S.E.16), tells me that he will be pleased to send to all "P.W." short-wavers who will provide him with a 1½d. stamp a "World Time Chart."

The A.-A. R. and T. Society.

THE Anglo-American Radio and Television Society is organising four new branches — Glasgow: Sec., Mr. S. McLean, 94, Geils Avenue, Dumbarton, N.B.; Manchester: Sec., Mr. H. B. Shields, 39, Hardman Lane, Failsworth, Lancs.; High Wycombe: Sec., Mr. W. Cope, Carriers Arms, Wycombe Road, Marlow, Bucks; Uxbridge: Sec., Mr. L. W. Orton, 11, Hawthorn Drive, Willowbank, Uxbridge. The A.-A.R. and T.S. is a society with a *present*, having members in forty-three countries.

In the Wild and Woolly West.

THANKS to aircraft and radio, the air survey of Western Australia is expected to be done in two years. Without these, and perhaps photography, the job would take thirty or forty years. It is the Western Mining Corporation which has undertaken the survey, the object being to examine the mineralised areas.

First, they will take aerial photographs generally; then they will take detailed photographs, and then certain areas will be "prospected." Two aeroplanes are to be used, fitted with radio, which will work in connection with three mobile ground stations on motor-lorries. Yoicks!

How I wish that I could kick my "bowler" into Pump Court—and serve on one of those lorries!

Japan Honours Marconi.

THE Emperor of Japan has honoured the Marchese Marconi with the Grand Cordon of the Order of the Rising Sun. I understand that this decoration is usually reserved for the representatives of royal families and high officials of the Diplomatic Service, so that the honour is emphasised. I suppose that the Marchese now possesses a collection of decorations that must be unique.

(Continued on next page.)

RADIO WARNS THE CARELESS MOTORIST

This thought made me turn up a photograph of him standing at his mother's knee in the cutest little button-up boots. His bright little Italian child-face; his Bologna experiments in the garden; his arrival in England with his modest outfit—they seem so far removed from the Rising Sun of Japan and his royal progress in America!

Mann Stages "Come-Back."

ALF. MANN o' Middlesbro', our old, voluminous, esteemed correspondent, after a long silence has whizzed up through the trapdoor and landed lightly on the boards, bearing in his hand a letter of criticism. Like most friendly criticisms, his mingles the sweet with the bitter, and we are comforted to know that "P.W." is not wholly bad.

But may I say, Alf, that a great deal of your criticism is merely your personal opinion as a radio enthusiast of no small experience and skill? Now, criticism ought to be based on certain general principles, and not on the private fancies of the critic.

Moreover, when you quarrel with our methods in general you are largely questioning matters of policy, and, as I have said before, "Policy is a Sacred Thing." Now, Alf, do leave the business of publishing to *us*, and write some more lovely, long letters full of S.W. news. Eh?

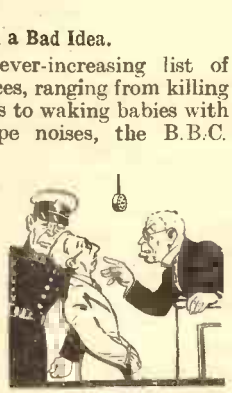
How Is Your Transducer?

WHILST examining an Indian radio paper I came across a page of definitions, and the definition of "telephone receiver" began, "An electro-acoustic *transducer*——" My bump of philology began to throb and heave. "Traducer" I know, and "transformer" and "translator." But "transducer"!

Latinised, it does not look too bad, but surely it is an *ersatz* word. Mark me well—Mister Ghandi's goat is somewhere behind all this!

Not Such a Bad Idea.

IN view of the ever-increasing list of motorists' offences, ranging from killing mere pedestrians to waking babies with devilish exhaust-pipe noises, the B.B.C. might well copy W C A E, an American station, which broadcasts for half an hour daily from a magistrate's court where traffic violators are given hearings.



The hearings—*and* the sentences—are well and truly poked thru (Yank!) the microphone for "read, mark, learn, and inwardly digest" purposes of the motorists who happen to be resting from their sanguinary labours. These Americans are—they really are—practical in some things, even though children and dreamers in many others.

Continental "Sponsored" Programmes.

MY Sunday explorations of the Gallic ether have been, I confess, merely the lesser of two evils—an escape from the B.B.C. Sunday. I closely observed the "sponsored" programmes, and soon came to the conclusion that I could spend my time more pleasantly with a book.

Nevertheless, when Alan Howland, in the "Saturday Review," refers to them as "a deliberate pandering to the tastes of the lowest stratum of society," I say that he errs. Enthusiasm for dance music, even that maniacal stuff known as "hot," extends over the whole cross-section of society.

And I would hazard the opinion that the peerage does not contribute greatly to the Queen's Hall audiences.

Gramophone Broadcasts.

SOME time ago, when there was a dearth of major complaints to harp upon, some critics began to twitter about the wickedness of the B.B.C. in broadcasting gramophone or Blattnerphone records more and more frequently, sometimes not revealing the fact that these broadcasts were not by persons then present before the microphone.

I think that the B.B.C. ought to make the distinction clear; but as to the quantity of canned broadcasting they are not overdoing it, only about 9·8 per cent of the total time being thus occupied. Holland's percentage is 44·4; Belgium's, 31·8; France's, 28·4; and Italy's 14·5.

A Technical Note.

TECHNICAL matters are not supposed to be within Ariel's domain; but sometimes, when I see a particularly misleading statement in print, I am impelled to correct it in the public interest.

I have just read: "Ampere. A unit measuring the quantity of electricity that flows through the circuit in each second." A common mistake, this. An ampere is not a *quantity*, but a *rate*; just as a sea "knot" is not a *distance*, but a *speed*. An ampere is a rate of *one coulomb per second*; a knot is a speed of one nautical mile (6,080 feet) per hour. If a current of one ampere flows, then one may say truly that this measures the *amount of electricity* that flows. But the words which I have quoted are alleged to be a *definition* of "ampere," and as such are incorrect and misleading.

Personal Twitter.

THIS is addressed only to J. P. G. (Macclesfield), who deserves a paragraph for having rediscovered the fact that a sense of humour is the gift of the high gods. He is good enough to recommend these random remarks of mine as a salve to those whose sets will not behave, despite much tinkering. You may not find the remedy in these Notes, but you will find, he says, that which will make the job seem easier.

I should like to drain a can with J. P. G. in his Bee Hive hostelry to the sovereign virtues of humour, one of those attributes which distinguish man from the other animals. He wonders how these Notes are produced. Well, you just keep shoving a pen up and down.

Who Is His English Counterpart?

IT is the fate of many public favourites to be "here to-day and gone to-morrow," for public taste is wayward and fickle.

Yet Paul Whiteman—and, one presumes, his band—still reigns in American radio. He sees "stars" rise and set; he quarrels with his Press agents and sometimes is short-spoken to reporters. Yet he goes on being Paul Whiteman; next to the Statue of Liberty he is the most enduring American institution.

Lynching seems to be making a bid to hurl him from that pinnacle, though.

Was It Merely Coincidence?

SUCH of you as are superstitious—and I hope you are few in number—and will not walk under ladders, or who believe that black cats, opals, broken mirrors, etc., have dire significance, will be cheered by this story.

An American business company "sponsored" a weekly programme entitled "Origins of Superstitions," with the object of arguing that superstitions are unfounded and foolish. When, lo and behold! for the first time in its history this company's cashier was held up and robbed of 7,000 dollars. This took place *on October 13th, a Friday. Oo-er!*

ARIEL.

SHORT WAVES

"Some radio set owners behave as if they own the ether," complains a writer.
Whereas probably they don't even own the set.

* * *

Dear Old Lady (writing to the B.B.C.): "..... And will you please send me the pamphlet telling me how to osculate?"
—"Weekly Record & Mail."

* * *

"Everything Wireless," runs an advertisement in a provincial newspaper.
That's what the canary wished.

* * *

GALLANT.

"More and more fool-proof radio-sets." "Women now keen enthusiasts."

* * *

Wireless Dealer: "Yes, this is a wonderful set—a child can manage it."
Dubious Dad: "H'm! That's what I don't like about it."

* * *

Oh, what is the use of the B.B.C.,
What use the S O S,
If it can't render help to me
In moments of distress?

In short, if in life's crises I
Am not considered free
To S O S—of what, I say,
Use is the B.B.C.?
—"Daily Herald."

"Daylight" Television

The Cathode-Ray Tube is already widely used for the reception of Television pictures. It is now being realised that its freedom from inertia makes it eminently suited for the scanning of pictures as opposed to the mechanical system in use in most present-day transmitters. A practical description of the methods employed is given here

By CARDEN SHIELS.

THE rotating-disc method of scanning is often criticised because of its limited speed as compared with the cathode ray.

It is true that an electron stream can be "driven" at a far higher speed than any mechanically moving system; but there is another limiting factor which applies with equal force to both methods of scanning, and is even more important than speed. This is the problem of getting enough light response from the object at the transmitting end to ensure a "brilliant" image in the receiver.

The Question of Time.

The whole art of television depends upon converting different values of light and shade into equivalent electric currents. It is only when a picture has been converted into an "electrical" facsimile that it can be transmitted to a distance, either over wires or through the ether.

This essential conversion from light into electricity is effected by means of a photo-electric cell, which produces an electrical output proportional to the amount of light applied to it.

Now, the total amount of light applied to the cell (i.e. the "driving force") depends not only upon the actual intensity of the ray at any particular instant of time, but also upon how long the light acts upon the cell. It follows that the output from the cell is determined not only by the intensity, but also by the duration of the light impulse.

It only requires a very simple calculation to show that the "time of impact" in any scanning system is very short indeed. For instance, if 40,000 picture elements are to be sent 12 times per second the cell must respond to a light impulse which lasts approximately the two-millionth part of a second.

Microscopic Impulses.

No matter how efficient the cell may be, the output produced by such a transient impulse must, in the nature of things, be definitely microscopic. This means that the photo-electric output must be amplified up to an enormous extent before it can be used to modulate the carrier-wave for television.

But high amplification almost always leads to distortion; and, moreover, there is a limit to which it can be pushed. On the other hand, unless "strong" signals are sent out from the transmitter it is hopeless to expect to get a "brilliant" picture at the receiving end. At the best there will be little difference between the high lights and the low.

This difficult problem is definitely solved by the new Iconoscope system, a development due to Dr. V. K. Zworykin, who is already famous for his work on cathode-ray television.

Instead of using a scanning beam to explore the picture point by point, he focuses the scene, as a whole, upon an entirely new type of sensitive surface, built up of several millions of tiny photo-electric cells.

The sensitive surface remains constantly active, so that it can be used to reproduce the effect of motion.

But the main point is that the photo-electric surface is exposed to the incident light rays for a period of time much greater than is possible in any scanning system. The actual duration depends upon the speed at which the whole picture is repeated in order to give the effect of motion. At the most this need only be from 15 to 20 times a second.

Each of the tiny cells which go to make up the Iconoscope surface is accordingly kept under the influence of the light for, say, one-fifteenth of a second. By contrast we have seen that the average duration of the light impulse in the ordinary scanning system works out at something like half a millionth of a second.

As already stated, the light response of the Iconoscope is definitely electrical, whereas in the ordinary photographic plate the action is a chemical one.

Millions of Cells.

The reason is that the sensitive Iconoscope surface is built up of millions of individual photo-electric cells, each consisting of a tiny globule of silver coated with a minute layer of cæsium. These are deposited upon a thin plate of mica, about four inches by five, by a process of evaporation.

The silver is deposited not as a continuous layer, but as a multitude of separate globules, uniformly distributed, though each one is isolated from the others. The subsequent coating of cæsium is deposited by a special process.

When the image to be televised is focused upon the prepared surface each tiny cell responds by emitting a number of electrons, the output being proportional both to the intensity of the light falling upon it and to the time during which the light lasts.

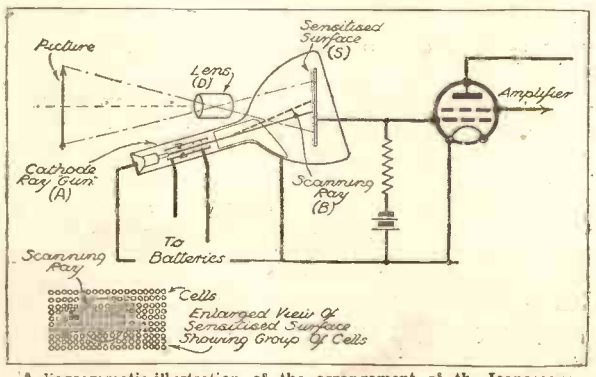
The liberated electrons set up corresponding electric charges across the condenser formed by the mica plate and a backing plate of metal. The action of the light, in fact, produces an immense array of small condensers, each of which is charged up proportionally to the high- and low-light values of the focused picture.

In other words, there has been formed an electrical "facsimile" of the picture to be televised.

The subsequent process of modulating the carrier-wave with this electrical picture is carried out by scanning the charged surface with an electron stream, as shown in the figure, where S represents the Iconoscope surface, D the lens system for focusing the picture upon it and B the cathode scanning beam projected from a cathode-tube "gun" (A).

The impact of the cathode ray discharges each of the photo-electric cells or "condensers" in rapid succession, the resulting pulses of current being applied through an amplifier V to modulate the outgoing carrier-wave in the usual way.

HOW THE ICONOSCOPE WORKS



A diagrammatic illustration of the arrangement of the Iconoscope cathode-ray tube and its associated circuit as applied to the transmission of television pictures.

Outdoor Scenes Reproduced.

For television purposes the sensitivity of the Iconoscope is substantially equal to that of a photographic film operating at the normal speed of a kinema camera.

As the apparatus is portable it can be taken to any selected point of local interest for direct television transmission. Finally, like the camera, it can be used to reproduce ordinary outdoor scenes under normal weather conditions, instead of being limited to indoor or studio work and to special methods of lighting.

THE MIRROR OF THE B.B.C.

MR. VERNON BARTLETT FOR FLEET STREET

More Freedom for Announcers ?—Organisation of Broadcast Music—"Empire Envoy" in the States, etc.

By O.H.M.

MR. VERNON BARTLETT'S arrangement with the B.B.C. will come to an end this year. He had been engaged on a contract that does not expire until October, 1934; but so many tempting offers have been made to Mr. Bartlett from national newspapers that he has induced the B.B.C. to release him from the contract as from January 1st. After that date Mr. Bartlett will become the chief diplomatic correspondent for two newspapers of a well-known London group.

This, fortunately, will not debar Mr. Bartlett from all broadcasting. He will in practice revert to the sort of arrangement that was in force when he was still an official of the League of Nations. He will also go abroad occasionally for the B.B.C.

To what extent the "secret history" of the famous Disarmament broadcast is responsible for this change is difficult to assess; I can say this, however, that if it had anything to do with the matter it was only a minor factor.

FROM MICROPHONE TO CABARET

Mrs. Giles Borrett, until recently the B.B.C.'s woman announcer, appearing under her professional name of Sheila Stewart as Mistress of Ceremonies at a Jermyn Street Restaurant.

"Standard English."

The B.B.C. Advisory Committee on Spoken English, of which Mr. George Bernard Shaw is chairman and Mr. Lloyd James secretary, is not so popular as it was at Broadcasting House. Some recent decisions of the committee appear to have gone so against usage as to embarrass the broadcasters.

I would not be surprised to see the B.B.C. change its policy on standard English. For a long time there has been a growing movement to leave the matter of pronunciation to announcers in whom certain peculiarities of speech would not be discouraged. The idea is that as long as the announcers speak cultivated English it would be better in distinctive accents. More will be heard of this in March next year.

New Year Honours.

Friends at the "Big House" tell me there is a good deal of ill-suppressed excitement there over the possibility of several broadcasting honours in the New Year list. The betting favourites are Mr. Noel Ashbridge and Dr. Adrian Boult. Both are so popular that any honour would be gratifying to their colleagues.

B.B.C. Music.

Next year is likely to witness important changes in the organisation of B.B.C. music. The Music Advisory Committee, of which Sir Hugh Allen is chairman, has prevailed on the B.B.C. to set up a small paid committee to give continuous attention to musical matters. While Dr. Boult will remain in general charge, an effort will be made to relieve him of some of the great burden of conducting which he has been shouldering in the past two years.

I hope that in the impending reshuffle some preferment will be found for Mr. Joseph Lewis, whose work at the microphone has been and is a tower of strength to the B.B.C. throughout the country.

Mr. Frost in America.

Mr. Malcolm Frost, the B.B.C. "Empire Envoy," will land in New York on Christmas Eve. He is to spend several months in the United States and Canada trying to market B.B.C. recorded programmes, which he placed to such good advantage in South Africa, Australasia, and in the Far East during tours of the past few years.

Mr. Frost's task this time will not be so easy. There is a deep-rooted objection to "electrical recordings" of any kind on the other side of the Atlantic, and the B.B.C. need not expect a roaring business. Canada perhaps holds out more hope than the United States. Anyway, Mr. Frost can be relied upon to make the best of possibilities.

A Unique Party.

During his brief stay in New York, Sir John Reith avoided public engagements; but one of the private parties in his honour was unique. He sat between the Presidents of the United Press of America and the Associated Press of America, the two great rival news agencies. I believe this was the first occasion of such association of these competitors.

Christmas Items.

Henry Hall and his Orchestra will supply dance music on Christmas night.

Martyn Webster, who was recently transferred from Broadcasting House to Birmingham as Midland Regional producer, is to be responsible for a divertissement programme which will also be given as part of the National programme on Christmas Day.

In it Mr. J. C. Cannell will tell, under the title of "The Mystery of the Christmas Bells," the true story of how the famous Houdini baffled the mayor and magistrates of a Midland town one Christmas Day. Another item in the same programme will describe Christmas Day with famous film stars.

Of the King's Christmas message, which is to be relayed from Sandringham, as was done last year, a good deal has been written. But little has so far been said about the greetings which will be exchanged between British citizens and friends of the Empire and the good wishes which will be transmitted to and from London about the world.

These will include messages from the Irish Free State (Dublin), Bermuda (representing the Colonies), Canada (Ottawa), New Zealand (Wellington), Australia (Sydney),

(*Continued on page* 722.)

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes and on microphone personalities of the moment.

WE are coming to the end of the Twelve Plays for Broadcasting. The thing that struck me most about them is that in the case of plays written originally for broadcasting, they have nearly all dealt with horror in some shape or form. We generally have to listen to shrieks. When there have been no shrieks, we've been brought face to face with people or peoples "in imminent danger of their lives." There have been exceptions, of course, but I have found that it is generally plays written originally for the stage and since adapted for broadcasting, that have given us something more palatable. I must say, however, that the B.B.C. have shown themselves masters of the "horror technique." They can do it very well, and listeners with a liking for this type of drama must be well satisfied.

* * *

But others who, like myself, have a preference for comedy must bemoan the fact that radio-drama is such a one-sided affair. When we sit down to listen to a play nowadays, it is always with the knowledge that, at any rate, we are not going to be enlivened or amused.

* * *

A feature common to all broadcast plays is the supremacy of the people cast to play them. I have often commented on this fact, and I make no apology for doing so again. We want nothing better in the nature of voice quality or clearness of diction than what these supply. In no other branch of the B.B.C. activity are these characteristics more pronounced.

* * *

The event of the week was, of course, the Petersen-Harvey championship-match relayed from the Albert Hall. I say "of course" because I confess I am fanatical about running commentaries. I justify this fanaticism on the grounds that I, like most people, am fond of outings. Personally, I would like to be able to poke my nose into most of the gatherings—sporting, social and educational—that are taking place nightly up and down the country.

* * *

Unfortunately, I can't do this, and until the days of broadcasting I accepted the inevitable with good grace. But as the microphone can—and indeed does on occasions—I'm a bit displeased because it doesn't do it more frequently.

The Petersen-Harvey broadcast was a first-rate show. The fight was unique in that it was a real fight going the full 15 rounds. The commentator was also first-rate. He spoke freely and missed nothing of importance. Every listener had the next-best thing to a ringside seat.

We felt all the excitement, tension, and the momentary annoyances of the fight. We could hear every blow, even the creaking of the boxers' shoes. While

(*Continued on page* 725.)

The CLASH IN THE ETHER

The transmission of two programmes on the same carrier-wave is an ideal often sought after. In this contribution, J. C. JEVONS gives an interesting account of experiments on these lines which are being carried out in Holland.

ONE of the points made—and well made—by Mr. Scott-Taggart in presenting his now-famous "S.T.500" to the readers of "P.W." was that any listener who wants to get the most out of his set can no longer afford to use single-knob control.

The single knob is essentially a compromise—one loses a little selectivity here and a little there—and the sum total may make all the difference when it comes to cutting out that unwanted station.

Conditions Have Changed.

The day has gone by when we can be satisfied to get less from a set than its best—particularly where selectivity is concerned. A few years ago it was different. In 1926 there were only 120 broadcast transmitters operating in the whole of Europe. Now there are double that number, radiating roughly thirty times more power. And the situation definitely threatens to get worse as time goes on.

For instance, the first thing that ought to be done is to enforce a revision of the present wavelength allotment for all European transmitters. But it seems impossible to persuade or cajole the various countries into common agreement on this elementary point. No less than eight countries stood out against it at the Lucerne Conference, and the Amsterdam meeting broke up after further disagreement on this point.

One is forcibly reminded of the time when Nero fiddled whilst Rome burned!

Meanwhile, something must be done to limit overcrowding in the ether. Present principles will no doubt be able to keep pace with the increasing congestion for some time to come—but what then? There is a limit to the ability of even the most brilliant designer to cope with the impossible.

Sooner or later reform must come from the transmitting side. We must either call a halt in the number and power of the stations operating, or else open up a new field for broadcasting on the ultra-short wavelengths.

Or can we find some other and more ingenious remedy?

Remarkable Experiments.

It is true that existing methods of transmission do not necessarily represent the last word in making the best of the available ether-space. This is shown by some remarkable experiments which are now being carried out in Holland with a system in which two different programmes are sent out on the same carrier-wave.

Startling as it may appear at first sight, each programme can be received at will free of any overlap with its "opposite number," merely by operating a change-over switch. Of course, it means an extra valve or two in the receiver, but there is always a price to be paid for progress!

A DUAL TRANSMITTING CIRCUIT

The two modulation schemes used in a "double" transmission are illustrated in diagrams 1A and 1B below. Taking the hand A in each case, there is either a variation in length or a difference in speed. Each system of modulation deals independently with one programme.

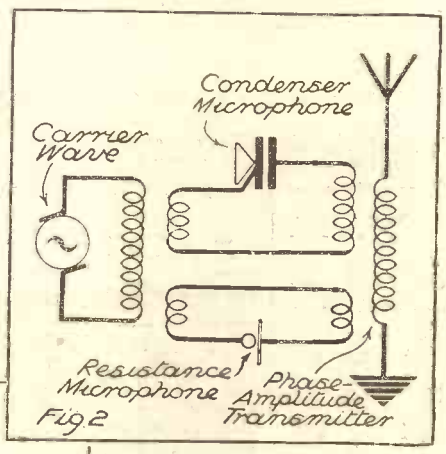
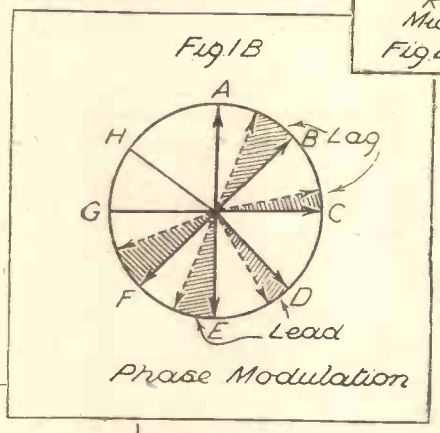


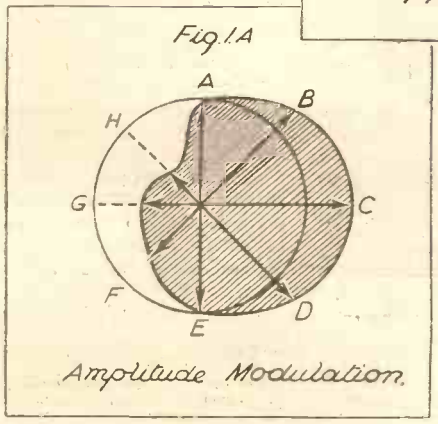
Fig 2

Fig. 2 (seen above) shows a typical experimental dual transmitter. Phase modulation is applied through the condenser microphone and amplitude modulation through the resistance microphone.

LEAD AND LAG



"ONE PROGRAMME"



Actually the two programmes are cut up into small subdivisions, which are fed to the same transmitting aerial alternately and in very rapid succession. As they go into the ether they might be compared with a never-ending series of sandwiches, the "bread" being one programme and the "meat" the other.

"Sandwiching."

The sandwiching process is performed by means of an oscillator valve which acts as a high-frequency switch, to bring first one microphone into circuit and then the other. The rate at which "sandwiching" occurs is far too high to be audible.

At the receiving end there is a similar oscillating valve, which acts on the grid of the input valve so as to "paralyse" it at one instant and "free" it the next. If the valve is operative during those intervals when the "meat" portions arrive, then only that programme is received, the second programme being shut out.

Conversely, if one wants to hear the second programme instead of the first, then a reversing switch does the trick.

The system is, of course, still in the experimental stage, and although satisfactory results have been obtained complete success is still in the balance.

A "Double" Programme.

Meanwhile, it is interesting to note that there are other possible methods of attacking the same problem—namely, radiating a "double" programme on the same carrier-wave.

For instance, one programme could be radiated by using ordinary or amplitude modulation, and a second programme by using frequency or phase modulation.

This may perhaps sound rather "highbrow," but the idea is simple enough in principle.

Suppose the hand A, in Fig. 1A, is rotating around its centre at a uniform speed and that it represents an unmodulated carrier-wave. Then the effect of ordinary or "amplitude" modulation is to vary its effective length periodically, as shown at A, B, C, D, E, F, etc.

(*Continued on page* 723.)

Short-Wave Notes By W.L.S

All those interested in short-wave reception will find the information in these notes of special value. Our popular contributor deals with the current topics of this fascinating band in an absorbing and entertaining manner.

SHORT-WAVE conditions during the past month or so have been quite good, on the whole, without ever being brilliant. My own personal experience has been that one of the most reliable short-wavers is W 3 X A L on 16·87 metres. During the early evenings and late afternoons he has been excellent on nearly every occasion on which I have listened for him.

W 2 X A D on 19·56, of course, is *never* bad nowadays unless everything is dead. An addition to the list of reliable short-wave transmissions is W 1 X A L, who works on 25·45 metres, just above W 8 X K. He is never as strong as the latter, but is usually quite good.

A Fascinating Transmission.

Sydney (V K 2 M E) on 31·28 is usually very much in evidence on Sunday mornings, but he can't be called a consistent station yet. I suppose he has a greater fascination for short-wave listeners than any other station on the air, simply because he is likely to be their first sound from the Antipodes.

For those who don't consider it below their dignity to listen to mere Europeans, I strongly recommend Aranjuex (E A Q) on 30 metres. His transmission has improved greatly. Quality is usually excellent, and some of the programmes I have heard from him have been quite entertaining.

Another big noise from Spain is Madrid (E A R 110) on 43 metres, just above the 40-metre amateur band. E A R 58 is the call sign of the Teneriffe Radio Club, Canary Islands, and may sometimes be heard on 41·6 metres, which is actually *in* the amateur band. Unfortunately, this quarter of the band is rendered almost useless by two Russian commercials using a quite unnecessary amount of power.

Two or three readers have suggested to me that for the benefit of the continual stream of novices (to short waves) who pick up these notes and find them a little beyond them, I should give, about once a month, a little space to the newcomers.

Indentifying the Bands.

Here is the first "Novices' Bulletin." I will assume, Mr. Novice, that you have recently made a short-wave set, and are very interested but a little disappointed (that *is* the usual state after the first few weeks). Your set probably brings in lots of carrier-waves and heaps of Morse, but very little in the way of intelligible programmes.

My first suggestion to you is that you should find out roughly where you are in the world of wavelengths. As soon as you find one decent telephony station, hang on to him like grim death until you get an announcement. That will tell you which band you are in, if nothing else. Short-wave broadcast stations are grouped in five "bands," centred round 49, 31, 25, 19 and 16 metres.

If you can find the five short-wave broadcast wavebands on your dial with your various coils, I suggest that you spend a lot of time tuning very, very slowly in their immediate vicinity.

Getting Fine Tuning.

I am going to suggest, later on, that you install, in parallel with your tuning condenser, a very small condenser, equipped with a slow-motion dial, so that you really can go through these narrow bands with a fine-toothed comb, because it is in those bands that you will find all the interesting stuff.

It is sheer waste of time, for instance, to hang about in the vicinity of 35 metres, because you will hear very little but commercial Morse between 32 and 41 metres, which is a very wide space indeed.

So far I haven't touched on possible troubles with your set at all. If you find that you *can't* do as I tell you and "hang on like grim death" to a station without taking the instructions too literally—if, for instance, you lose him every time you remove your cigarette from your mouth—then you are one of the great army of sufferers from "hand capacity."

No Excuse For "Hand Capacity"

I have spoken about hand-capacity effects so often that I am almost ashamed to mention them again. Look up my past Notes, particularly those dealing with "layout" problems, and you will find out just what I think about hand capacity.

There is no excuse for its existence in a short-wave set; and if you have built a set to a "P.W." specification you won't suffer from it.

Though it savours of freakishness, I am now going to make a suggestion to all those who are interested in 5-metre work. I am becoming more and more convinced that the design of the aerial system has almost everything to do with the success of a receiver or transmitter on these ultra-short waves.

I have mentioned before that I have always found a 16-foot vertical aerial admirable for receiving. I have since tried a modification of that scheme, in the shape of a 16-foot vertical wire, broken in the middle and connected to the set, using the upper half as aerial and the lower as counterpoise.

Although I only had local signals available for that test, it certainly appeared to be very successful.

Underground Aerials.

What I *am* very keen on doing is to install an underground aerial of suitable length. We used to play with underground aerials before the days of broadcasting, but no one seems to have given them a thought in connection with ultra-short waves.

I can foresee that the big difficulty is going to be that they turn out to be very directional; and changing the direction of an underground aerial isn't such an easy matter. Forgive me for this continual harping on 5 metres, but we can't lose sight of the fact that this wave is likely to become enormously important.

When that happens, those of us who have played about with it and found out something about its peculiarities are going to have a handsome start over the others.

THE LATEST TELEPHONE

A condenser-microphone telephone transmitter at the Dollis Hill laboratories of the G.P.O. It is housed in a specially lined non-reverberating cabinet.

The RADIO ORACLE

An ingenious "stunt" which you can rig up for the Christmas party with the aid of your radio set and a few extra items. It is a most effective scheme, and the simple connections needed are clearly explained

By A. S. CLARK.

MEET the Radio Oracle! He's an amazing little fellow. There he is, on that slim table in the middle of the room.

Looking like some ancient god from the Far East, he will answer any question you like to put to him. And if it happens to be one of those queries that you don't want everybody to hear, just step across and whisper it in his ear. He'll hear you.

Imagine the fun you can have with him at the Christmas party. But what is he? How's it done? Why, it's "as simple as anything," and the scheme will enable you to spring other surprises on your guests as well.

The Secret of the Scheme.

The "shape" of the "god" is merely a cloth-and-wire contraption covering up a loudspeaker, the leads to which are made as inconspicuous as possible. Even if they are visible they will not give the trick away, especially if you arrange a light inside the image, for then the leads may quite conceivably be taken for the supply wires for the lamp.

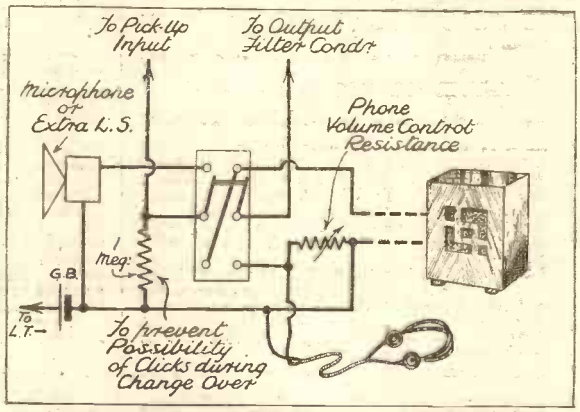
The secret of the scheme lies in the ingenious way in which the loudspeaker is employed. One minute it may be connected to the output of your set and reproducing all that you say into a microphone connected to the pick-up terminals, and the next, with out a second's pause, acting as an extremely sensitive detectaphone that enables you to hear in headphones all that is being said in the room.

Easily Arranged.

The set itself, the microphone and the person controlling the Oracle are, of course, in a room somewhere else in the house, the only connection between the two rooms being one of twin flex to the loudspeaker terminals.

The connections entailed are shown in the circuit diagram in the centre of this page, and they do not necessitate alterations to any of the set's internal wiring. The main extras are a two-pole change-over switch, a pair of telephones and a microphone (complete with microphone transformer), or an extra loudspeaker to act as the mike.

A SIMPLE CHANGE-OVER SYSTEM



These are the connections you have to make. They are all external to the receiver itself, which can still be used for radio simply by altering the position of its radiogram switch.

Use an Output Filter.

It is, of course, assumed that your set has provision for pick-up input. And if an output filter is not incorporated this should be provided, otherwise a distinct click may be heard in the loudspeaker when changing over its duties.

The 1-megohm grid resistance is desirable for the same reason. The 1½-volt G.B. battery is to ensure the first amplifier valve working without distortion; and the variable resistance across the telephone (its value should be around 50,000 ohms) is to prevent you being deafened because of the sensitivity of the loudspeaker as a microphone. As the value of this resistance is reduced, so the volume of sound heard in the phones will get less.

The connections should be easy to carry out, for the circuit diagram is really a pictorial one. When the switch is in one position the loudspeaker is joined to the set's output and the microphone is connected to the pick-up input so that you can speak via the mike to the people in the room below.

Amusing Effects Obtainable.

In the other position of the switch the loudspeaker downstairs is acting as a mike across the pick-up input, and you hear in the telephones, now connected to the set's output, all that is said in the party room. Thus you can listen to any questions, throw the switch over and immediately reply.

With a witty person, quick at repartee, on the mike, the most amusing effects are easily obtained.

Quite apart from the use as a Radio Oracle, it will be appreciated that the scheme has immense possibilities. It must be remembered that the additions do not prevent the set being used for ordinary radio reproduction.

Think of all the thought-reading games you can play, such as those in which someone goes out of the room and then comes back to pick out a chosen subject, and so on. You can have an accomplice sitting near the speaker to make doubly sure that the key word is heard in the telephones, and no one will suspect that the ordinary loudspeaker to which they have been listening is giving them away.

Adds Novelty to the Party.

Similarly, how easily you can listen in to what is going on and then break through with a most knowledgeable remark, although you are not in the same room! As a matter of fact, you will find the possibilities quickly multiply once you have tried out the scheme. And it will certainly add a note of real novelty to your party.

A NEW PICKETT CABINET

IN an article in our recent special Christmas number, among other things I dealt briefly and rather lightly with the subject of cabinets for radio sets. But I was nevertheless quite serious as to the sentiments expressed.

Home-constructor progress must remain to some extent impeded while so many of the "make-your-own" fraternity are content to exhibit bare chassis. Indeed, there must be many listeners who imagine that a home-made set must necessarily be a rather crude, unfinished-looking affair because they haven't seen anything better.

I myself have always realised that a pretty heavy proportion of constructors do not bother about proper cabinets for their receivers; but it wasn't until I was recently given certain figures by our largest kit supplier that I realised how serious was the matter.

The "Royal Grand" oak cabinet is one of many designs from which Pickett customers can choose.

And it is serious, you know. Some of my correspondents suggest that the constructor builds set after set in the same cabinet, and that is the reason why so relatively few cabinets are sold.

Without arguing this point at length I can assert with confidence based on adequate evidence that this by no means universally applies. In any event, it is almost as bad to stick to the same old cabinet year in and year out through the ages as it is to use no cabinet at all.

It might not always be the case, for cabinets have improved out of all knowledge during the past two years.

Take as an example the "Royal Grand" oak cabinet de luxe made by Messrs. Pickett's Cabinets, who claim to be the oldest-established radio furniture specialists.

This is a very fine piece of work, and when equipped with a home-constructed outfit the result is to outward appearances equal to a first-class factory-built set.

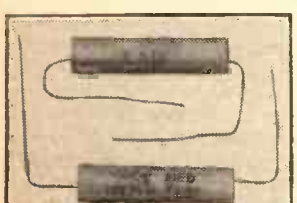
Such a cabinet as this can certainly be used to house a succession of sets equally well, and no criticism could be raised against the practice.

Constructors who habitually use plain American box-type cabinets, with medleys of external equipment, or who use no cabinets at all, should graduate to such cabinets as this Pickett for the good of their own souls, and the soul of the constructing movement.

The design of the cabinet is definitely artistic, but, if it does not appeal to all, Pickett have plenty of other designs from which to choose.

The construction is on very robust lines, but the finish is delicate. A great feature is the ample space inside for the largest moving-coil speakers and for batteries and mains units.

A first-class radiogram built into such a cabinet as this ought to be the ambition of every home constructor.



Erie tubular condensers, costing only one shilling, were found on test to be exactly as rated.

ERIE TUBULAR CONDENSERS

Several readers have asked me if those small wire-end resistances and condensers can be regarded as trustworthy in regard to ratings.

It is a quite natural conclusion to think that the construction of such tiny, compacted components which sell at such attractively low prices might not perhaps be as sound and stable as that of their bulkier equivalents.

But modern mass-production methods have brought consistency in their train, and as a matter of fact the "wire-ends" are perfectly reliable in all respects.

At least, that is so with the better-class makes, among which Erie (The Radio Resistor Co.) hold a high position, in my view.

Their tubular condensers are said to be tested to a tolerance of plus or minus 10 per cent at 1,500 volts D.C., and this claim is, judging by my own tests, a quite conservative one.

I measured the capacities of two of them, one marked ·0002 mfd. and the other ·0003 mfd., and in each case found them to be exactly as rated, which is unusual for any but a calibrated laboratory component of any make.

And remember that they cost only 1s. each! This price applies to all capacities from ·0001 mfd. to ·006 mfd. The ·01 mfd. costs 1s. 3d., and values from ·02 mfd. to ·25 retail at 1s. 6d. each.

ARTISTIC SIGNAL LAMP

Some of you will probably remember my Electro system which was introduced in "P.W." some six or seven years ago. I believe this was the method which first placed the all-D.C. set on a sound footing. Anyway, it was very popular indeed.

It will also, no doubt, be remembered that the system employed ordinary electric lamps as resistances.

I had a set based on the method in my own home for a long while. And it was not long after it was installed that it occurred to me that the lamp resistances, although doing an essential job, were not pulling their *full* weight while they were boxed up in a well-ventilated cabinet.

So I took them out and fixed them in nicely shaded holders which were stood on the mantelpiece. Wires ran from them to the set, so they could still act as resistances. But in addition they provided a pleasing, subdued lighting for the room.

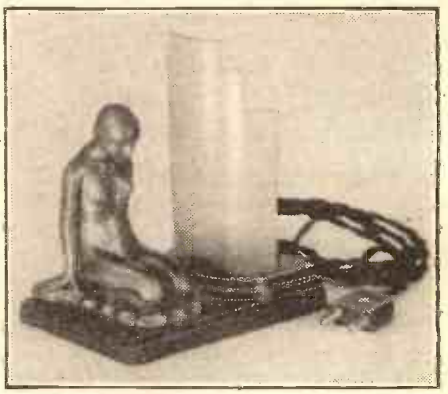
Further, they gave a very tangible evidence that the set was switched on. Later a third lamp was added. This was used as a resistance for the field-winding of a D.C. moving-coil speaker.

The arrangement was greatly admired, and I still don't know which of the extra duties of those lamps pleased me most. Anyway, they constituted a fine combination of the utilitarian and the artistic.

But Bulgin have "gone one better." Their Decorative Signal Lamps are indeed de-luxe interpretations of such a scheme.

You will at once be able to see exactly what form their novel device takes by glancing at the accompanying photo.

As you will see, there is a tasteful piece of modelling in an antique bronze finish, mounted on a base which is composed of a fine-grain bakelite moulding.



"Thoughts" is the name given to this Bulgin signal lamp which combines artistry and utility. 15s. is the cost.

A translucent screen is placed between the figure and the lamp (which is preferably a standard bulb of 15 watts or lower rating), and this softly illuminates the figure. An extremely attractive result is thus achieved.

Six feet of twin flex and a 5-amp. plug are provided.

Besides this particular model, "Thoughts," which I have described and which is illustrated on this page, there are three other models available, styled "Wisdom," "Doggy" and "Polly Peachum," featuring respectively an owl, an alert, finely chiselled dog of the rough-haired type, and the famous character from the "Beggar's Opera."

This Bulgin Signal Lamp idea is, in my opinion, one of the most artistic ideas ever introduced into radio, and constitutes a fine contrast to the usually rather formal designs taken by the average radio outfit. Besides which it has a definitely useful function to perform—that of indicating whether or not the set is on.

The price is 15s., and I suggest that here we have *the* perfect radio Christmas gift for anyone who has mains.

Weekly jottings of interest to buyers.

HOME constructors who fall into the category of battery users have particular cause for rejoicing over a valve that has just been released by the General Electric Company, Ltd.

There must still be many thousands of home-constructed sets in use which were built three or four years ago, and in so far as the H.F. side is concerned the fact that they were originally designed around valves which were much less efficient than they are to-day precludes, in many cases, the use of modern, very high-efficiency screen-grid valves, on account of the possibility of instability.

With the idea of enabling sets of this description to be brought up to date by the substitution of modern valves and without the risk of instability troubles, the G.E.C. has designed and produced a special valve for the job.

It is a 2-volt battery type, and this new screen-grid valve, which is to be known as the Osram S.23, has the following important characteristics:

Four Valuable Features.

(1) The lowest possible anode current for adequate efficiency (actually, it is considerably less than many of the older types of screen-grid valves). (2) A very low screen-grid current. (3) A high impedance, which, in many cases, will probably bring about an improvement in selectivity. (4) A slightly higher mutual conductance, not sufficiently high to cause instability, but high enough to bring about an improvement in general sensitivity.

In passing, may I just mention that the new Osram S.23, which is obtainable either with a clear or metallised bulb, has a perfectly standard base? In other words, it can be plugged into the majority of

(*Continued on page* 725.)

ECKERSLEY EXPLAINS-

A question from a reader at Pinner this week provides our Chief Radio Consultant with the opportunity to explain how valve amplification is calculated, with special reference to the relation between anode and transformer impedance.

THERE'S an interesting question from H. J. J. (Pinner) which says:

"If I connect the primaries of two input transformers of two identical moving-coil speakers in series, will the extra impedance in the anode circuit of the output valve be sufficient to upset the quality? If so, how can I use two moving-coil speakers at the same time?"

Now, the voltage developed across the anode of a valve and earth depends upon the relative impedance of the anode impedance and the impedance of the valve and the magnification of the valve.

That is to say, in Fig. 1, if we put in a signal Eg to a valve grid, this signal gets magnified and we get a magnified voltage Ea between anode and earth (or anode and +H.T., which, owing to the large condenser C, is at earth (A.C.) potential).

ANODE IMPEDANCE

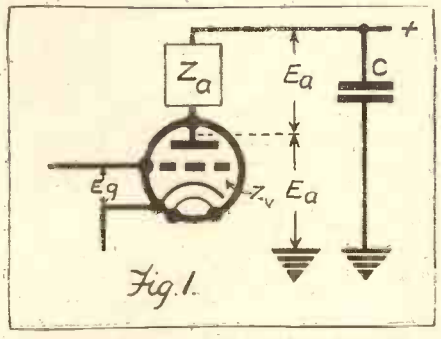


Fig. 1.

If to any valve you apply Eg, a voltage to the grid, and this voltage is magnified by the valve acting with Za (the anode impedance), to give Ea, Ea divided by Eg is the practical magnification of the valve and circuit combined.

The formula—*don't* be frightened of formulæ, they are only letters which signify numbers for a particular case—is that $Ea = Eg \times \mu \times \frac{Za}{Za + Zv}$: where μ is the theoretical magnification factor of the valve and Za and Zv are the anode and valve impedances respectively.

A Simple Calculation.

Let's look in a valve catalogue. Here's a valve which says it has a μ of 80 and an impedance of 100,000 ohms. All right. Let's see what will happen if we put 1 volt on the grid, how many volts on the anode. If Eg = 1, what will Ea equal?

Well, we write down that

$$Ea = 1 \times 80 \times \frac{Za}{Za + 100{,}000}$$

where Za is the anode impedance. So we have to see what Za can be. For fun, let's pretend Za = 0. Then Ea = 0. No valve will magnify if there is no anode impedance.

Now let's make Za greater than 100,000 by, say, 10 times. Then Ea equals 80 × one million ÷ 1·1 million, or nearly equals 80. That is, the valve magnifies 80 times, and it magnifies according to its theoretical magnification.

So now we have two things decided: *that if Za is nothing, the valve doesn't magnify; and if Za, the anode impedance, is very much larger than Zv, the impedance of the valve, then the valve magnifies according to its theoretical magnification factor.*

You have seen, perhaps, that the theoretical magnification of a screen-grid valve may be of the order of 500. But such magnification could only be attained in practice if the anode impedance was much greater than the valve impedance.

But the valve impedance being what it is in the case of a screen-grid valve you would want an anode impedance of millions of ohms; and you can't get such impedances for practical working, both because it is difficult to do so and because if you did the whole arrangement would oscillate like mad!

High or Low Impedance.

But do not let us lose sight of the fact that magnification goes up and up as the anode impedance is increased, until a saturation point is reached (when the anode impedance is much greater than the valve impedance) where the magnification is a maximum and constant.

Now let us apply these principles to answer the question. If you put two transformer primaries in series, then you have increased the anode impedance by two times. All right—twice! The question is, what kind of a valve are you using? If you are using a very low impedance valve, one transformer primary may be many times the valve impedance, and the addition of another transformer will not make the slightest difference to the magnification.

If, however, the valve impedance is so high that the impedance of one transformer is only a small proportion of the impedance of the valve, then the adding of the second transformer will nearly double the magnification.

But, you say, all this does not quite answer my question. My question was about quality, not about magnification. Gently, gently! All in good time!

Now, a transformer primary impedance varies with frequency. The higher the frequency the higher the impedance. So that, even with a high-impedance valve, adding a second transformer will make no difference at high frequencies, but may make all the difference at low frequencies.

It is a bit complex, isn't it? But not really if you go slowly.

Increasing The Bass.

Now for practical advice and experience. In Fig. 2, I have drawn curves which are actually based upon practice. The valve is a high-impedance pentode. With one transformer you will see how the curve of output rises and rises and rises until capacity takes charge.

But because the pentode impedance is high, and because the impedance of the transformer varies with frequency, the use of two transformers levels up the bass parts.

It is not a bad thing to have a rising characteristic like this, because in an ordinary set the high-frequency circuits cut off the top. So it's good to put it in again.

WITH TWO TRANSFORMERS

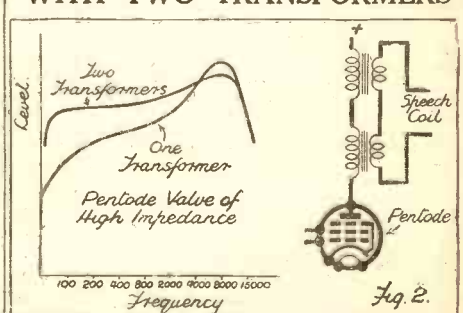


Fig. 2.

Showing how you can get more bass by using a higher anode impedance in the form of two transformers in series, as shown, provided the valve has a high impedance.

If you are keen on wireless, read this again. If you understand it clearly, I shall be pleased: partly pleased with myself, but more pleased because you are understanding the real subtleties which are based upon the fundamentals!

"P.W." TESTS: THE READY RADIO "E.M. PLUS 4"

A NEW FOUR-VALVE KIT SET FOR BATTERY OPERATION. IT INCLUDES A MULTI-MU S.G. STAGE.

The "E.M. Plus 4" in the walnut cabinet that can be supplied, complete with built-in moving-coil speaker, for fifty shillings extra.

IT is the exception rather than the rule these days to come across a set employing coils of what, from the point of view of appearance, might be termed the old solenoidal type. Modern tendencies have all been towards smaller and still smaller coils, and with the comparatively recent advent of iron-cored types, it is reasonable to suppose that finality has not been reached in this respect even now.

But the question of appearance is not everything, as is evident from the tests which we have just made of the new Ready Radio "E.M. Plus 4." The fact that there is ofren a distinct tendency to weigh up the pros and cons of a receiver on the score of appearance makes it highly desirable for us at this juncture to point out that technically there is no reason why coils of the old solenoidal type should not be every bit as good as—and, in fact, in some cases better than—those of more modern design.

The Coil Design.

But make no mistake. The coils employed in the "E.M. Plus 4" are old only in so far as appearance is concerned. From the point of view of efficiency and their general suitablilty for exacting modern requirements, there is ample evidence to show that their design is up-to-date.

We make no secret of the fact that our tests of this new Ready Radio kit set were based upon the standards set in our labs. for a representative two-tuned-circuit four-valver of the latest type, and under these conditions the results, in general, were consistent with the claims that are made for it.

The "E.M. Plus 4" is a battery four-valver with the circuit sequence of one S.G. H.F. stage, detector and two L.F. stages. From the point of view of the home constructor, it is outstanding in the sense that for a set of its type it is particularly easy both to construct and, again we speak generally, to operate.

Pre-detector Volume Control.

It has only one main tuning control, which is supplemented by a concentrically-mounted trimmer knob requiring only occasional adjustment. The H.F. end of the set is designed around one of the new multi-mu types of S.G. H.F. valves, and adequate control of volume, and, indirectly, of selectivity, is provided by the "variable-mu control" on the left.

The only other control in the operating sense is that of reaction, which is located on the extreme right, and as our tests have shown, it is a control that will be required only for the reception of the more distant stations. The wavechange and "on-off" switches are located on either side of the main tuning control.

Built-in Loudspeaker.

Just before we pass on to the question of results, since so much importance is attached these days to outward appearances, it is opportune to say a word or two in this respect concerning the "E.M. Plus 4."

The walnut cabinet supplied to us, and which is illustrated in this review, is truly a handsome-looking design. Bearing in mind that it costs only fifty shillings extra over and above the price of the kit, and that its price includes a built-in moving-coil speaker, it is undoubtedly remarkable value for money. The finish is good, and ample space is provided inside for the necessary batteries.

TABULATED DATA

GENERAL DESCRIPTION: Four valve kit with one variable-mu screened-grid H.F. stage for battery operation.

CIRCUIT ARRANGEMENT: One variable-mu H.F. amplifying stage (P.M.12V.), leaky-grid detector (P.M.2D.X.) resistance-capacity coupled to the first L.F. valve (P.M.1.H.L.) which is in turn transformer-coupled to the output valve (P.M.2 or P.M. 202).

PRICE: Complete kit, less valves, £4 17s. 6d. Oak Consolette cabinet with built-in moving-coil speaker, £2. Similar cabinet in walnut (also with built-in M.C. speaker) £2 10s. 0d.

MAKERS: Ready Radio, Ltd., Eastnor House, Blackheath, London, S.E.3.

REMARKS: Full-size wiring chart of the "E.M. Plus 4" is obtainable from your local dealer, or by post from Ready Radio at the above address.

The first of our series of practical tests with the "E.M. Plus 4" was conducted under what might be termed average conditions. Locality roughly 14 or 15 miles south of Brookmans Park; aerial perhaps a little above the average, and earth to a main water system. The valves and battery voltages employed were exactly in accordance with the recommendations given in the operating instructions that are supplied with every kit.

Under these conditions, the performance of the "E.M. Plus 4" by comparison with our adopted standards was good. Selectivity was quite up to the standard to be expected for the type of set, but it was apparent that the whole secret of the successful reception of stations using wavelengths near to those of the locals lies in the correct use of the reaction and variable-mu controls.

It is a knack that is soon acquired, and it should certainly not be allowed to act as a deterrent to those who are looking for an otherwise excellent kit at an extremely modest price. In any case, even without an elementary knowledge of operating procedure, the "E.M. Plus 4" is a set that can be relied upon to provide a reasonable number of alternative programmes.

Avoiding Overloading.

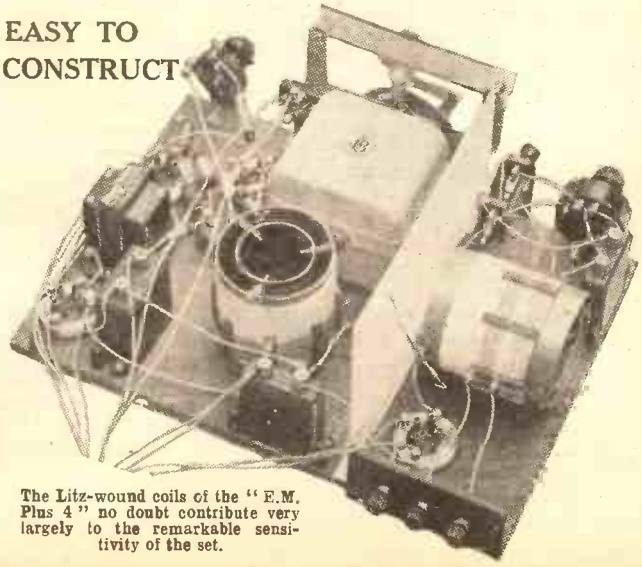
As a matter of fact, in these days of high-power local transmitters, some sort of pre-detector volume control is almost a necessity if overloading is to be avoided, and that is one of the great advantages of a multi-mu H.F. stage.

From these remarks the importance of the variable-mu control in the "E.M. Plus 4," as with any other set of its type, will be obvious.

A feature of the present design which is particularly commendable is the provision of four separate H.T. tappings which enable the voltages to be adjusted to suit individual requirements. In the event of there being the slightest tendency towards self-oscillation, variation of the tapping positions will almost invariably provide a way out, although it is only fair to mention that in the model we tested there was no trace of instability.

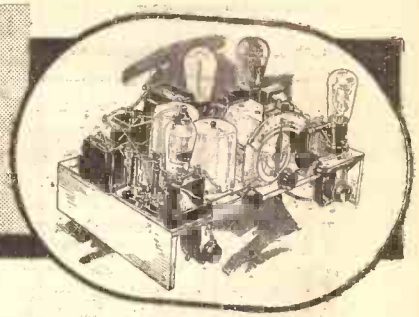
Without a doubt, the old but still famous Ready Radio "Meteor" kit has a worthy successor in the new "E.M. Plus 4," and there is every reason to believe that it will achieve widespread popularity.

EASY TO CONSTRUCT



The Litz-wound coils of the "E.M. Plus 4" no doubt contribute very largely to the remarkable sensitivity of the set.

INSTALLING Your D.C. RECEIVER



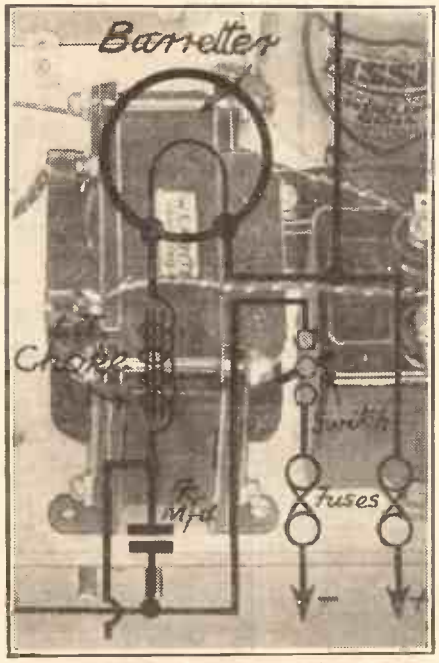
Final important details concerning the installation and operation of the D.C. mains receiver described last week.

BY THE "P.W." RESEARCH DEPT.

LAST week we gave the necessary construction details of a new D.C. mains receiver, incorporating in it the new vacuum barretter current regulator. Construction of the set is easy, as probably a number of readers have already found, and so comparatively few directions had to be given.

But we left the matter of the installation of the receiver, including its first tests, for description this week. Not that it is unusually tricky or that any peculiar snags are likely to arise, but to get the best out of any set it is essential that the owner should be able to operate it properly.

THE L.T. SMOOTHING



The L.T. heater-smoothing choke shown above in photographic and diagrammatic form should normally be connected in the positive feed. On occasion it is found that better results are obtained with the choke in the negative feed, as is explained in the article.

After wiring, the first task should be to check over every connection methodically and carefully, making sure that each terminal is fully gripping the wire or wires under it and that no wrong leads have been put on.

Prevention is Better Than Cure.

In a mains set things are apt to be lively if wrong connections are made, though the fuses incorporated in the mains plug would prevent serious damage being done. However, prevention is much better than cure, so every care should be taken that no mistakes have been made.

In the cases of the screened leads it must be seen that the lead comes out well clear of the wire-mesh covering, for this has to be earthed, and if it should touch the wire it would also earth that, possibly causing a great deal of trouble.

With the connections duly tested and no wrong leads or short circuits found, connect up the set (*minus* the valves) to the mains, and switch on. This will further test the connections—up to a point—and, if no fuses blow, the test can be carried further.

It should be noted, of course, that the fuses referred to throughout are the glass-enclosed fuses in the mains plug on the set —*not the house fuses.* These latter are adequately protected by the set fuses, and whatever happens in the set you will not be likely to affect the house fuses.

Next switch off again and connect up aerial and earth, loudspeaker and, if you have it, the pick-up. Place the three valves in their places (the VDSB in V_1, DH in V_2, and DPT in V_3). The barretter goes into the remaining socket.

Mains Polarity.

Switch on again and watch the valves until they have warmed up (about 30 seconds). Then switch off and on again quickly, listening to the loudspeaker. You should hear a click or thud in the speaker if the mains plug is in the right way round. A further test is the reaction control. On turning to the right you should hear the detector go into oscillation.

If no noise greets your efforts remove the mains adaptor plug where it fits in the house wiring and replace it the other way round. This will change the polarity of the two feeds to the set. It is essential, of course, to have the positive main connected to the feed in the set that goes to the anode circuits of the valves.

After the change-over of the mains plug you should get evidence that the set is "alive" by noises in the speaker when reaction is applied. On turning the tuning dial you should be able to find one or more stations. They may not be very strong, as the set is not yet trimmed.

All these tests are carried out with the receiver external to the cabinet, and, as was mentioned last week, care must be exercised that the metal parts of the set are not touched while the receiver is "on." This precaution is in case you happen to touch an earthed point at the same time and the mains happen to have the positive side earthed.

Earth Return through the Body.

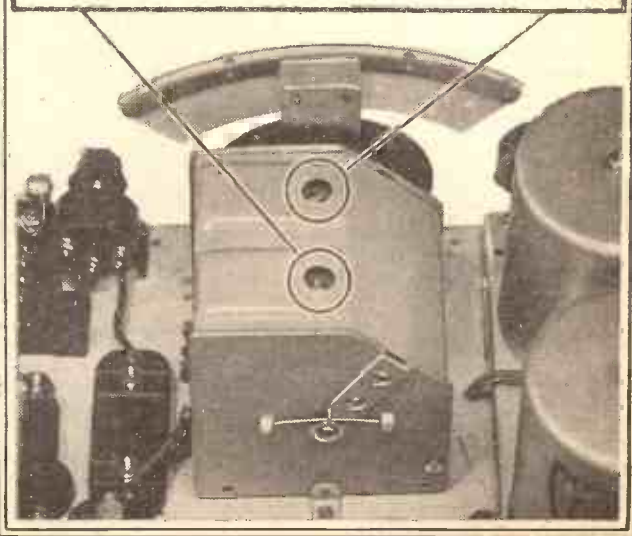
While the tests are going on it is best to stand on a mat, unless the floor is of wood or is carpeted. Do not stand on tiles, metal or concrete during the tests, as these may be conductive and so cause an earth return through the body.

All this sounds as if the testing of the D.C. set is a dangerous procedure. That is not so. But one may as well take all precautions against getting even a slight

(*Continued on next page.*)

ADJUSTING THE TRIMMERS

The two trimmers should be set all "out" and gradually tightened up by means of a screwdriver until maximum sensitivity is achieved. Always aim at completing the trimming with as little added capacity as possible.



The moving vanes of the two-gang condenser are automatically earthed to the metallised chassis.

INSTALLING YOUR D.C. RECEIVER

(Continued from previous page.)

shock, as no one is likely to want the sudden surprise an electric shock brings.

The next task, after which the set can be placed in its cabinet, is trimming. This is carried out by means of a thin wooden or insulated-handled screwdriver, and consists of the following procedure:

Unscrew the two trimming screws on the top of the gang condenser until they are obviously loose. Don't take them out. About three anti-clockwise turns of the screwdriver will probably do.

Now tune in the lowest wavelength station you can find on the medium wave-band, using reaction to assist if you so require. Now slowly screw up the trimmer nearest the panel (or where the panel will be), noting the point where the station is loudest or where the set goes into oscillation.

Setting the Trimmers.

If things do not improve, leave that trimmer at minimum and do the same with the other one. Leave it set at the point of maximum strength or oscillation point, and reduce the strength of the station by means of decreased reaction on the volume control.

Again adjust the trimmers, one at a time, until the loudest result is obtained, leaving them set at that position. It should be remembered that no more trimming capacity should be added than is absolutely necessary to effect the trimming. If one trimmer is almost at minimum and the other only a little further "in," so much the better.

With the trimmers set we can switch off and place the set in its cabinet. The latter is obtainable from the makers ready drilled, so no difficulty should arise at this point. Note that the top of the cabinet has a metal grille at the back to allow for cooling of the barretter, which, in spite of the fact that it does not light up or even glow, gets quite hot.

After the housing of the set has been completed there is nothing to be done except to connect up again and settle down to enjoy the use of the receiver. The ganged-coil unit, it will be noticed, has a switch at the back. This is not used in the set, the "on-off" being controlled by the multi-mu-valve volume control.

Accordingly, the wave-changing is carried out by a full "turn" of the knob from one side to the other. The intermediate "click" denotes the switch action going to "off," but as this switch is not used no notice is taken of this point.

There is just a possibility on particularly poor D.C. mains, such as those of the mercury arc rectified A.C. variety, that a little hum will be noticeable in the set. In this event it is often cured by changing over the heater-smoothing choke to the other mains feed. Thus in this set it may be advantageous to wire up the choke in the lead that comes from the on-off switch. But a trial will soon test that point.

A FINE TEAM OF VALVES

The three Osram or Marconi valves and the barretter used in the D.C. receiver described last week. They are, from left to right, V.D.S.B., D.H., D.P.T. and barretter type 251.

THESE COMPONENTS ARE RECOMMENDED FOR OUR LATEST D.C. RECEIVER

Component.	Make used by designer.	Alternative makes of suitable specification recommended by designer.
1 Cabinet	Peto-Scott	—
1 Metaplex chassis, 16 × 10 × 3½ ins.	Peto-Scott	—
1 2-coil unit	Lissen L.N.5161	—
1 2-gang ·0005-mfd. variable condenser	British Radiophone, type No. 605	—
1 Disc drive and escutcheon for above	British Radiophone, type No. 711	—
1 Binocular screened H.F. choke	Telsen W.340	Graham Farish
1 single screened H.F. choke	Graham Farish, H.M.S.	Telsen, Bulgin, Wearite
1 L.F. choke	R.I. "Hypercore"	—
1 L.T. choke	Wearite ·25 amp.	—
1 L.F. transformer	Lissen "Hypernik"	Telsen, R.I., Ferranti, Varley
1 ·0005-mfd. reaction condenser	Telsen W.358	Graham Farish, Lissen, Polar
1 2,000-ohm combined volume control and on-off switch	Bulgin V.S.23	Lewcos
1 Rotary change-over switch	Bulgin S.86	—
4 5-pin valve holders	W.B. small type	Telsen, Benjamin, Lissen
1 50,000-ohm resistance with horizontal holder	Graham Farish 1½-watt "Ohmite"	Ferranti
1 4,000-ohm resistance with horizontal holder	Graham Farish 1½-watt "Ohmite"	Ferranti
1 150-ohm resistance without holder	Graham Farish 1½-watt "Ohmite"	—
1 1-meg. resistance with wire ends or terminals	Dubilier 1-watt	Telsen, Graham Farish, Varley, Lissen
1 500-ohm resistance with wire ends or terminals	Dubilier 1-watt	Graham Farish, Varley
1 250-ohm resistance with wire ends or terminals	Dubilier 1-watt	Graham Farish, Varley
1 Special 100-ohm wire-wound resistance	Bulgin A.R.100	—
1 10,000-ohm resistance with vertical holder	Graham Farish 1½-watt "Ohmite"	—
1 5,000-ohm resistance with vertical holder	Graham Farish 1½-watt "Ohmite"	—
2 4-mfd. fixed condensers	Dubilier, type B.B	T.C.C., Igranic
1 2-mfd. fixed condenser	Telsen W.226	T.C.C., Dubilier, Graham Farish, Igranic, Lissen
1 2-mfd. fixed condenser	Igranic	T.C.C., Dubilier, Graham Farish, Lissen
1 2-mfd. fixed condenser	Lissen L.N.134	T.C.C., Dubilier, Graham Farish, Igranic
1 2-mfd fixed condenser	T.C.C., type 80	Lissen, Graham Farish, Igranic, Dubilier
2 1-mfd. fixed condensers	Telsen W.227	T.C.C., Dubilier, Graham Farish, Igranic, Lissen
1 1-mfd. fixed condenser	Lissen L.N.133	T.C.C., Dubilier, Graham Farish, Igranic
1 ·001-mfd. fixed condenser	Dubilier, type 610	T.C.C., Telsen, Graham Farish, Igranic, Lissen
1 ·0001-mfd. fixed condenser	Dubilier, type 610	T.C.C., Telsen, Graham Farish, Lissen
1 ·0001-mfd. fixed condenser	T.C.C., type 34	Dubilier
1 ·0001-mfd. fixed condenser	Dubilier, type 665	T.C.C., Igranic
1 Combined mains plug and fuse holder	Bulgin F.15	—
3 Pairs of terminal blocks	Goltone	Lissen
6 Terminals	Goltone	Igranic, Clix, Belling-Lee
2 Reels of insulated wire	British Radiophone "Pull-back"	—
2 Yds. screened wire	Goltone, type R34/963	—
2 Brackets	British Radiogram, type 22	—
1 Bracket	British Radiogram, type 22A	—
2 Pieces Metaplex, 3 × 2 × ⅛ in.	Peto-Scott	—

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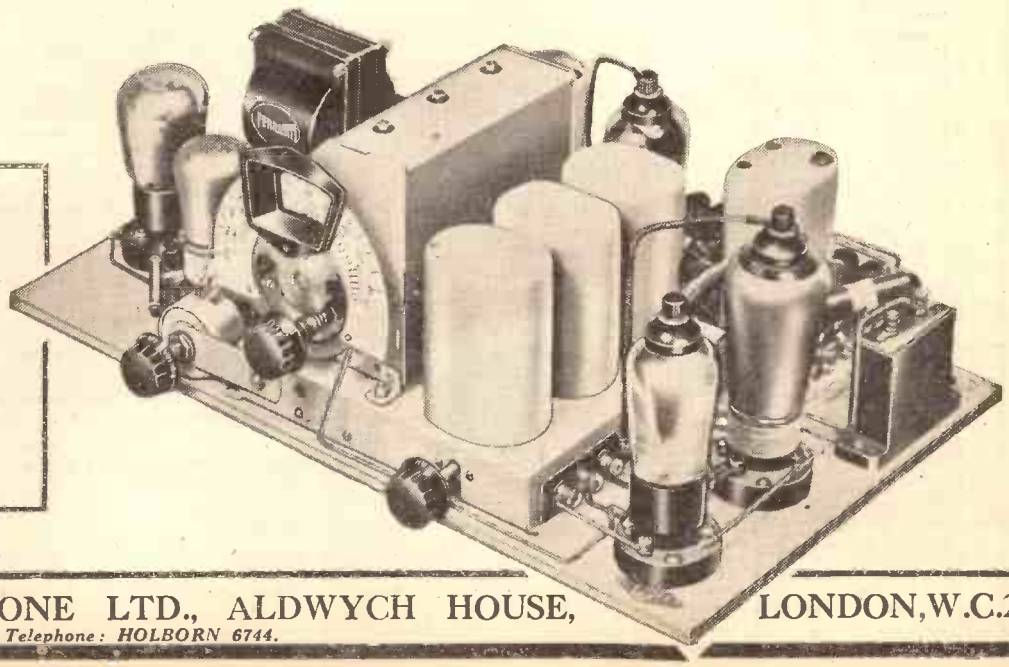

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HOW A TRANSFORMER WORKS

THE transformers used in radio may be divided into two main types, viz. those employed in high-frequency amplifiers, about which we shall have more to say in a future article, and those whose work is connected solely with the supply of power from the mains or whose function is to increase the volume of the received programmes so as to operate a loudspeaker.

Transformers which come within the last two categories have iron or alloy cores, and are widely different, both in construction and appearance, from those which form part of the high-frequency chain.

Magnetic Flux.

In the article on Magnetism we described how the magnetic flux set up by a current of electricity flowing in a wire spreads out in all directions. This magnetic flux, we said, could induce currents in a neighbouring conductor if some of the lines of force were permitted to cut it and providing the lines of force varied in number.

We also showed that the effect of an iron core was to provide an easier path for the magnetic flux, the result being to increase the intensity of the magnetic field influencing the second wire or coil.

This is the principle of a transformer. First we have an

CORE AND COIL

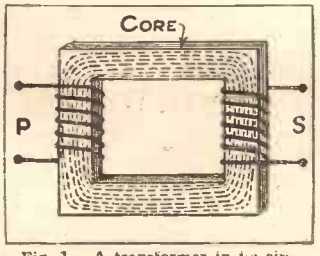


Fig. 1. A transformer in its simplest form. Two coils of wire, P and S, are wound round the core as shown.

iron core which may be either "open" or "closed." An "open" core is simply a bundle of iron wires bound together in the form of a rod; but magnetically this type of core is inefficient, and it has been ousted by the "closed" core, which is far more effective and is universally employed in commercial designs.

A "closed" core in practice is shaped like Fig. 2, although for purposes of explanation it is convenient to consider it to be like Fig. 1.

The word "closed" implies an unbroken path for the magnetic flux round the iron core, and consequently the lines of force crowd themselves into the space occupied by the iron in preference to spreading out into the surrounding air.

If we take a core arranged like Fig. 1 and wind on it two coils of wire (marked P and S) we have a transformer in its simplest form. If a current of electricity is passed through the coil P lines of force will follow the path round the iron and cut the second coil S, inducing in it a current proportional to that flowing in P.

If P and S have exactly the same number of turns we find that the voltage across the two ends of the coil S will be the same as that applied to P. In practice this is not quite true, because certain losses occur (e.g. losses in the core), but the voltage across S is *very nearly* equal to that of P.

A transformer will only work when the current is of an alternating or pulsating character. If we applied a perfectly steady E.M.F. to the terminals of the coil P the current through this winding would also be steady, and a current would only flow in S at the moment of starting and stopping the current in P.

Voltage "Step-up."

But if we apply an alternating voltage to P the number of lines of force cutting S will vary, and current will be induced in S in proportion to the change in the magnetic flux cutting the coil turns.

The winding P is called the primary and S the secondary. We can step-up the voltage in P by increasing the number of turns on S. Thus, by giving S twice as many turns as P, we can step-up the voltage applied to P in the ratio of 1:2. In this case 10 volts at P would be increased to 20 at S, neglecting losses.

Valuable Device.

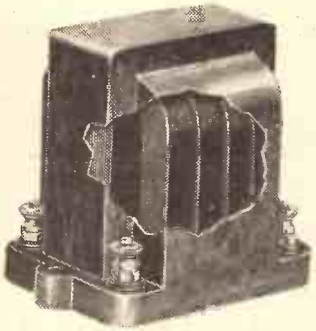
A transformer is therefore a very valuable device for increasing or decreasing the voltage of alternating currents. We may have a mains-supply voltage of 200 which we wish to increase to 1,000. Very well, then. All we have to do is to use a transformer with a voltage ratio of 1:5.

But with transformers, as with everything else, it is not possible to get something for nothing. Even with a theoretically perfect transformer one cannot obtain more *power* from the secondary winding than is put into the primary. Although the voltage can be stepped-up, the current must go down proportionately, so that in the ideal transformer the power output (watts) from the secondary would be the same as the input to the primary.

In practice there are the various losses which have to be taken into consideration, such as the core loss already mentioned, and also that due to the resistance of the windings.

These are factors which we cannot deal with fully at this stage, but a few words on the question of cores will not be out of place.

INSIDE INFORMATION



This transformer has a part of the outer shell cut away to show how the windings are arranged on the core.

The commercial transformer does not employ a solid core. The core is built up of a number of stampings or laminations which are clamped tightly together. These laminations are insulated, one from the other, by a thin coating of varnish, a layer of paper, or by some other convenient means.

Eddy Currents.

The object of this is to reduce the core losses. When the magnetic flux passes through the iron it induces currents in the iron in exactly the same way as it does in the winding S. These currents are called eddy currents, and represent wasted energy, since the only work they do is to heat up the core. If the core were solid the losses would be relatively large, but in a good laminated core the eddy losses are very small.

Incidentally, it should be remembered that a transformer can be employed to step-down voltage equally as well as it can be used to step it up. It is merely a question of primary to secondary turns ratio. Similarly, current can be stepped up or down.

Alloy Cores.

Many of the cores employed in modern transformers are made

IN PRACTICE

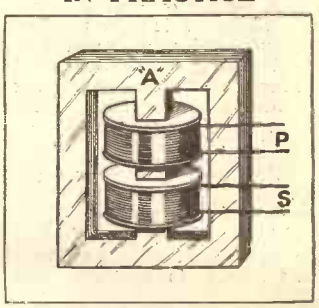


Fig. 2. The core of a commercial transformer is made up of a number of laminations clamped tightly together and insulated from one another.

of an alloy such as nickel-iron. These special alloys have a much greater magnetic permeability than ordinary iron, and enable the bulk of the transformer to be reduced to a marked degree.

The primary and secondary windings are wound on bobbins, usually in sections for certain electrical reasons.

Special Beginners' Supplement—Page 2

RADIO TERMS
A PRACTICAL REVIEW
BY G.V. DOWDING, ASSOCIATE I.E.E.

BAKELITE, BAND-PASS TUNING, BARRETTER and BLOCKING CONDENSER form the subject for this week's practical survey of radio terms.

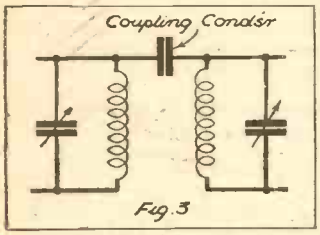
BAKELITE

A MATERIAL extensively used in radio. Is an excellent insulator and can be moulded to any shape and almost any colour. Whole cabinets are now made in single mouldings of bakelite, and a hardness and durability superior to the best woodwork can be achieved, together with a most attractive finish.

Bakelite is a phenol compound. Phenol is distilled from coal, wood and other organic substances. Formaldehyde is added, and under the treatment of heat a kind of resin is formed.

This resin is powdered, a filling material such as asbestos

CONDENSER COUPLING



A fixed condenser is used in this method to couple the two tuning circuits.

or mica powder is added, together with a colouring dye, and the whole is placed in the moulds and subjected to great pressure at a fairly high temperature.

Good Insulator.

The result is a switch cover, loudspeaker cabinet, receiver panel or other object having first-class electrical and mechanical properties. It will have good resistance to the effects of heat, acid and damp, a high insulative value and a handsome appearance.

Bakelite should be cut or drilled with metal-working tools.

BAND-PASS

Although a broadcasting station is said to use a certain wavelength, in actual fact its transmission occupies a *band* of wavelengths. A "300-metre" station, for instance, will occupy a channel in the ether extending a little above 300 metres and a little below 300 metres.

These "skirts" are composed of *side-bands*, and to understand what these are it is as well to consider the transmission in terms of frequency—1,000,000 in the case of the 300-metre wavelength.

When there is no speech or music there is a steady radiation at 1,000,000 cycles. But any modulation of this "carrier" produces new frequencies (side-bands) in the ether. A very low note, say the 100-cycle vibration of an organ, introduces frequencies of 1,000,100 and 999,900 cycles. A high note, say 3,000 cycles, produces side-bands of 1,003,000 and 997,000 cycles.

Always, you will note, there are two side-band frequencies for each low frequency superimposed on the carrier-wave, one plus and the other minus.

Side-bands "Cut-Off."

In order, then, that a receiver shall be able to give equal treatment to the whole band of frequencies of which a broadcast transmission is composed, it must be able to provide a right of way not to just one sharply defined wavelength, but to a small, compact group of wavelengths.

And it is the object of a band-pass tuner to enable that to be done.

If very sharp tuning were possible with the simple Fig. 1 aerial-tuning circuit it would tune only to the one sharply defined wavelength, and as the side-bands would be eliminated the speech and also the music characteristics would be lost.

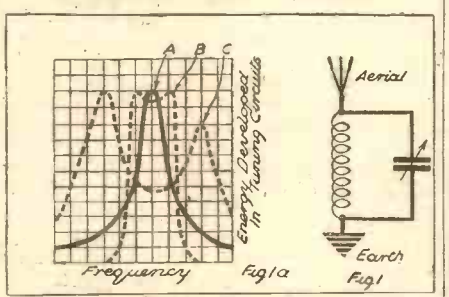
In practice such sharp tuning as that cannot be obtained with a simple single-tuned circuit. But when reaction is applied a very "peaky" effect is possible.

That is to say, the sideband frequencies rapidly fall off in strength towards their upper limits. (See A in Fig. 1A.)

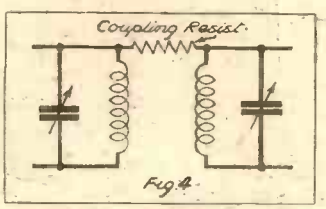
Weakened High Notes.

The result is that, although the low notes come through well (for these are represented by the side-bands closest in frequency to the "carrier" frequency), the high notes get proportionately weaker as the scale is ascended. A muffled, boomy response from the loudspeaker is the evidence of peak tuning.

LOSS OF TOP NOTES



If the simple tuning circuit in Fig. 1 were capable of sharp tuning it would tune only to one wavelength, thus eliminating the side-bands as the curve in Fig. 1a shows.



In this case a resistance takes the place of the condenser in Fig. 3 for coupling the circuits.

When two tuning circuits are coupled together, as at Fig. 2, the energy is transferred from X circuit to Y circuit by an inductive effect existing between the two coils.

Peak tuning can now result only if the coupling between these two coils is a weak one. If the two coils are tightly coupled (perhaps by being very close together) a tuning effect as at C in Fig. 1A results. This shows the sort of thing that happens when there is a *very* tight coupling.

A mean between the two extremes produces something of the nature of B in Fig. 1A. A band of frequencies is accommodated, and that is, of course, a desirable effect for reasons already explained.

In practice difficulty is experienced in obtaining a uniform band effect over the whole of a tuning range; but with carefully designed coils and suitable tuning condensers very good results can be achieved.

Screening is Important.

Various methods of coupling the coils of a band-pass tuner are adopted. Fig. 2A illustrates a scheme where the two coils are coupled through two further smaller coils. These usually adopt the form of small windings wound on the same formers as their respective coils.

The object is to enable the two main tuning coils to be separated from each other by means of metal shields or screens. It is important in many cases that this should be done, especially when the band-pass coils are incorporated in a complete tuning unit with other coils.

In the absence of such separation instability might result.

Mixed Coupling.

The coupling can be carried out by means of a condenser (Fig. 3) or a resistance (Fig. 4). Alternatively, a condenser or coil can be arranged so that it is common to both tuning circuits (Fig. 5).

In order to obtain a uniformity of band-passing over the whole tuning range, a mixture of both inductive and capacitative coupling is often employed.

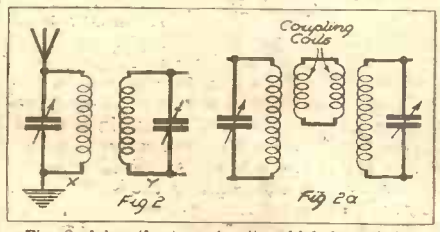


Fig. 2 shows the two circuits which have to be coupled for band-pass tuning. Fig. 2a is one method of coupling them through two smaller coils.

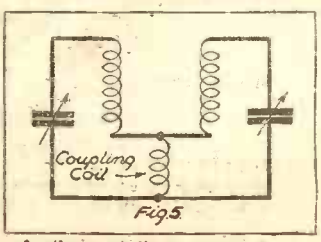
BARRETTER

A device for maintaining within limits a constancy of current flow despite any voltage changes that may occur.

BLOCKING CONDENSER

The name given to any suitable type of fixed condenser which is used to provide a "path" for alternating current while direct current has to follow another route.

DOUBLE TUNING



Another coupling method is to arrange a coil (or a condenser) so that it is common to both circuits.

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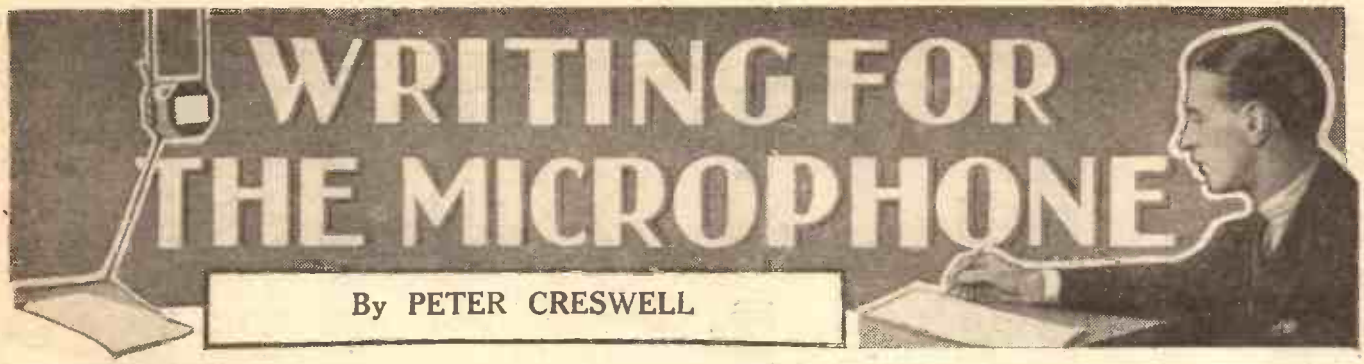


WRITING FOR THE MICROPHONE

By PETER CRESWELL

"WHAT is the ideal length for a radio play?" is a question I am asked more frequently than any other; yet it is obviously an impossible one to answer.

There is no ideal length, or rather the subject matter of your prospective play imposes its own ideal. You would not expect me to tell you that two feet square is the ideal size for a landscape, nor does "Hamlet" fall short of perfection by any known canon of criticism because it plays (in full) for nearly five hours. Practical considerations are, however, another matter. As, presumably, you have most chance of selling your picture if it accommodates itself to the wall of an ordinary-sized room, in the same way—practically speaking—a radio play should not occupy more time than that in which, for psychological reasons, your unseen audience may be expected to concentrate without undue strain.

How are you getting on with YOUR radio play for the "P.W." Competition? Continuing our series of practical articles by leading broadcasting experts, we publish this week some interesting views by one of the B.B.C.'s leading producers.

Make Your Play Short.

Brevity of speech, economy of dialogue, tautness of situation are the targets to aim at. Cut all extraneous matter, though the operation feels like drawing a tooth; and, above everything, regard all adverbs and adjectives which find their way into your manuscript as suspect. If, after the most rigorous scrutiny, you find they justify themselves as being necessary to the rhythm of the sentence, the character development of the speaker or the particular mood you want to evoke, let them stay; otherwise out they go!

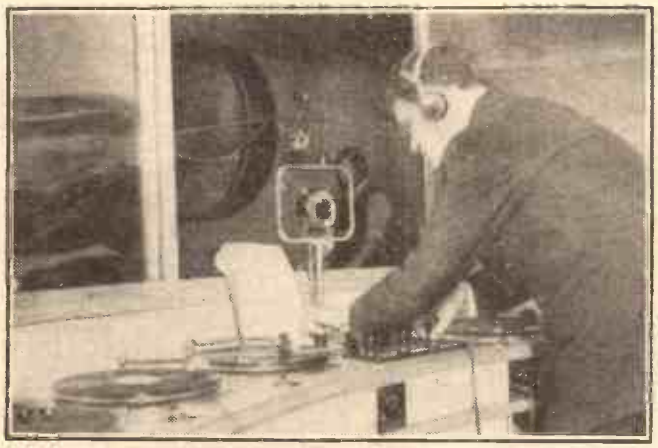
So that, both practically and ideally, your play should be as short as you can make it.

The next point I would like to deal with is wrapped up in the question: "How is one to hold the listener's attention?" When I was an actor I found that all of us behind the footlights became peculiarly susceptible to what might be called the collective mood of an audience. Now, there is one mood that every actor knows and dreads above all others; it is very catching, too. One man can infect an entire theatre. It is the mental attitude of "Here I am; I've paid for my seat. Now amuse or interest me if you darned well can."

If that attitude is not infrequent in the theatre, how much more likely is it to be a very prevalent one in the home circle, where the loudspeaker has to contend with a hundred competitors, there is an unfinished job to be attended to, a letter to write, a neighbour to ring up, an interesting book close at hand, an experience during the day to be discussed—even, if the worst comes to the worst, family bridge!

So you had better assume at the start that your listener is tired and cross, that there has been a very worrying day at the office, that the children have been more than usually refractory; in fact, that it has been just one of "those days."

Therefore plunge at once into the heart of things. Be forceful and concise. A few quick, clean strokes is all you can allow yourself in the way of character drawing or scene painting. Do you remember how Shakespeare begins his "Anthony and Cleopatra" with that tremendous sentence of Philo's—Philo, mark you, of whom we know nothing and whom we are never to see again? There's an opening for you if you like! You are now under way, then, with your story, and that grudging fellow you are trying to hold is beginning to feel a certain amount of curiosity—he's not yet going to admit that he's really interested. He has, perhaps, taken up a book: but so far it is unopened in his hand.



THE EFFECTS DEPARTMENT plays a very important part in many radio plays. In this photograph a member of the staff is operating the bank of gramophone turntables, for many of the most used effects have been recorded.

Use Few Characters.

Well, don't go and worry him with a large cast. In a performance which, unlike the pattern Victorian child, is heard and not seen, only a few characters, or at least important characters, should be employed. Indeed, I would go farther. Your theme is only really a suitable one for broadcasting if its expansion and unfolding can be done through the medium of very few contrasted voices. I do not include what we may call incidental voices—paper boys, cab drivers, programme sellers, crowd chatter and that sort of thing; but your main plot should implicate a minimum number of characters, and you should set yourself to help the producer, as much as you can, by making it possible for him to select voices calculated to produce harmonious or contrasting effects.

Remember, too, that if one character speaks at great length without interruption the others are liable to "disappear" from our hearing. Their presence is forgotten and they have to be reintroduced. Incidentally, the question of introduction is a very important one. Every character that "enters" must be labelled clearly, yet not obtrusively, and whenever you feel that the label has been lost sight of you must exercise your ingenuity in bringing it back to the listener's mind.

"Scene Changing."

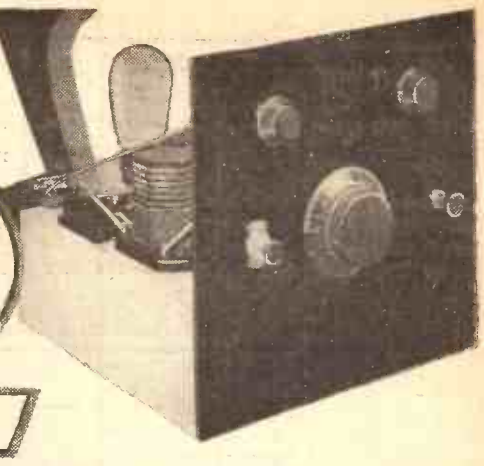
Much of the foregoing applies equally to the problem of "scene" and "scene changing." The fact that radio plays are independent of time and place has led some authors to rush gleefully about the globe without rhyme or reason other than the excitement of "travel"—a kind of aural "wanderlust." This independence is a privilege and an asset; but should not become a liability in the shape of a

(*Continued on page 725.*)

A £50 PRIZE!

This is the reward offered by "POPULAR WIRELESS" for the best original radio play written by a reader. In addition, the B.B.C. has undertaken to broadcast the winning play. There are no irritating rules and regulations; you just write your play and send it to us! Full details will be found in the issue of "POPULAR WIRELESS" dated September 30th, 1933.

The VOL-PEN 2



Power and selectivity are combined to an amazing extent in this compact all-mains two-valve receiver. It makes use of one of the latest and most efficient pentode valves, and is capable of an output wattage of over 3,000 milliwatts.

Designed and described by K. D. ROGERS (Chief of the "Popular Wireless" Research Department).

WE wonder how long it will be—if ever—before the two-valve receiver is relegated, like the crystal set, to the almost obsolete. True, there are numbers of crystal sets giving excellent service in various parts of the country, but they are fast disappearing and will eventually be extinct from any practical point of view.

One would imagine from the chaotic state of the ether at the present time that the simple valve set, too, would be relegated to the ranks of the also-rans, but nothing is farther from the facts.

The one-valver, except for short-wave purposes, has nearly disappeared, but the two-valver is by no means dead. It has a charm of its own, has the two-valve set, that cannot be eclipsed by its bigger brothers, the three and four.

Easy to Tune.

What better local loudspeaker receiver could you have—either battery or mains—than a two-valver consisting of a detector transformer coupled to a power valve? What easier receiver to tune than a single circuit, or band-pass-coupled detector with reaction? Anyone can handle it, no matter how inexperienced he may be in matters radio.

The economy in first costs and in operation of a two-valver are too obvious to need enumeration, while on local reception the purity of reproduction should need no second thoughts—the L.F. side is so simple that it can hardly help being first class.

Many will say that the question of adequate selectivity is one that cannot be solved by any set of such small dimensions—so few tuned circuits—as the two-valver. Up to a point they are right, but they forget that selectivity is a close relation of sensitivity, and that it is only limited in practice by the receiving powers of the set.

It is well known that in a single circuit, or H.F. transformer-coupled aerial, the selectivity depends on the aerial coupling and the damping of the coils. It may be improved by loosening the aerial coupling and by reducing the damping of the tuned circuit by, say, reaction.

The effect of reaction is to upset quality—unless A.T.B. is used—if pushed anywhere towards its limit, while decreasing the aerial coupling inevitably means reduction of "signal" strength. We are discussing the one-stage set, of course not one where there is subsequent H.F. amplification.

Another form of providing selectivity is the band-pass, a more expensive but admittedly effective method that is becoming more and more widely used. This depends on two or more tuned circuits and requires H.F. amplification if the sensitivity of the set is not to be seriously impaired.

It looks hopeless for the two-valver, doesn't it, unless we employ pretty close reaction and not too much looseness in the aerial coupling?

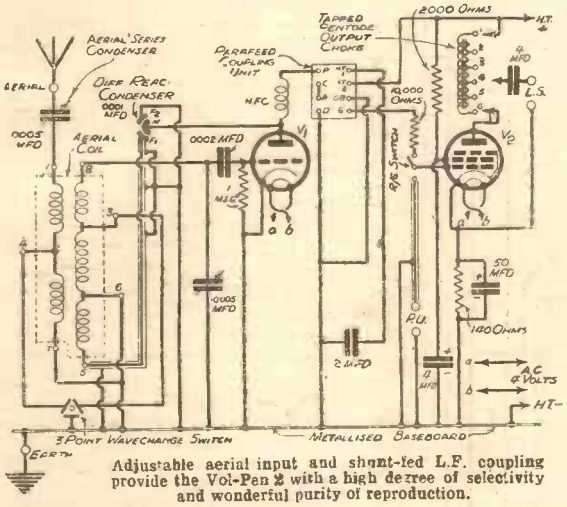
"All the Good Properties."

It looks hopeless until we realise the remarkable sensitivity of the modern valve, and especially the mains type. Obviously, if we can design a two-valve set with the sensitivity of a three we can push our selectivity schemes much farther and still have a really good set, retaining all the good properties of the two without the bad ones.

That is what we have done with the "Vol-Pen" 2 which we introduce to readers this week. This set is based on the

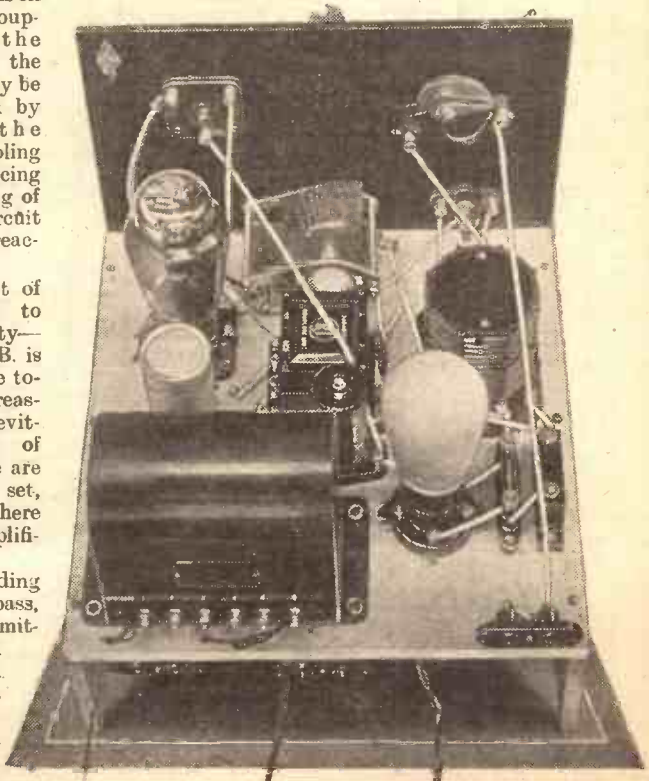
(*Continued on next page.*)

A SELECTIVE AND SENSITIVE SET



Adjustable aerial input and shunt-fed L.F. coupling provide the Vol-Pen 2 with a high degree of selectivity and wonderful purity of reproduction.

POWER AND PURITY



The pentode on the left is capable of giving tremendous power output with a quality that will satisfy even the most critical listener.

THE VOL-PEN 2

(Continued from previous page.)

remarkable characteristics of the modern A.C. detector valve—which has an amplification factor of anything between 35 and 80 nowadays—and particularly on the new A.C. pentode recently introduced by Mazda.

This valve—the A.C.2/Pen.—was used in the design of our Christmas set, the A.C. "Double X," and provided astounding results. Capable of an output wattage of about 3,400 milliwatts from a grid input of approximately three volts peak value the valve is obviously not only an exceedingly good power valve where full volume is required, but also a valve that will provide that volume on the slightest provocation. In other words, it will give fine strength with but a tiny input from the detector.

Coupled to a detector with a 1 : 3 step-up transformer, we can see that a mere 1-volt peak *from* the detector will be adequate to fully load the pentode. With normal broadcasting this corresponds to a *steady* level of about 4 volt from the detector, peaking up to the 1 volt on 80 per cent modulation passages.

These figures are not difficult to obtain on quite a few stations, for we still have amplification of the detector to consider, and this should be of the order of at least 15 out of the maximum of 35 or more. We can therefore safely say that the detector peak input need be only about one-fifteenth volt L.F. Not very much, is it?—for it represents quite a small H.F. voltage: one that can be easily attained from a number of stations.

High Degree of Selectivity.

With a *sensitivity* so high the *selectivity* of the Vol-Pen 2 can be adjusted to a high degree without loss of receptive power, for obviously it can be carried to a far greater extent than in normal sets where increased selectivity would mean an input reduced below the "adequate-signal" level.

In the "Vol-Pen" we can cut down the aerial input (a simple method of obtaining selectivity), and so sharpen the tuning, in the sure knowledge that the subsequent amplification of the set will make up for the loss and that we shall obtain really good strength of reproduction.

We have made the set as a complete radio receiver, but without the power pack required for the two A.C. valves it contains. This enables the constructor to use any suitable power pack he may have available, or if he so desires, to build one specially for the set.

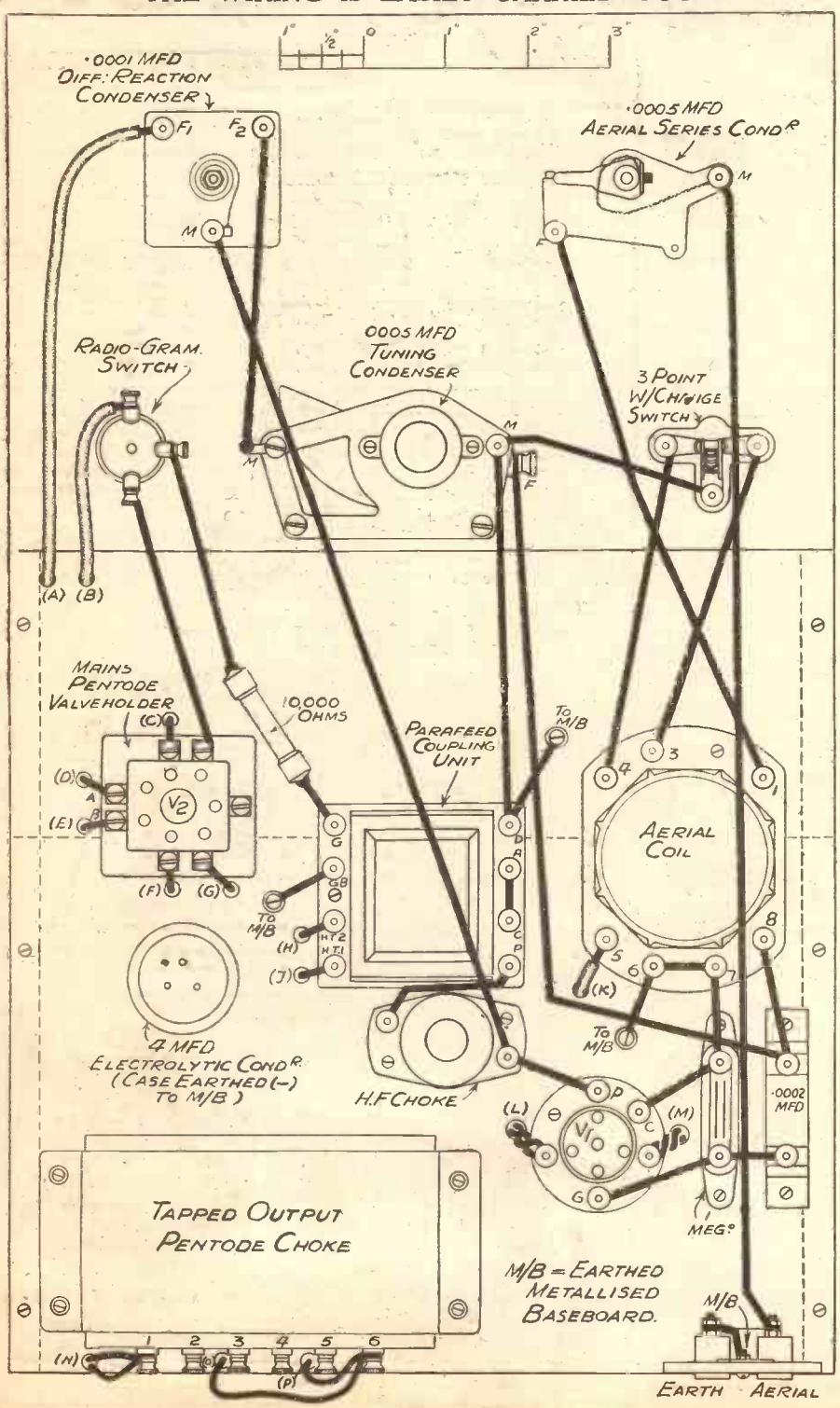
A Straightforward Circuit.

The circuit is straightforward, being merely a single aerial transformer with reaction, connected to a detector which is coupled to the output valve via a shunt-fed transformer. The result is remarkably pure reproduction and ample voltage application to the grid of the power valve.

A pick-up switch is included in the design, and this will be found to be in the grid circuit of the power valve. The reason for this is that if a sensitive pick-up is used it will provide far too much peak voltage for

(Continued on page 714.)

THE WIRING IS EASILY CARRIED OUT



Besides the components shown on this above baseboard diagram there are a few situated below. This form of layout greatly simplifies construction, and makes for ease of wiring.

RECOMMENDED VALVES AND ACCESSORIES

Make.	Detector.	Output.
Mullard	354V.	—
Cossor	41M.H.L.	—
Mazda	A.C./H.L.	A.C.2/Pen.
Marconi	M.H.L.4	—
Osram	M.H.L.4	—
Tungsram ..	A.R.4101	—

ACCESSORIES.

LOUDSPEAKER (to handle 3 watts).—Blue Spot, Celestion, W. B., Rola, G. E. C., Amplion, H. M. V., Atlas, R. & A., Marconiphone, Cossor.

AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," Radiophone "Receptru" down-lead, Bulgin lightning switch, Graham Farish "Filt" earthing device.

Simplified detection & a.v.c.

is now made possible by the use of

THE

WESTECTOR

H.F. METAL RECTIFIER

this year's *biggest* contribution towards radio perfection.

This new high-frequency metal rectifier offers untold advantages over present methods of detection and automatic volume control. It will operate exactly as a diode valve, and in the same circuits; but it is even simpler, as it requires no heater or anode supply; is small in size; and may be suspended in the wiring, no valve holder being required.

When used as the second detector in a Superheterodyne Receiver, the Westector gives straight-line rectification with consequent absence of distortion. It is almost impossible to overload it, and little I.F. filtering is required.

The Press have described its action when used for A.V.C. as "positively uncanny." The alterations required when adapting a receiver, whether to simple or delayed automatic volume control, are of quite a simple nature, and it will work efficiently for years without any replacement.

It will pay you to get further particulars of this useful component. Complete the attached coupon to-day, and get them.

"Quality of the highest order" was specified. Westectors — for detection and Automatic Volume Control — were the designer's *first and last choice* for the

BRITISH RADIOPHONE "MATCHED PERFECTION SEVEN"

THE WESTINGHOUSE BRAKE & SAXBY SIGNAL CO., LTD., 82, YORK ROAD, KING'S CROSS, LONDON, N.1

Post COUPON To-day!

I enclose 3d. in stamps. Please send me 'THE ALL-METAL WAY, 1934,' containing full particulars of, and circuits for use with, the WESTECTOR.

Name .....

Address .....

.....

P.W. 15-12-22.

"Perfect Reception for Xmas"....

STOP THAT STATION OVERLAP

with the

MICRION

ADJUSTABLE INDUCTANCE IRON CORED COIL

Overlapping of reception, the big bugbear of radio today, is practically eliminated by the high selectivity of the "Micrion" — the coil that will enable your set to bring in station after station with clear-cut separation. Easily fitted in place of existing coils without costly alterations. Can be adjusted to the existing calibration and aerial working conditions. Other coils in the same set can be matched by "Micrion." Described by "Wireless World," Oct. 27th as 30% to 40% better than any air cored screened coil.

List No. B.Y.36. 2¾ x 2¾ x 3 ins. high

12/6

.... and use these SPECIFIED Components for your 'VOL-PEN' 2

'PARAFEED' Coupling Unit

Combines in one small component the whole system of parallel feed amplification—it has no equal where uniform response and high amplification are required over the complete audible range of frequencies.

List No. D.Y.32. Primary inductance 85 henries.

11/9

HYPERCORE Pentode Choke

The nickel-iron core employed ensures high inductance and brilliant reproduction.

List No. D.Y.22. Inductance 30 henries.

18/6

The Advertisement of Radio Instruments Ltd., Croydon, Surrey

THE VOL-PEN 2

(Continued from page 712.)

the pentode valve if it is fed through the detector. If it is fed direct to the output stage it will probably load the pentode without the need for vigorous volume controlling to obviate overloading.

If the pick-up is not sensitive the question of supplying adequate grid-voltage input to the pentode is easily settled by inserting a transformer between the pick-up and its input terminals on the set, the volume control across the pick-up being used in the usual way.

The aerial coil is a well-known type of transformer, the selectivity of which is controlled by means of a series condenser placed on the panel. This device also makes an excellent volume control and removes the need for any L.F. potentiometer scheme to reduce the volume when listening to the local station.

Reaction is provided for long-distance reception, and it is unlikely that it will be needed for any near-by station unless the aerial conditions under which the set is being used are particularly bad. Reaction is, however, a great help where increase of selectivity is required and, used in conjunction with the aerial-series condenser, the reaction control enables a very fine degree of separation of stations to be achieved.

The set is constructed on the chassis principle, but using a wooden baseboard and sides instead of sheet metal. This makes it very much easier to build than the all-metal design, while the wood is of the metal-sprayed type to act as shielding.

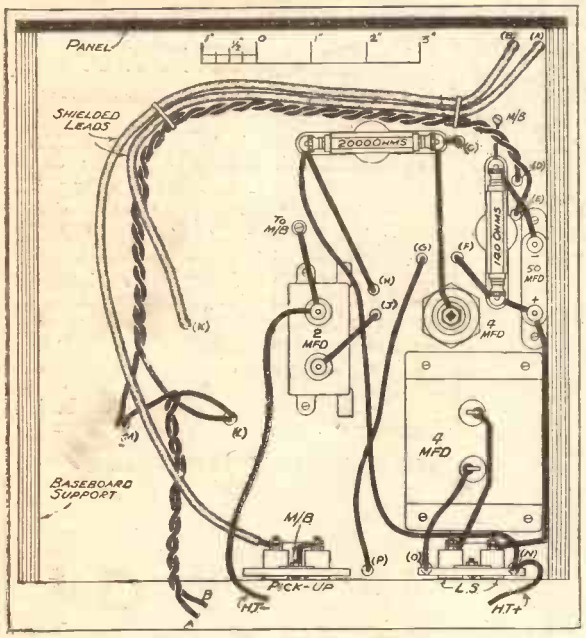
The heater wiring is carried along on the underside of the baseboard, and the decoupling resistance of the screen grid of the pentode is also mounted on the underside. The condenser used in conjunction with that resistance is of the wet electrolytic type, and is mounted through the baseboard.

Underneath, also, is the output condenser, which must be of the high-voltage-working type to withstand the A.C. peak voltages applied across it, and the bias resistance of the output valve and its associated condenser. This is of the dry electrolytic type and has a capacity of 50 microfarads. Owing to the low bias voltage required by the A.C.2/Pen., however, the voltage of this condenser need be but 12 volts.

Apart from the two socket strips, the only remaining component under the baseboard is the 2-mfd. condenser, which is

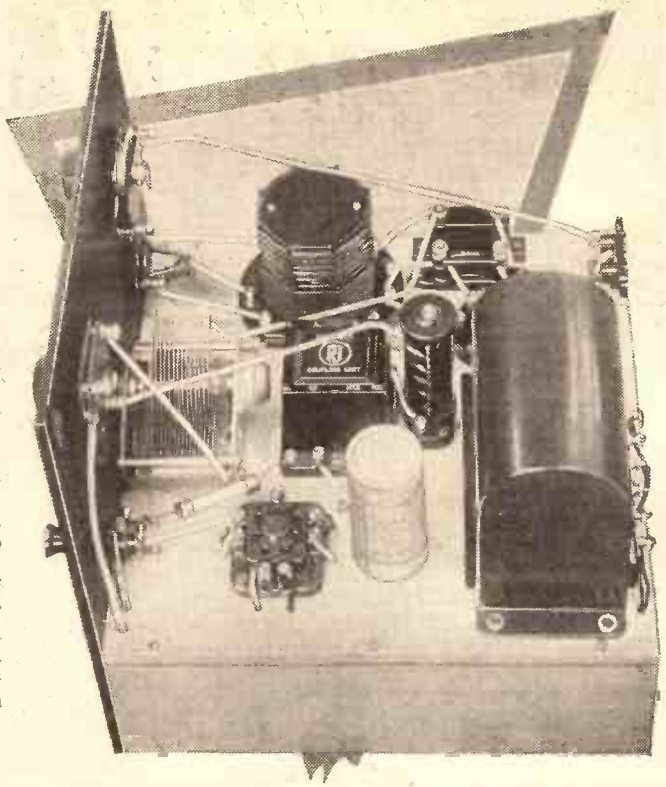
(Continued on page 720.)

BELOW THE WOODEN CHASSIS



The screened leads and the twisted dex heater connections run mainly below the wooden baseboard, which is sprayed with metal to form a screened chassis.

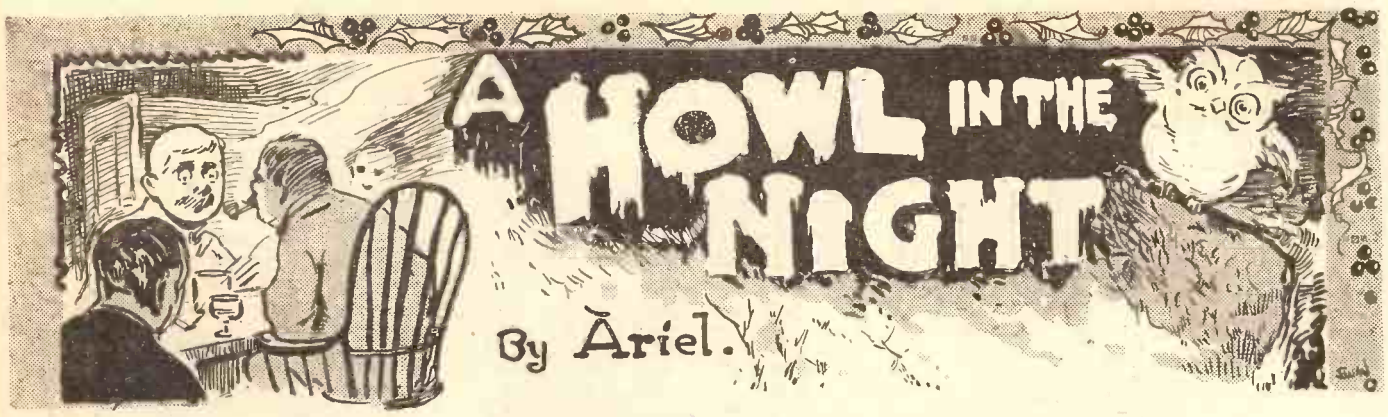
THE OUTPUT END OF THE SET



The output valve has a seven-pin base and needs one of the new seven-socket valve holders. The output choke, on the right, is of the tapped variety, and should be "adjusted" to suit the loudspeaker.

ALL THE PARTS REQUIRED FOR THIS POWERFUL TWO-VALVER

Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.
1 Ebonite panel, 10×10 in.	Peto-Scott	Permcol, Becol, Goltone
1 Metaplex chassis, 10×10×3½ in.	Peto-Scott	—
1 Aerial coil	Telsen W.154	—
1 ·0005-mfd. slow-motion tuning condenser	Polar No. 2 S.M.	J.B., Ormond, Utility
1 ·0001-mfd. differential reaction condenser	Polar	Graham Farish, J.B.
1 ·0005-mfd. series-aerial condenser with terminals	Magnum	Telsen, Polar, Lissen
1 4-mfd. electrolytic condenser	T.C.C. Aqueous	Dubilier, Telsen
1 4-mfd. fixed condenser	Dubilier, type LEC.	T.C.C., type 87, Telsen
1 50-mfd. electrolytic condenser	T.C.C. type 501	—
1 2-mfd. fixed condenser	T.C.C., type 50	Graham Farish, Telsen, Igranic, Dubilier, Lissen
1 ·0002-mfd. fixed condenser	Dubilier, type 620	Telsen, T.C.C., Graham Farish, Lissen
1 1-meg. grid leak and horizontal holder	Ferranti	Graham Farish, Dubilier Telsen, Lissen
1 2,000-ohm resistance and horizontal holder	Graham Farish 1-watt "Ohmite"	—
1 140-ohm resistance and horizontal holder	Graham Farish 3-watt "Ohmite"	—
1 10,000-ohm resistance with wire ends or terminals	Dubilier 1-watt	Varley, Graham Farish, Bulgin
1 H.F. choke	British Radiogram No. 44	R.I., Telsen, Igranic, Lissen
1 3-point change-over switch	Wearite G.C.O.	Bulgin, Goltone
1 3-point shorting switch	Bulgin S.13	Lissen, W.B., Telsen, Goltone
1 5-pin valve holder	Benjamin	W.B., Telsen, Lissen
1 7-pin valve holder	Graham Farish	Telsen, Benjamin, Wearite, Ferranti, W.B.
1 Tapped pentode output choke	Atlas type C.P.S.	R.I., Wearite, Varley
1 L.F. coupling unit	R.I. D.Y.32	—
3 Twin-plug strips	Bulgin (A.E., Pick-up and speaker)	Belling-Lee
3 yds. insulated sleeving	Goltone	Wearite
4 yds. 18-gauge tinned copper wire	Goltone	Wearite
1 yd. screened wire	Goltone R 43/93	—
Flex, screws, etc.	Peto-Scott	—



I HEARD this story in the parlour of the Quiet Woman Inn at T———— on Christmas Eve, 1932. Four people, I being one of them, were weatherbound there, the snow being qualitatively and quantitatively more than the chains on our car tyres would look at.

Two of us were those beefy, hearty kind of men who spend their lives careering from place to place, selling things. The third was a little man who might have been a tailor's cutter or something in the insurance business, but that, on the one hand, he did not seem to be interested in clothes and on the other he was not fluent in speech.

As Thick as Thieves.

While for several hours the little man and I alternately exchanged small talk and read the newspaper, the two jolly salesmen told each other the usual stories of barmaids, "orders," commissions, bets, beer and breakdowns which go to make up their lives. Then they turned to us for further diversion, by that time being "half-oiled"—as the "boots" muttered to me when I stepped into the hall to observe the weather and tap the barometer.

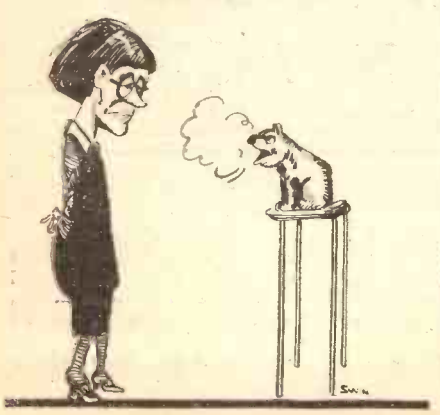
Presently we four were as thick as thieves, owing to a lucky hit of mine over a story about a "commercial" who sold an electric cooker to the president of a gas company.

The small third man stuck to lemonade, but we others were quite sociable. At nine-twenty, the large "commercial"—"Soups pickles, jams: that's me"—contrived to pour a fair quantity of whisky into the little fellow's lemonade, surreptitiously.

Hence, at nine-thirty-five the little man said:

"My Aunt Proserpine . . ."

THE EVIL EYE



Aunt Proserpine "could make a brass dog foam at the mouth."

Christmas is the time for a rattling good yarn, so get the fire roaring up the chimney and settle down to read this gem of a Yuletide story. You'll enjoy it.

"Wasser mean—Proshpi?" said the second "drummer." ("My house is pre-eminent in the world of waterproofing!")

"My Aunt Proserpine had been more than usually fractious, and my nerves got about as much as they could stand. I began to develop a stutter, and occasionally bit the mantelshelf. You can see the marks."

"I knew a lunatic once . . ." began Soups, Pickles, Jams, but Macks silenced him.

"Lerrim gerrom wi' t' yarn."

A RURAL WELCOME

"I found the farmhouse of my dreams . . . . Hens clucking softly and dusty old dogs . . . ."

"I will not lacerate your minds with a recital of my sufferings. Suffice it to say that Aunt Proserpine is the Ultimate Frustrated Spinster. She could make a brass dog foam at the mouth. Mad wolves slink from her presence biting their tails to keep themselves from sobbing. And she—IT—*lived under my roof.* However, fortified by this excellent lemonade, I am my own man again."

From Aunt to Aunt.

"At last my wife—th' angel!—said: 'Why don't you go and stay with your Aunt Ceres for the week-end? The change will do you good.'

"From aunt to aunt is no change, so I just stuck a pin in Bradshaw and took the next train to the place. Gooble's Halt."

"Barksher," said Macks. "I once sold goloshes, four and a half dozen, there, and *berlieve me . . .*"

"At Gooble's Halt," continued Lemonade, "I found the farmhouse of my dreams. Eggs and bacon, honey and all that. Hens clucking softly, and dusty old dogs all as friendly as possible.

"But what I liked best was the absence of radio. They hadn't even the usual harmonium. Quiet? Why, after he had put the farm to bed the old man used to walk about the house in his stockinged feet.

"But at night the difference between that place and Putney was a little too marked. Not so much *silence* as absence of sounds—if you follow me. And another thing: I never quite liked the farmer's eye. I was brought up to be particular about farmers' eyes, I suppose. Anyhow, this one's were too sort of glinty. And after six hours I thought that his missus was a trifle too oily—*smarmy.* But I put that down to over-anxiety to please."

Butter, Honey and Cheese.

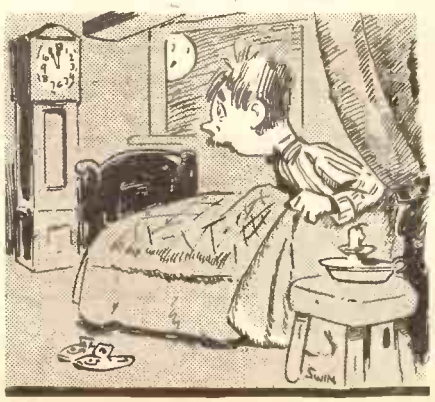
"As the evening wore on I began to come all over creepy. I caught the couple nodding and winking to each other, and there was more telling the time than seemed polite. Every now and then the man would shove his head out of doors and waggle his ears. *She* sat by the fire, smoothing her apron down and quite obviously trying not to burst with excitement.

"At ten o'clock I had another whack at the butter and honey and cheese, and went to bed, and as I flopped in I heard my entertainers scurrying about like mice in a newspaper. Nothing in it, but there seemed to be *something on.*

"At eleven I was awakened by the noise

(*Continued on page* 724.)

WHAT WAS THAT?



At eleven I was awakened by the noise of men walking about . . . ."

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos.

Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

GRID BIAS FOR THE CLASS B VALVE OF THE "S.T.500."

Will readers please note that the *only* Class B valve that needs grid bias is the B.21?

When using any Class B valve other than the B.21, it is essential to follow Mr. Scott-Taggart's instructions.

In effect these were as follows:

Connect lead 23 (G.B. — 2) to the L.T. — terminal, instead of to a negative tapping on the grid-bias battery.

HEARING AMERICA ON THE MEDIUM WAVES.

W. M. A. (Caterham).—"I could hardly believe my own ears when the loudspeaker gave out 'Chicago.' But as I had a pencil lying on the table I grabbed it, and put down what he said, and this is it:

"'Chicago, W B B M, on 389·4 metres.

"It was half-past twelve time, and the strength was so good when he faded in a bit that I was afraid I should have complaints from upstairs about waking people up with the wireless in the middle of the night!

"Some of the people at my office who fancy themselves as wireless experts tell me it cannot be done on the medium waves, but you have to put in a set of short-wave coils. And, of course, I haven't got such a thing, but just had the set on exactly as if it had been London Regional.

"(And one chap says it is common at that hour of the night, even on a three-valve set.) So I should like to know what you think, especially as I am certain he said Chicago."

They were wrong about it being always necessary to have short-wave coils in, in order to hear American stations direct. It is continually being done after the European stations have closed down when conditions happen to be favourable.

In our own minds we have no doubt at all that it was Chicago you heard, particularly as this station has been well reported by other "P.W." readers. (See also the paragraph below headed "Early Morning Transatlantics.")

EARLY MORNING TRANSATLANTICS.

As several readers who aim at getting American stations by direct transatlantic reception have raised questions about what is the best time for this class of reception, it would be of interest if those who have succeeded in qualifying for this "Radio Blue Riband of the Atlantic" would inform us of their opinions as to the best times.

It probably varies a lot with time of the year, and possibly with locality.

Experimenters and night-workers who keep late hours may be interested to know that right up to dawn has been found suitable for such very-long-distance work, on simple two-, three- and four-valvers. It is even easier on a superhet.

In this connection the following letter from a Ware reader is of special interest (though, owing to lack of space when it arrived, it refers to the conditions that prevailed weeks ago).

It is written by R. D. E., and the following are typical extracts:

"I am quite 'green' as to the real technicalities of wireless, but I have managed to obtain reception from nearly fifteen U.S.A. stations on several mornings lately at 5.20 a.m. to 6 a.m., but could not get reception from these stations after 6 a.m. as I suppose they all close down.

"Chicago, W B B M, was quite plain, as was New York City, 348 metres, ditto 454 metres. Static conditions, however, interfered considerably on occasions with the above and others heard.

"At about 9 p.m. last night I am certain I got an unknown U.S.A. station, but reception was marred by a powerful European station.

"It may interest you to know that although I am not an expert in handling or tuning a superhet, I managed to get 76 stations a week or so ago.

"This was on a night when static conditions were none too good. Nearly all of these stations came in fairly strong, the time spent in getting these stations was from 9 p.m. to 10.35 p.m., and I was then working on an internal aerial fixed around the beams in the attic.

"My wireless set is an eight-valve (plus a rectifier) superheterodyne."

CLASS B COMPONENTS IN THE "S.T.500."

W. F. (Castleford).—"I want to use the Benjamin driver transformer for the 'S.T.500.' Also the Benjamin output choke.

"Please give the connections for these where they differ from the blue print."

When using the Benjamin driver transformer terminals P and H.T 1 should have leads 33 and 34 connected to them respectively. Terminal H.T.2 should not be used.

Terminal C.T. corresponds to terminal G.B. shown on the driver transformer in the blue print. The other terminal markings are obvious.

Leads 26 and 27 should be connected to the two P terminals on the output choke. Lead 28 to H.T.+ terminal. Leads 29 and 30 should be connected to either 1 and 4 or 2 and 3, a trial being made to see which connections give better results.

NOTE.—As no separate earthing terminals are provided on the Benjamin components, leads Nos. 17 and 20 should be taken direct to the respective holding-down screws of the components in question.

A PUZZLING FAULT

We have to thank O. S. (Huntingdon) for the following interesting letter dealing with a very puzzling fault:

"When reading about other people's troubles in your paper I have often thought that surely a *careful* examination of the set would *always* afford a clue as to the faulty component or whatever it was. Little did I know what was in store for me!

"I'll describe it as briefly as possible, and I'm sure you will agree that as faults go this was a snorter!

"I ought to explain that in all I must have made at least a score of different sets at various times, so I have met with and overcome all the usual little snags. In fact, I rather fancied myself on construction. And this last set was to be the last word.

"Four-valvers were nothing new on me. And I had previously had a three having, like this one, a band-pass followed by H.F. stage, using a three-gang closed-in tuning condenser; so I wasn't expecting any difficulties at that end of the set.

"I must admit I thought I might get some sort of surprise with the Class B end, as it was my first venture in that direction. However, I felt pretty sure, as I finished it, that the set would be a winner from the word 'go'!

"It was *not*. For when I switched on, with my ear-drums braced ready to stand anything, all I got was two-valve strength.

"And it wasn't only the lack of punch that staggered me—it was the lack of stations as well.

"In spite of the fact that it looked perfect (easily the best-looking job I had ever turned out) I could only get London Regional! Not a smell of a foreigner, no other station at all, just the Regional at good quality but with no pep behind it.

"That was on the Friday night. So I went to bed late, quite happy in the thought that I'd find what was wrong on Saturday afternoon or evening and have the full benefit of it for the rest of the week-end.

"What a hope! When Sunday night came I was worn out with the wretched thing. Except for short breaks I had spent the whole time testing and checking, but was no better off.

"I had never been beaten by a set before, and as I had tested everything that could be tested I didn't look at it at all on the Monday, but waited till I had a free evening. (I did tell a friend of mine about it, and though he was very interested, and suggested dozens of things to try, there was not one that I had not covered in my own efforts.)

(*Continued on page* 720.)

"P.W." PANELS, No. 148.—PRAGUE (CZECHOSLOVAKIA).

Until the new Moscow station came into operation with 500 kilowatts, Prague was the most powerful station in Europe. It works on 488·6 metres and 120 kilowatts.

* * *

The name Prague is given as "Praha," and the station employs both men and women announcers. Its distance from London is 640 miles.

* * *

Prague's programme is usually relayed by Brno, Bratislava, Kosice and Moravska-Ostrava. The closing words, "Dobrou noc," are Czech for "Good-night."

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 718.)

"On Tuesday night I found what was wrong with it! And, as you may have guessed, it was the softest kind of fault in the world—that was why I missed it, I expect. I felt I could kick myself, but decided it would be better to explain it to you in case it might help other 'P.W.-ites.'

"On the Tuesday, instead of getting out the voltmeter again and fretting about broken contacts, etc., I sat down in front of it with a fag on and asked myself *why* a carefully built set could behave like this. No tuning. No real punch. One station at the same strength for all dial readings.

"I knew that the condenser *looked* all right, because I had had the cover off (bit of a job it was, too), and I had tested each section. But the more I thought of it the more I felt it *must* be that. One station for all dial readings *must* be a tuning fault.

"So in the end I decided 'I'll test that condenser once more, and test the coil, and if I don't find what's wrong there I'll give it up.'

"The Spindle Wasn't Turning."

"So I took the condenser cover off again, turned the knob, and found *the spindle wasn't turning!*

"(Of course, if there had been no cover on the condenser it would have taken only one second to see what was the matter; but as the dial turned and the tension of the knob was O.K. I naturally supposed the altered dial readings corresponded with altered tuning!)

"One touch with the screwdriver and—my word!—what a difference! It's going grandly as I write. But in future my motto will be: 'What the eye doesn't see don't trust.'"

THE "VOL-PEN" TWO

(*Continued from page* 714.)

connected between H.T.1 on the L.F. coupling unit and earth. This is the detector-anode decoupling condenser which is connected in circuit between the two resistances inside the coupling unit.

The rest of the parts are mounted on the upper side of the baseboard, including the pentode output choke, which is a necessary adjunct to the set, and which is particularly adequately tapped—an important feature when dealing with a valve of the A.C.2 Pen type.

Wiring the Set.

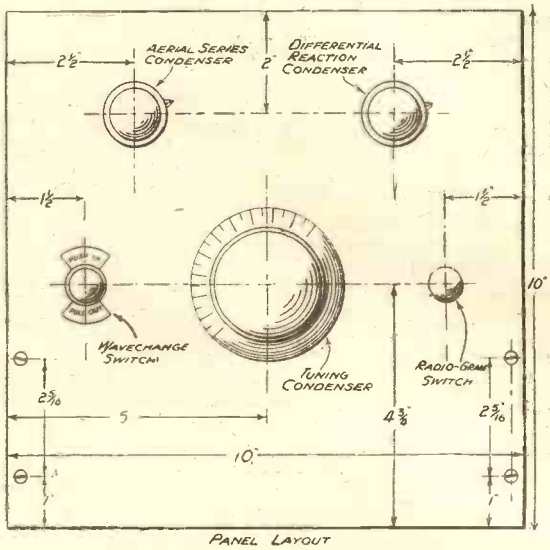
The majority of the receiver can be wired up with ordinary wire and sleeving, or better still with such wire as the Radiophone "pull-back," but certain sections have to be screened or to be of twisted flex.

These wires are kept in position by means of a copper staple, which also effectively earths the casing of the screened leads to the metal covering of the baseboard. The baseboard is used as earth return in several places, and in fact the earth socket itself is connected only to the Metaplex.

Care must be taken when mounting the Ohmite holders that the screw heads underneath are not proud of the moulding or they will short circuit on the baseboard. To make sure that this does not take place they should be carefully examined before use, and if there is any doubt a thin piece of card should be placed under the holder to keep it away from the metal.

The operation of the receiver is perfectly straightforward and normal—it is handled exactly as would any other two-valver. The power pack must, however, for full effect, be able to give about 50 milliamps at over 200 volts (250 volts, if possible). Any mains unit rated for less current than 50 milliamps is of no avail in this case.

HOW THE PANEL IS DRILLED



PANEL LAYOUT

The panel drilling is particularly easy since all the panel components are of the one-hole fixing type.

ECONOMY WITH POWER

By J. UTTLEY.

You may not agree with the idea in this article, but it forms a striking illustration of the economy available by application of the maximum possible G.B. and the careful reduction of high-tension voltage.

I AM afraid that what I have to say will be read as rank heresy, but these suggestions are not made without careful thought and experiment. They are an encouragement to those who wish to run a fairly powerful set on a standard dry high-tension battery, as I find that the implied necessity to invest in expensive super-capacity batteries has often proved a deterrent.

Very Few Milliamps.

I first became interested in the question of economy some years ago when a friend keenly followed the experiments of Mr. Dowding with the high-tensionless sets. He then took up various reflex circuits and experimented with the early double grid valve.

The culmination has now been attained when he runs a four-valve set consisting of S.G., detector, R.C. coupled L.F., then transformer L.F. through a small pentode. A standard 60-volt dry battery is used, and with a consumption of 6 m/a it lasts four months.

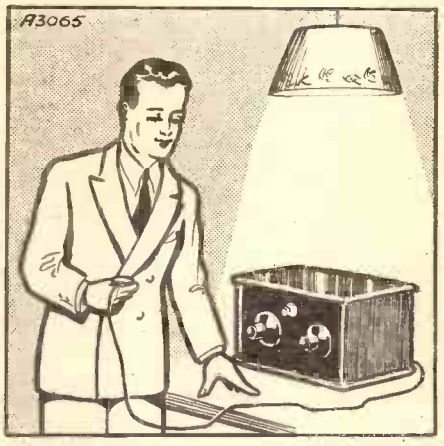
Output through a Pentode.

Most people would be satisfied with a S.G., followed by a detector, and the output through a pentode. I have experimented with these and, using a 60-volt dry battery, can get ample power with a consumption of 5 milliamps. Starting with the screened grid valve, this type of valve, when giving its maximum amplification, can be very greedy, and I find it is not always an easy matter to get undistorted reproduction.

But reduce the voltage to 30 or 40 volts, and there is a noticeable change. There still remains quite satisfactory amplification, but the tone is much improved and the consumption drops to less than 2 milliamps.

To get the best results, a certain amount of experimenting will be necessary in balancing anode and screen voltages. A detector valve need not consume more than one milliamp, and if the output is through a low wattage pentode a further 2 milliamps may be required.

USE A MILLIAMMETER



The total H.T. taken by your set can be ascertained with a milliammeter joined in the H.T. negative lead.

Careful Experiment Needed.

I was surprised at the economy of this type of valve when I first tried it in a two-valve set, where it replaced an L.F. valve which was much more extravagant.

The combined drain of 5 milliamps is well within the capacity of the standard dry H.T. battery, but satisfactory results will not be obtained without careful experimenting.

Grid bias variations have a remarkable effect on both purity and consumption. It is essential that the preliminary adjustments be made with a milliammeter in each of the H.T. positive leads, and a check for the total consumption is made by inserting the meter in the common H.T. negative lead. If the milliammeter be coupled semi-permanently in the set at first a lot of interesting facts will be learnt.

Worth a Ton of Theory.

I know that I am open to criticism; that I shall be told that I am spoiling the characteristics of the valves, and that I am working on the wrong parts of their curves. But an ounce of practice is worth a ton of theory, and if economy can be read on the scale of the milliammeter and distortion cannot be heard by the ear, what can the sacrifice of a little power matter with the present high-power stations that come in so easily these days?

THE STENODE

Dr. Robinson replies to our Chief Radio Consultant on the subject of the overcrowding of the ether and the solution of the problem.

The Editor, POPULAR WIRELESS.

SIR,—"Eckersley explains" in your issue of Oct. 28th that it is impossible to find a solution to the biggest problem in wireless—"the multiplication of stations to any limit"—because the side-band theory stands in the way. Further than this, he is becoming impatient with those people who have attempted and are still attempting to solve this problem, doing me the honour of associating my name with that of one of the best-known names in the electrical industry—Westinghouse—as a subject for his humour.

Some Budding Edisons.

Amongst your vast circle of a quarter of a million readers there may be some budding Edisons, and they will be well advised to follow the example of Westinghouse, and to make their aim in life to attack the biggest problems, in spite of the certainty that there will always be people to ridicule them on the slightest opportunity. "Man's reach should exceed his grasp," has been the maxim of the most famous men of the world.

On the point in question—the multiplication of stations—your readers are left with the impression from Capt. Eckersley's article that the stenode can be dismissed with a gesture. He knows perfectly well that the stenode has come to stay and that it has added very considerably to the knowledge and technique of wireless.

Plenty of Stenodes Available.

For the sake of truth and justice, he should correct the wrong impression he has conveyed, and explain just how the stenode eliminates certain types of interference. There are plenty of stenodes available and volumes of literature on the subject, including a Government Report covering the theory.

Further, I must put forward my view that it will soon be necessary to find room for more services on the medium and long-wave ranges, and that it is possible to do so. The stenode will be essential under such conditions because of the amount and type of interference that it eliminates. Incidentally, this makes it also the most suitable receiver for dealing with present broadcasting conditions.

J. ROBINSON.

Mill Hill, November, 1933.

THE MIRROR OF THE B.B.C.

(*Continued from page* 696.)

India (Bombay) and South Africa (Cape Town).

The King's message will be broadcast at 3 p.m. G.M.T., and will be heard at the following local times in various parts of the Empire: Bermuda, 10.50 a.m.; Ottawa, 10 a.m.; Wellington, 2.30 a.m. (December 26th); Sydney, 1 a.m. (December 26th); Bombay, 8.30 p.m.; Calcutta, 8.50 p.m.; and Cape Town, 5 p.m.

A Broadcast Pantomime.

In the microphone version of the pantomime "Sindbad," arranged by Harry S. Pepper and Gordon McConnel, which is to be a feature of the Christmas programmes, Sindbad will be played by Arty Ash; Hindbad by Bertha Willmott, and the principal girl by Betty Huntley-Wright.

Denis O'Neil will be the Envoy of the Empress; Wynne Ajello the Fairy Queen, and Aimee Bebb will be Mrs. Sindbad. The Theatre Orchestra and Chorus will be conducted by Stanford Robinson.

From the Midland Region.

Let us now turn to some of the items we shall hear from the various regions during the week preceding Christmas.

First, take the Midlands, which has carol services on Thursday, December 21st, and Saturday, December 23rd. The first is a luncheon-hour broadcast from St. Martin's Parish Church, Birmingham, which Canon Guy Rogers will conduct.

The second is a relay from Peterborough Cathedral, where the choir will be under the direction of Dr. Henry Coleman. Old English, traditional and foreign carols will be heard in these broadcasts.

It is only as it should be that some special programmes have been arranged for the Children's Hour at this time of the year. That entitled "Robert Tredinnick Records Christmas" sounds very attractive, and will no doubt appeal to many listeners outside the Midland Region on Friday, December 22nd.

Carol Service from Dartmouth.

Carols are certainly the strong point in the arrangements made by the West Region. They begin on Sunday, December 17th, with an evening relay from the Royal Naval College, Dartmouth, where the choir consists entirely of naval cadets, officers and masters.

The carol service on the last Sunday of the Christmas term has always been an outstanding event at the college, but this will be the first occasion on which it is broadcast.

Quite different will be the programme of Welsh carols to be sung on Wednesday, December 20th, at 6.30 p.m., by Dai Cwmhywel's Carol Singers, in a broadcast which, in English, means "Welcoming Christmas." This programme comes from the Swansea district, and the idea behind it is that listeners shall be able to join a company of Welsh carol singers who are making a Christmas Eve circuit of Llan-y-gwystlon.

The next carol broadcast, on Friday, December 22nd, at 6.30 p.m., is in yet another category. The carols will be sung in Welsh and led by the Porth and District Choral Society in a relay from the Congregational church, Cymmer, Porth. This will be more in the nature of community singing.

Later the same evening Mr. Tom Parry will give a talk in Welsh from the studio on "Old Carols." On the following evening Will Ifan will tell West Regional and also Daventry National listeners how his countrymen keep festival at this time of the year.

Handel's "Messiah."

And now for the North, with its broadcasts of Handel's "Messiah" and of relays from pantomime rehearsals. Listeners will give an equally warm welcome to both. The broadcast of "Messiah" will certainly be unique in musical history if the plans it is hoped to make can be carried through.

It will take place from 7.30 to 10 p.m. on Thursday, December 14th, and it is no less ambitious than that each of the three parts of Handel's great oratorio shall be taken from a different hall where it is being performed in the Region.

The pantomime rehearsal relays come on successive days—Monday and Tuesday, December 18th and 19th—from the Palace Theatre, Manchester, and the Theatre Royal, Leeds, respectively, and both are of that popular show "Cinderella."

"The Shepherds."

Away to Scotland, where in the Regional programme on Thursday, December 22nd, Molly Iverson will give a recital of Christmas songs. These will be followed at 9.30 p.m. with a presentation of George Rowntree Harvey's Nativity play, "The Shepherds," which has already been broadcast on two occasions.

This play will be given from the Aberdeen studios, from where another Christmas play, "The Oxen Kneel," by Ida Rowe, will be broadcast in the Scottish Children's Hour programme on Friday, December 22nd.

THE CLASH IN THE ETHER

(*Continued from page 697.*)

Now take Fig. 1B, and again suppose the hand to be rotating at uniform speed in the same direction. The effect of "phase" modulation is that, although the amplitude (or length) remains the same throughout the circle, the modulated wave sometimes lags behind its proper position, as at B and C, and sometimes gets in front, as at D and E.

No Mutual Interference.

Two such programmes can be imposed on the same carrier-wave without interfering with each other, provided they are received on a special type of set. As shown in Fig. 2, in simplified form, the first programme is applied through a condenser microphone, which sets up phase variations in the carrier-wave, whilst the second is applied in the ordinary way through a resistance microphone so as to create amplitude variations in the high-frequency currents radiated from the aerial.

The receiving set shown diagrammatically in Fig. 3 comprises a local oscillator and a filter circuit. In practice these are so arranged that they can be cut out, when

AN INGENIOUS SCHEME

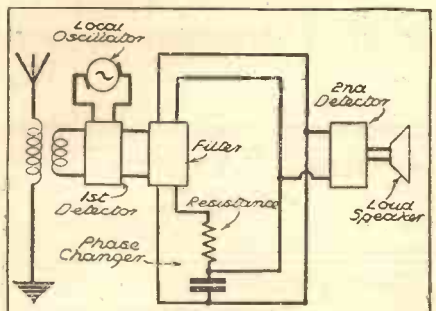


Fig. 3. Double-Programme Receiver

This receiving circuit includes a local oscillator and a filter. In practice these are arranged so that they can be cut out so as to convert the set into an ordinary "straight" receiver.

desired, by a change-over switch so as to convert the set into an ordinary "straight-circuit" type of receiver working in the normal manner.

The amplitude programme is, of course, received on the "straight" circuit, which does not respond to the phase-modulated programme. As soon as the change-over switch is operated the phase-modulated programme comes through alone, the other having no effect.

Separating the Sidebands.

Here the local oscillator valve, in combination with the first detector, acts as a frequency changer. This steps-down the frequency so that the filter circuit is able to separate the sidebands from the carrier-wave.

The sidebands go through unaltered, but the carrier is passed through a phase-shifting circuit, comprising a resistance in series with a capacity. By tapping across the capacity the carrier-wave is first given a 90-deg. phase change and is then recombined with the sidebands in the second detector. When so adjusted the circuit responds only to the phase-modulated programme.

A HOWL IN THE NIGHT

(*Continued from page 716.*)

of men walking about in the cobbled yard, and muttered conversation. Then a phrase came clearly to my ears and sent the blood from my heart:

"'*Do you think the old girl will kick up much of a row?*'

"Then I heard my farmer say: '*Lord, sir! I reckon she'll screech summat cruel.*'

"Subdued sniggers followed, and then the talk went on, whilst I lay there, growing cold with apprehension.

"'*Are you sure she'll come to-night?*'

"'*Aye! Never misses her little jaunt.*'

"'*Which way does she come?*'

"'*Straight across meadow there. Any minute now, I reckon, so I'll leave ye to yer job. Hope ye'll catch the old besom.*'

A Stiff Silk Skirt.

"I got out of bed, crept to the window and put my nose over the sill. All I could make out were the figures of two men standing under a big elm. Presently I heard the farmer again:

"'*Psst! Psst! She's a-coming!*'

"'*You all set, Bill?*'

"'*Yes. Shhh! That's her! Keep quiet.*'

"I heard a sort of rustling, like somebody walking quickly in a stiff silk skirt. Then it stopped. *That* was a thriller—that silence. My mouth went dry and my brow damp.

"And then! Such a series of shrieks as I never heard before or since. Me—I turned bang into a lump of ice and I could hear my pulse going plunk-ker-plunk in my temples.

"After I had stood congealed for a few seconds I went off my head. Although I am only a featherweight and always get hurt in a scrap, I tore downstairs, out of the door, and simply chucked myself at those two devils, who were crouched over something which lay on the cobbles.

"'You cowards!' I screamed.

"They picked themselves up and came for me.

"'*Hey! What's the idea?*' shouted one of them. '*Are you mad or only drunk?*'

"'Robbery with violence!' I panted. And an old lady, too. Where is she?'

"They dropped their hands from me and began to laugh. They laughed at first like gentlemen; then like madmen, slapping their legs and holding their sides.

Britain's Vanishing Bird Life.

"Presently one of them caught me by the arm and led me to the foot of the elm.

"'*There she is,*' he said, pointing upwards to the branches. '*That's her.*' And as he spoke a large bird flew away.

"'*Let me introduce you to the Larger Speckled Screech Owl. We are the B.B.C.; Outside Broadcasts; Department Four; Section, Records; Sub-section. "Britain's Vanishing Bird Life," and we have just recorded your protégés remarks by Blattner-phone.*'"

"But what about Aunt Proshpine?" asked Soups, etc.

"Pooh! *Her?* Waddoo I care for *that* ole Screech Owl? This lemonade makes me feel abso——"

"*Not* a nowl," said Macks, sleepily. "It's a *Howl.*"

"No, no! No *howl!* 'T's a *scree-sh,*" replied Soups.

And they argued it out, the Boots said, long after I had left them.

WRITING FOR THE MICROPHONE

(*Continued from page 710.*)

compulsion to "keep moving." Actually, unless the scene itself has some significance or emotional content—in which case it can probably be conveyed in dialogue, with a little help, perhaps, from the "effects" studio—it need hardly be referred to, and should be as unobtrusive as possible.

The Question of Effects.

Which, in turn, brings me to the much-discussed question of "effects." "How do I know about putting in the effects?" I am asked. The reply to that, in the first place, is that the conception is false and an utterly wrong way to approach the subject. Effects should never be "put in" like illustrations in an edition de luxe of a well-known library work. They should be thought of as part of the theme, a "motif," not added separately, but woven into your sound pattern as a whole. They are occasionally, and quite rightly, used for illustration—for "scene painting," in fact. Their real and important function, however, is not that of sham realism but emotional significance.

If we hear approaching footsteps and feel relief or horror, if we hear knocking and react to it with terror or joy, then that sound effect is as much a symbol as Ibsen's wild duck or Chekov's seagull in the plays concerned, and correspondingly as integral and vital a part of your play.

But unless you can conceive of noise effects in that sense you had much better omit them altogether, leaving it to the collaboration of the producer, much as you might write an air of music, leaving it to a technician to harmonise and orchestrate.

THE LINK BETWEEN

(*Continued from page 700.*)

existing battery sets which have an S.G. H.F. stage without any alteration whatever to the set

Up-to-Date Party Entertainment.

Christmas, I feel, is the one time of the year above all others when *everybody* looks to the radio or to the gramophone for seasonal entertainment especially if any parties are in the offing.

I know that I, personally, get hours of fun out of my pick-up and amplifier during the festive season, and I am very glad to note that H.M.V. has again stepped into the breach this year with the issue of some records specially for the occasion.

If you want some really good fun, take my tip and obtain copies of H.M.V. records, Nos. C2298, C2492 and C2609. The first two of these are "Guess-the-Tunes" records, each tune with a reference number and with the correct answers grouped together in special inner grooves at the end of the record. Record C2609 is a similar record, except that "Everyday Noises as Heard Through the Microphone" form the basis for the competition instead of tunes.

For Cossor Sets.

By arrangement with Messrs. A. C. Cossor, Ltd., Siemens have just introduced two new sizes of "Full o' Power" double-capacity batteries specially designed to fit the cabinets of the new Cossor battery sets.

For Cossor sets Nos. 335, 341, 342, 344, 3456 and 735 order Full o' Power battery No. 1172. The price is 15s. 6d. For the model 634 the Siemens reference number is 1175, and the price in this case is 20s. A good scheme!

For Our Scottish Readers.

The Young Accumulator Company (1929), Ltd., has asked me to call the attention of Scottish readers to the fact that as and from the middle of December, the whole of the sale of Young accumulators in Scotland will be handled by Messrs. Day and Night Auto Serve, Ltd., of 285–295, Clyde Street, Glasgow.

Mr. T. S. Johnson will continue to act as the Scottish manager for the Young Accumulator Company, but his address will be 285, Clyde Street, Glasgow, instead of 75, Robertson Street as hitherto.

Trade Note.

While on the subject of changes of address, here's a little note of particular interest to our trade friends:

Will those concerned kindly note that the head office of Edison Swan Cables, Ltd., has been transferred from Queen Victoria Street to 155, Charing Cross Road, London, W.C.2? The new telephone number is Gerrard 8660.

Stop-Press News.

I learn with interest as we go to press that an entirely new kit set for home constructors has just been produced by Messrs. British Radiophone, Ltd.

It is to be marketed under the alluring title of the British Radiophone "Matched Perfection" Superheterodyne, and from all accounts it is a real winner.

I am glad to say that arrangements have already been made by "P.W." for a complete test report to appear in an early issue. Meanwhile, may I just add that it is a seven-valve super, and it is designed for battery operation? I am making arrangements for further details to appear in my notes shortly, when I am hoping that it will also be possible to announce the date of the issue in which the full technical report will appear.

THE LISTENER'S NOTEBOOK

(*Continued from page 696.*)

we heard everything, we also visualised everything, including the blood that first trickled down, and then daubed Peterson's face. What a great thing could be made of extensive running commentaries!

* * *

I'm sure we should feel less disposed to grumble at radio fare if there were more of these commentaries. Half the criticism we level at broadcast variety, musical comedy, orchestras and gramophone recitals is due to our having too much of them.

Again, most of us like to mingle with the crowds—to share their fun with them. Studio performances are mainly private or semi-private affairs. Therefore, I say, take the microphone out into the streets a little oftener. Man's a social creature. Let's hear the shouting applause of others, and the booing, too, if necessary. I repeat, man's a social creature, and the microphone could serve him as nothing else can, if only it were given the chance.

* * *

Don't you think that "In Town To-night," the new Saturday evening feature ought to exclude any item the like of which we hear scores of time every week? Reginald Forsythe's orchestra may be the goods all right, but even *its* brand of hot music isn't a novelty nowadays.

* * *

I must say I like to hear from people in the news. That's why I was pleased to hear Pan, the walking Chinese. I had been reading about him only a few days before.

* * *

Martin Taubmann (I hope this is the way he spells his name) was interesting only after the intricacies of the Electronde had been explained. I wonder which of the several dance bands will be the first to experiment with this new instrument.

* * *

Larry Gains, the Colonial heavy-weight champion boxer, commanded respect more, I think, for being Larry Gains than for the story he had to tell. Perhaps it was excessive modesty that forbade him to do little more than just mention "Some of His Big Fights."

* * *

Mr. Desmond MacCarthy had a lot of interesting things to say regarding the publication of the Supplement to the Oxford Dictionary. In defiance of the purist and the proof reader he exhorted listeners not to be afraid of using excessive slang. "Use Slang shamelessly!" he said. This advice must have caused many a maiden aunt to frown, especially those blessed with already precocious nieces.

A READER'S APPRECIATION

The Editor, POPULAR WIRELESS.

Dear Sir,—In connection with your advertisement in POPULAR WIRELESS re "The Manual of Modern Radio" and your reservation form, may I say a few words on behalf of POPULAR WIRELESS?

I have been a constant reader of your popular wireless journal for the past six years, and during this time I have gained very valuable information—information that has been written in a very simple way, easy for anybody to understand, yet absolutely technical. I have four volumes bound, each volume consisting of fifty-two papers, and even now I refer to your journals of four or five years ago. Wishing you the best of future success,

Yours sincerely,

Gillingham, Kent. E. MARCH.

P.S.—I am also a constant reader of "Wireless Constructor," having had this journal for four years. Needless to say, I am one of S.-T.'s admirers. My "S.T.400" is going to be an "S.T.500."

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Adjusting Ganging.

IF you are using a set with ganged tuning—as is so general now in modern sets—it is very important that the individual trimmers should be accurately adjusted. Most people set to work on this job simply by trusting to their ears to tell them whether the signal is louder or quieter. This is really a rather haphazard way of adjusting trimmers, because your ear will, as it were, adjust itself to quite appreciable differences in volume without your being aware of it.

The only really satisfactory way of ganging up accurately is by the aid of a milliammeter in the anode circuit of the detector valve; this should be one reading from, say, 0 to 5 or even 0 to 10 milliamps—although it will not, as a rule, read anything like that current—and should be put close to the high-tension end of the circuit. It doesn't particularly matter whether the meter gives accurate readings, nor is it important what the actual values of the readings are; the meter is really there to give you indications of the *relative* values of the current.

If there is no signal coming through you will get the steady anode current on the meter; but when a signal comes along the anode current will decrease, and the stronger the signal the greater will be the movement in the needle. If the detector is not being overloaded the reading should be pretty steady, even if the incoming signal is modulated, so that when actually receiving a programme the needle should be fairly steady.

Avoid Overloading.

You then adjust each part of the ganged condenser so as to get the maximum shift of the needle, and you will find that you get improvements in the ganging by the adjustment of the trimmers and by watching the needle even when your ear is quite unable to detect any difference in loudness.

In making these adjustments it is important not to use too strong a signal, because if you get the detector valve overloaded you will get the needle jumping about, and it is then practically impossible to observe small changes in its mean position.

Power Components.

Have you ever noticed what a lot of people think that if they put a power valve—or preferably a super-power valve—in the last stage of their receivers they will get "power" results? Quite a lot of people seem to be hypnotised with this idea that a "power" component is in itself invested with all kinds of powerful virtues or that it is in itself, as it were, a *source* of power.

The fact is, unfortunately, that these so-called "power" components are nothing of the sort. Power-grid detection, for instance, does not actually give you more power, but merely enables you to use more power if you have it.

If you have an ordinary detector, and you are trying to handle power in excess of the power-handling capacity of the detector, you will, of course, get distortion due to overloading, and this is a case where you might turn to the power-grid arrangement in order to handle what you have got.

Using a Super-Power Valve.

The same sort of thing applies to a power or super-power valve for the output stage. If you are using an ordinary valve for the output, or a small power valve, and the available output is too much, again you will get overloading distortion, and it will be the proper thing to go to a super-power stage.

(*Continued on next page.*)

Presentation Book Token No. 9 appears on the back cover of this week's issue of POPULAR WIRELESS.

If you have reserved a copy of

THE MANUAL OF MODERN RADIO

and have now collected the tokens from eight consecutive issues of "P.W." you should attach these to your Gift Voucher and post them immediately — together with the necessary remittance — according to the instructions on the Voucher.

IF YOU HAVE COLLECTED EIGHT TOKENS

post them at once. There are tens of thousands of the Manual to send out, and the sooner you post your completed voucher, the earlier you will receive your copy.

TECHNICAL NOTES

(Continued from previous page.)

But if you have *not* got this power available you are wasting your time using a super-power stage; in fact, it is worse than that, because you will actually get better results by using an ordinary small power valve, since this will have a higher amplification and give more volume.

Cutting Out Interference.

One of the many practical problems of radio reception is the cutting out of electrical disturbances, or "man-made static," which interfere so seriously with reception; these are due to high-frequency electrical currents, or radiations produced by all kinds of electrical apparatus. You may get it as crackling, buzzing, roaring or sizzling sounds, or you may get clicks or rumbling in the loudspeaker.

I dare say hardly any of my readers have not at one time or another experienced interference of this kind. As you know, it is caused by electrical machinery or apparatus in the vicinity, such as electric motors (in office buildings particularly the electric motors working the lifts), vacuum cleaners, electric signs, electric tramways, battery chargers, electric bells and particularly the switching on and off of the electric lights in the house.

Wiring as a Distributor.

The disturbances due to these effects are communicated to the electric wiring of the house, which acts as a distributor. The effects are bad enough on battery sets, but as a rule are much more pronounced and more difficult to deal with on a mains receiver, for the obvious reason that there is a more direct access for the disturbances from the mains into the receiver, since the latter is connected to the mains.

Lots of people have had a shot at solving this knotty problem during recent years, especially since all-mains reception became popular, but I think it is safe to say that nobody has evolved any *absolutely* effective cure which can be used in all cases.

Suppressors.

Two or three manufacturers have produced "eliminating" devices which may be used in certain special ways and which undoubtedly cut out, or at any rate reduce, some of the types of interference mentioned above. Of course, this is in itself an important step in the right direction, and if you are lucky it may be that your particular type of interference is one which is amenable to the treatment of one of the available devices on the market. On the other hand, there is no doubt that in a good many cases listeners fail to get any very definite satisfaction, and so they keep on trying one thing after another.

I dare say you know that the best way of cutting out interference of this type is to cut it out *at the source*. But inasmuch as the source is very often beyond your control—for example, electric tramways, electric signs and so on—there is nothing for it but to do the best you can with some sort of device for use on your own receiver.

How to Fit Them.

One of the best things I have come across of this kind is the Belling-Lee "disturbance

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

suppressor," which is designed in accordance with Post Office recommendations and will *reduce* the disturbance in any case, whilst in many cases it will virtually eliminate it.

This, as I say, appears to be the most you can expect in present conditions, and the Belling-Lee suppressor is much better than one or two other devices which I have tried. It can be fitted in various ways, but generally the user is recommended to fit it adjacent to the electric meter.

Sometimes when the interference is very bad it will actually be picked up on the coils, valves or wiring of the receiver itself, and it may be necessary to screen all these efficiently before you can get any satisfaction, even when using any form of suppressor.

Ask the Post Office.

Some of my readers may not know that the Post Office gives a free service in connection with interference of this kind, and if you cannot get over your difficulty you can communicate with the Engineer-in-Chief, Alder House, E.C.1, who will arrange for the trouble to be investigated and for advice to be given to you as to the best method of getting over it. But remember that the Engineer-in-Chief gets an enormous number of these enquiries, so you should not trouble him until you have exhausted any possibility of dealing with the thing yourself.

NEXT WEEK

First Details of a Remarkable New Development

"P.W." WILL AGAIN LEAD.

Plating Your Components.

I do not know whether any of you are interested in electro-plating parts of your set or components, or for that matter any other metal articles used about the house. But in case you are, I should mention that a new process has been developed for what you might call "home plating" with chromium, and great claims are made both for the simplicity and for the efficiency of this new method. It was on show at the recent Motor Exhibition at Olympia, and chromium was deposited on the bright parts of a motor-car just as quickly as they could be cleaned.

The apparatus is no larger than a portable wireless set. A pad is dipped into the plating solution, and when this is rubbed on the part to be plated an electric current passes through, causing the chromium to to be deposited, the process being continued until a deposit of the required thickness is obtained. The same process, by the way, can equally be used for depositing copper, nickel, cadmium and silver.

Anyway, if you are interested in this, the name of the people is the Portable Plater Sales Company, 83, Cannon Street, E.C.2.

Aerial Designs.

Amongst my letters this week is one with regard to the Garthbe'k aerial. I said some little time back that the question of *aerials* had been rather neglected of late, although a good deal of attention had been given to various types of *earth*. These remarks prompted Mr. K. T. Hardman, the inventor of the Garthbe'k aerial, to bring this to my notice as being, in his opinion, something out of the ordinary and representing the "application of scientific principles to aerial design."

Some of you may have heard of this particular aerial, since the inventor tells me that he has sold several thousands of them during the past three or four years. Its characteristic feature is a vertical bundle of wires at the upper extremity of the aerial—not unlike, for a rough description, a large shaving-brush with thick metal bristles. It is rather curious to know that the idea of this bundle of antennæ was derived from the antennæ of insects.

REGISTERED AT THE G.P.O. AS A NEWSPAPER

REMARKABLE NEW VALVE—EXCLUSIVE DETAILS (See Page 745)

OUR CHRISTMAS CAROL

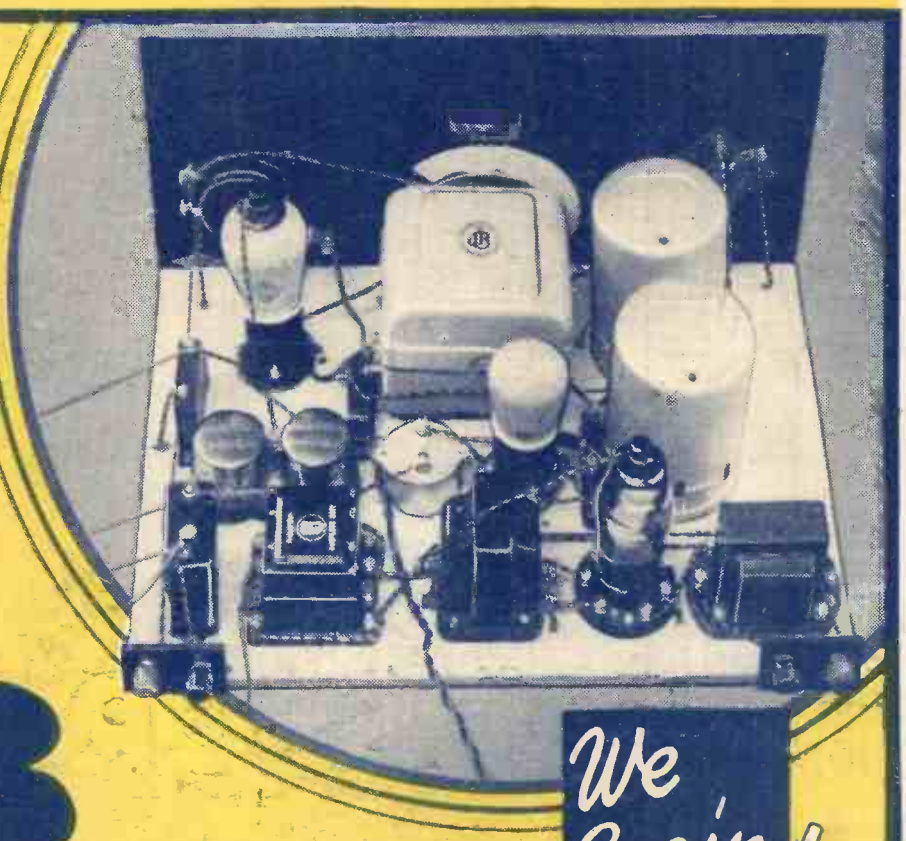
Popular Wireless

THE BETHLEHEM BROADCAST—SPECIAL PICTORIAL DESCRIPTION

No. 603. Vol. XXIV. December 23rd 1933.

EVERY WEDNESDAY PRICE 3D

Uses
AN ENTIRELY NEW DEVELOPMENT *in* CLASS B



The D-B THREE

We Again Lead!

POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
Technical Editor: G. V. DOWDING, Associate I.E.E.
Assistant Editor: P. ROBERT BIRD.

Managing Editor: N. F. EDWARDS.

Chief Radio Consultant: P. P. ECKERSLEY.
Assistant Editor: A. JOHNSON-RANDALL.
Chief of Research: K. D. ROGERS.

RADIO NOTES & NEWS

ARIEL'S "HOLIDAY"
BUTTON SLIPS UP
TELEVISION IMMINENT?
THOSE DRESS SHIRTS

RADIO ADVERTISING
EXIT JAZZ
RUSSIA REACHES OUT
"RELATIVITY"

A Christmas Oyster Hunt.

TO-NIGHT I shall cease to be Ariel for several days, so by way of a busman's holiday I am going to take part in a mirthful affair in which two fellows will compete with each other in a station-logging contest. The stakes—a barrel of oysters.

My job is to smoke cigars, keep an eye on the decanters and another on one of the rivals. My "opposite number" is to referee for the other oyster hunter and see that the coffee-pot is always open for business.

It will be fast and furious, for there is to be no identification; anything, except Morse, heard on the speaker counts a point. The amateur band is ruled out. The weapons are portables.

Button-Crump Episode.

THAT brings to my mind a bet between two men (I call them Button and Crump) who were my colleagues on a wireless station before the war.

The issue at stake concerned the whereabouts of a ship. Button said she was due to pass that evening, whilst Crump maintained that she was a thousand miles away. The loser was to take the winner's duty on Christmas Day.

Button Gives the Game Away.

WHILE Crump was on watch, old Button went about two miles along the beach with a sparking coil, sending key and battery—and a bottle—and pretended to be the ship. When he got back to the station he found Crump in a state of fizzle. "Button, you were right—and she must be aground near here, for her signals were thumping, but all muddled up." "No, lad," mumbled Button, "ye're wrong. *I never sent C Q D. Ye can't read Morse.*"

The Prince and Radio.

WHEN I drew up the first draft programme for Writtle—yes, I did that—I should have been incredulous had a prophet told me that in 1933 the Heir to the Throne would honour with his presence, and charm with a speech a banquet and ball given by an industry which was to arise out of that small beginning.

Nevertheless, in late November H.R.H. attended a "do" of the R.M.A. at the Savoy Hotel and made a speech in which he proposed the toast of the radio industry, coupled with the name of Mr. W. W. Burnham, the chairman of the R.M.A., to whose Sunday evening amateur broadcasts I used, with delight, to listen in 1919.

And so does the world wag!

Completely Crystallised.

SOME time ago I asked whether there is a listener who has used nothing but a crystal set since broadcasting began. F. W. W. (Woodford Green) does not claim such a record, but what he does claim is even more interesting.

He says that not only is he still using a crystal, but works a moving-coil loudspeaker with it and also a gramophone "pick-up." His loudspeaker, which has been in service for about seven years, runs on a three-volts dry battery.

It's a pity that F. W. W. omitted to state what stations he receives, but all the same he merits congratulations.

French Radio.

FOLLOWING the movement of French radio towards national control, Radio-Paris is now a State station. That, fundamentally, is all to the good. But what makes me fear for the French listeners is the announcement that the station is to be managed by a committee of *thirty*. Nothing was ever run well by a committee so large.

There is to be another committee to draw up the programmes, and by the time the thirty have done with it—well, I ask you to imagine the programmes!

More Liquor, Less Radio Tax.

I THINK that this is pretty cool. The American Radio Manufacturers' Association is going to press Congress to repeal the 5 per cent excise tax on radio and gramophone products, on the grounds that what the State loses thereby will be compensated for by the income which the State will receive as a result of the country "going wet."

Well, I admire enterprise in the right place, and so I hope that they succeed. They may, for the tax produces only about £40,000 a month, whereas beer, etc., will bring in more money than the world has ever seen cheerfully paid to tax gatherers.

Television Again.

ACCORDING to the New York "Sun" it is not expected that the introduction of television will be delayed beyond the autumn of 1934—in America, at least. It is suggested that the radio industry is pledged to arrange and support a public exposition of the art next year.

Behind heavily padlocked doors R.C.A.-Victor and Philco are straining every resource of engineering and research on the problem, and it has been whispered that television has advanced far beyond what is generally known to the public. Television is expected to be a "fact" next year; on ultra-short waves; requiring a separate instrument. And it will not be a cheap luxury.

Nous verrons! as M. Stephan might say.

(Continued on next page.)

AMERICAN STATION BANS "HOT" DANCE MUSIC

(*Continued from previous page.*)

A.-A. R. and T. Society in Birmingham.

MR. R. CLEWS, who is co-operating with Mr. R. O. Barnett in forming a Birmingham branch of the Anglo-American Radio and Television Society, asks if existing members who are interested would write to him at 88, Antrobus Road, Wylde Green, near Birmingham.

Non-members are requested to write in the first instance to the Hon. Pres., Mr. L. W. Orton, 11, Hawthorn Drive, Willowbank, Uxbridge. And will all correspondents kindly enclose stamps for the reply ?

One for Women Announcers.

EARLY last month the B.B.C.'s provincial stations complained that the weather report and second news bulletin were subject to "dirty background," and the engineers stated that the cause was an announcer's shirt-front ! It was a clean shirt, but it creaked and rustled.

Doubtless it has by now been Blattnerphoned for future use as a storm at sea. The announcers, instead of being emancipated from the tyranny of boiler-plate shirts, have simply had to arrange not to creak any more.

Here is where the woman announcers score, for the modern lady does not creak or rustle ; even her ma gave up doing that when she discarded those formidable stockades known as "stays" and no longer kicked her dress, etc., with every step she took.

Radio Advertising.

IN 1923 the American Telegraph and Telephone Corporation offered to broadcast "sales messages" at ten dollars (then £2) a minute. All manner of things which have happened to American radio since then are due to that naive proposal.

In 1931 the American trader spent ninety million dollars on that form of advertising, of which the artistes collared over twenty-one millions, a larger percentage of the total cost than the art and "copy" of printed advertisements ; so that one may say : "It's a rotten wavelength that purveys no dough to a crooner."

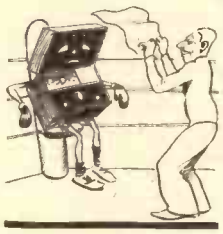
Correspondents Wanted.

MR. C. S. WELLS, 15, Academy Street, Concord, New Hampshire, U.S.A., a short-wave "fan" who would like to correspond with British Empire members of the International Short-Wave Club, has heard about our earlier paragraph on the subject and has asked that I may be put into touch with him.

Tempting as is the idea, I must banish it from my mind, for I have already one regular American correspondent to whom I but imperfectly fulfil my duty ; two would be impossible. Won't somebody deputise for me, please ? Besides, I am not a member. That disqualifies me.

More "Third-Degree" Methods.

APPARENTLY the great Catkin-Maltreatment Campaign has given the set manufacturers something to think about. Thus, one well-known firm has picked on a portable as the victim of a special brutality course, which includes the ordeal of hot air, sprays of water and blasts of freezing air.



The dials were moved by mechanical means at great speeds for hours together, the general idea being to cram ten years' normal use into a few hours.

Should a customer write in to say that (even after such tortures) his set has developed a new fault, the chief engineer will probably threaten to resign and go into the armour-plating business.

Misgivings about Jazz.

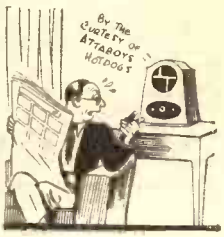
WHETHER this is the beginning of a nation-wide revulsion of policy I cannot say, but WMCA, of the Federal Broadcasting Corporation (U.S.A.), has emerged from the jazz era and barred "moaning saxophones, shouting songsters and the more violent of the orchestras."

Its programmes are now to coincide with the normal activities and home interests as they develop from hour to hour, the climax being a "symphonic concert" at 10.30 p.m., followed by dance orchestras.

What !—not a word about "God's children" ? Or even about the gentleman who wants a "dime" ? Is our America failing us—and after all these years, too ?

Mathematics of Radio Ads.

THOSE American radio experts, who rarely do things by halves and much more frequently do them by one and a half, have enlisted psychology in the study of radio advertising.



They find that the annoyance of an adult, when extraneous matter is pitchforked into radio entertainment or interest, takes thirty seconds to die away. Therefore, they argue, as the average advertising interpolation lasts ninety seconds, one-third of its persuasion is liable not to register.

The result is that they try to weave the sales talk into the programme instead of hurling it in as one sudden solid lump. But how can "Katzheimer's 100 per cent American Kandy" be woven into any programme except a Kids' Hour ?

Russia Rivalling America.

IT looks as though Russia has set out to emulate its new-found friend, America, in the scale of her conceptions. Indeed, I learn that the new "Radio Housesky" for Moscow will rank second in size to Radio City, New York.

Radio in Russia is growing as though it had imbibed some of Wells' Food of the Gods. In 1928 it had 348,000 receiving sets ; at the end of 1932 two and one-third millions. Its radio stations increased by 24 in the same period, and ended by topping the bill for the power of its broadcasting stations.

The "steam-roller" of radio !

Agate Gramophone Needles.

SO there is nothing new under the sun —except the latest women's fashions !

There was I, thinking that I had as good as invented an everlasting needle, and then along comes E. B. W. (Redditch) with the news that he has used agate for many years. However, the snag is that these needles have records made specially for them, because the grooves need to be wider than for steel needles.

Still, I am glad to learn that agate really will work, and I hope that someone will find a means of adapting it for general purposes. Much obliged,

E. B. W.

Einstein and his Fiddle.

PROFESSOR ALBERT EINSTEIN, who flung his theory of Relativity into an already over-perplexed world, and who has been exiled from Germany, is said to have planned to play the violin in a string quartet to help raise funds for German refugees in America.

I learn that station WOR hopes to broadcast his performance. Einstein is self-taught and is said to have a beautiful tone. A wit was asked if he played well ; the reply was "Relatively" !

ARIEL.

SHORT WAVES

Mr. —— claims that it is as great a crime to empty rubbish into the air as it is into the street.
The B.B.C. ought to be told about this.

* * *

"How to obtain volume on your wireless."
Place a book on it.—"Daily Mirror."

* * *

Miss B. : On what grounds did she sue for divorce ?
Miss C. : Cruelty. Her husband compelled her to use a 1922 radio set.

* * *

IN THE TRAIN.

Wireless Fiend (with portable set) : Now, which station would you like ?
Victim : The one you get out at.—"Punch."

* * *

(Every police-constable in Brighton now carries a pocket wireless set.)

When you are hasting to get on a train,
Or wanting a last nip of Scotch,
And find (as one does) that the end of your chain
Is, somehow, not clipped to a watch,
Observe the old slogan at Brighton-by-Sea :
Just query the p'liceman, and then
You'll get the right time now that ev'ry p.-c.
Represents the old firm of Big Ben.—"Answers."

The Battle of TELEVISION WAVES

SHORT or long? On which waves will television "float," at long last, into public favour and universal use? On the long, smooth swell of the 200–545-metre broadcast band or on the choppy, uncharted waves of the 6 to 8·5-metre ultra-short waveband?

It all depends, mainly, on how much detail the public will demand in the television image before they are willing to accept the new medium as an adequately satisfactory entertainment. And this factor, in turn, is wholly and inevitably governed by the "elbow-room" which will be allotted in the ether for the transmission.

Will our television of the future be on short or "broadcast" waves? It is largely a question of the degree of definition that will be demanded, and the amount of space which can be found in the ether. The matter is clearly explained on this page

By JAMES PEERS.

Under Ideal Conditions.

The limit in development in the direction of detail with the 30-line transmission which can be broadcast in the 9-kc. channel available in the medium waveband has probably just about been reached. The writer has had an opportunity of inspecting what are probably the most highly developed and super-efficient 30-line receivers in operation in this country (those installed in the listening rooms at Broadcasting House), and with these receivers, operating admittedly under ideal conditions and with skilled supervision, the detail in the image is really amazing, considering the limitations of the 30-line picture.

But public interest will inevitably demand real detail, comparable with the results achievable, say, with a home cinema. The television fans of the future, for instance, will undoubtedly expect to see their television idols' individual eyelashes—and for such and comparable detail at least 120-line transmission will be essential.

The Fascinating Depths.

This connection between "scanning lines," channel width, detail in the image, and wavelength is rather confusing to the beginner in this newest branch of radio. Why, they ask, should ultra-short waves be considered essential to ensure this adequate detail in the image?

Perhaps a little explanatory matter, touching lightly on the primary considerations involved, will clear the air somewhat for those who are just beginning to plumb the fascinating depths of television technique.

The B.B.C. uses at present what is known as a 30-line transmission system. The scanning disc in the studio has thirty holes and runs at 750 revolutions per minute, so that it covers the scene being televised with thirty adjacent vertical strips of light, repeating this operation twelve and a half times per second. (12½ x 60 equals 750).

This figure of 12½ transmitted images of the complete scene per second is just about the lowest number which will give the illusion of smooth movement without jerkiness. It is comparable with the figure of 16 frames per second for the old silent films and the higher speed of 24 frames per second for the present-day talkie.

Now, during the period in which a single spot of light from the scanning disc traverses its vertical track over the scene it may transmit to the photo-electric cell (the television eye) perhaps 20 fluctuations in light value, each representing a peak, or a complex series of peaks, on the modulation current.

Approaching the Limit.

As there are 375 such light spots traversing the scene every second (30 holes multiplied by 12½ "scans" per second) we arrive at a total of, say, 375, multiplied by 20, equals 7,500 fluctuations of light value per second, i.e. a 7·5 kilocycle frequency band.

So that, with these meagre 30 lines to cover the width of the scene and a conservative estimate of 20 variations in light value from each single traversing light spot, we are already closely approaching the limits of the 9-kc. band which can possibly be allocated in the 200–545-metre waveband.

The newest receiver with the mirror-drum gives an image on its screen measuring about 4 in. wide by 9 in. high. If you draw a rectangle this size, divide it vertically by 30 lines, drawn just under an eighth of an inch apart, and shade in a picture, allowing yourself not more than twenty variations of graduations from black to white in each space, you will obtain some idea of how limited the detail is with a 7,500-cycle (7·5 kc.) channel width.

A Beautifully Detailed Picture.

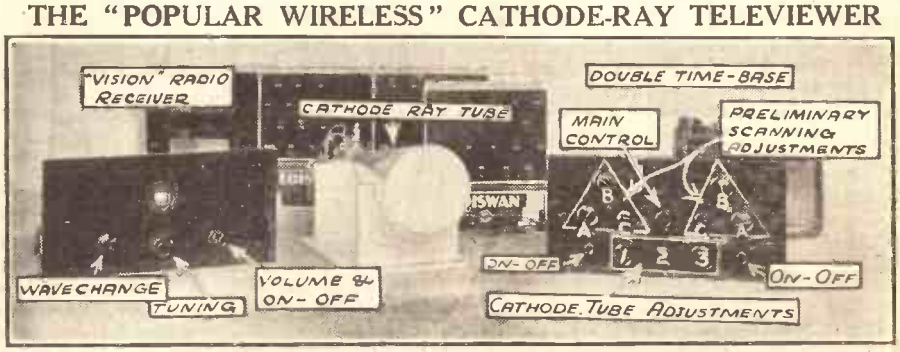
Now contrast it with a rectangle of similar size filled in with 120 closely spaced lines, shaded in twenty places. Notice how beautifully detailed a picture it would be possible to build up under these conditions.

But such an image would demand the ability to transmit at the least four times the number of frequencies, i.e. 30,000 cycles per second; and how can we find elbow-room for 30 kc. in the medium waveband where we must of necessity, by international agreements, limit ourselves to 9 kc. separation between stations?

An Enormous Band Available.

Because of this, then, we must turn to short waves to achieve minutely detailed television images, for in the ultra-short-wave field we have an enormous frequency band available. Do you know, for instance, that between 6 and 8·5 metres there are about 14,700 kc., a band over fourteen times as wide as the whole of the existing medium waveband from 200 to 545 metres?

THE "POPULAR WIRELESS" CATHODE-RAY TELEVIEWER



The cathode-ray system of television reception was developed by "Popular Wireless" for the home-constructor, and here you see the complete apparatus which was described in detail in "P.W." commencing with the May 27th number.

The ultra-short waves, therefore, have the enormous advantage of adequate elbow-room to offer television. But unfortunately there are many drawbacks to consider and difficulties to be overcome.

To transmit our 120-line super-detailed image we should have to build amplifiers which would handle faithfully frequencies up to 30,000 cycles; this in itself is

(*Continued on page* 752.)

THE MIRROR OF THE B.B.C.

THE B.B.C. AND OPERA

The Corporation is Still Growing—More Radio Plays Required—Important Changes in the New Year?—Broadcasts From the Midlands.

By O. H. M.

I CAN say that it is not likely the B.B.C. will take any part in the actual management or control of the new opera organisation which has been created to continue the grand seasons at Covent Garden. Memories of the trouble in Parliament about the old opera subsidy of £17,000 odd a year are still fresh in the minds of the Governors of the B.B.C. There will be no more of this sort of thing. On the other hand, there will be dealings between the new syndicate and the B.B.C. I prophesy that the B.B.C. as a customer will contribute about £5,000 a year to the syndicate.

By the way, the fading out of the old syndicate happened in such a way that there was no opportunity for anyone to express gratitude for its excellent work. Lady Snowden in particular was responsible for keeping opera alive in London in the very difficult period of the depression. There are not lacking those who deeply regret Lady Snowden's absence from the new Opera Board.

"SECONDS OUT OF THE RING"

The recent commentary on the fifteen rounds of the Petersen-Harvey fight aroused tremendous interest. Perhaps the time is not so very far distant when we shall be able to watch such events from our own fireside, for a boxing exhibition match between Freddie Baxter and Teddy Lewis was fought the other day in a B.B.C. studio and televised in the evening programme.

Exodus from Broadcasting House.

Broadcasting House is now relatively more overcrowded than was the old building in Savoy Hill before extra accommodation was secured in the Strand to keep things going at that time. It is a remarkable fact that for all the talk about the stabilisation of staff and permanent organisation, the B.B.C. is constantly taking on new people.

A spur to increase, of course, has been the new dual organisation which provides an administrative official for nearly every "creative" official. Two houses in Portland Place, Nos. 14 and 16, have already been reconditioned for permanent B.B.C. occupation. No. 12, the house next door to B.B.C. headquarters, will not be available for some time, but when it is taken over the three houses will make an additional block with direct access to the Big House at the corner.

In the roller-skating rink at Maida Vale there will be a number of studios and offices as well as accommodation for the big orchestra. During 1934 it is planned to acquire further property in Portland Place.

Lack of Dramatic Material.

One of the most acute problems of contemporary broadcasting practice is the lack of a sufficient range or quantity of dramatic material of the more serious kind. The B.B.C., indeed, has been forced back on the old expedient of a series of revivals. This, however, is now wearing thin, and new material has got to be found.

Thorough knowledge of the limitations and possibilities of microphone technique is, of course, necessary, and this limits competent writers to a comparative few. Even so, however, there is room for the evolution of a new, and no doubt profitable, school of radio dramatic writing.

Colonel Dawnay at Work.

Colonel Alan Dawnay, who gave up a brilliant and promising career on the Imperial General Staff to become chief of B.B.C. programmes, turns out to be one of the hardest-working officials in Broadcasting House. He is an early arrival, and rarely leaves before seven o'clock, frequently returning to attend studio performances or rehearsals.

In addition, Colonel Dawnay is an insatiable listener at home. Having now become steeped in the work, he can be counted upon to introduce important changes and reforms early in the New Year. The nature of these is not yet disclosed.

Sir John Reith Visits Belfast.

Sir John Reith went over to Belfast the other day to attend the annual ball of the B.B.C. staff of Northern Ireland. The visit was a great success, the staff much appreciating the kindly and gracious way in which their doughty chief unbent for the occasion.

This was the first of a new series of visits and tours of inspection which will bring the Director-General to all parts of the country where there are broadcasting stations or centres.

Christmas Day Relays.

The Midland Region is proud of the place it has been given as a contributor to the National programmes on Christmas Day. Summed up, it amounts to presenting a word-picture of the Midland countryside and arranging three short outside broadcasts.

The outside broadcasts include a relay from the country parish church of Bredon, which lies at the foot of the famous Worcestershire hill.

Another relay reflecting in a delightfully appropriate manner the spirit of Christmas as a children's festival is to come from the Birmingham Children's Hospital, where the Midland Radio Circle has endowed two cots.

Last is the relay from the giant Post Office wireless station at Hillmorton, the masts of which, towering eight hundred feet towards the sky, are clearly seen on a fine day from the B.B.C. stations at Daventry.

We shall all be interested to have a fleeting glimpse of the work which goes on at this nerve-centre of imperial communications.

Some famous entertainers will be in the West Country round about the festive season, and opportunity has been taken to utilise their services in West Region relays

(*Continued on page 754.*)

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes, and on microphone personalities of the moment.

I SHALL lament the passing of "In Town To-night," that *new* Saturday night feature, not so much for its own self as for the idea behind it. Since its inception I have regularly criticised certain of its contents. As recently as last week I considered the inclusion of a dance band a worthless feature, because we hear so many dance bands—old and new—and there's hardly a pin to choose between them.

* * *

But I had hoped that the idea behind "In Town To-night" would have been further developed: that the series would have been the forerunner of a number of similar features. People do like to know "what's on," and, when possible, to be in the thick of things.

Wireless tends to make home-birds of us all. There's virtue in this, of course; but there's no denying the fact that we do like being transported from the narrow confines of our four walls sometimes—perhaps a little oftener than the B.B.C. realises.

* * *

The passing of the "First Time Here" series isn't nearly so disheartening, and as the primary object was not to discover fresh talent, but to find out whether there was a listening public for variety at the unearthly hour of 4.30 p.m., I shall not shed a single tear.

The B.B.C. ought to know by now that there is a public ready to listen to anything at any hour, for the simple reason that their sets are never off. All the same, I do feel real sympathy for that undiscovered talent that will now remain undiscovered.

* * *

I always sympathised with them, even while they were being discovered. I sympathised with them because of the unearthly hour at which they were asked to perform, and because they had nothing whatever to inspire them. I always feel the same when I listen to lunch-time baritones. How they do it beats me. I'd cut out all singing before dark, if I had my way.

It is significant that we never have a promenade concert begin at midday. Is it because there wouldn't be a public to listen to it? I certainly wouldn't go to one, even if I could.

* * *

Fortunately, this quest for a tea-time audience

(*Continued on page 753*)

The RADIO INDUSTRY GREETS YOU

From G. J. FRESHWATER, Publicity Manager, The Marconiphone Company, Ltd.

"I am very pleased to have the opportunity of wishing you once more a very Happy Christmas and Prosperous New Year. Prosperity is at last 'in the air' again, and our great industry is leading the way to trade recovery. 1933 has most certainly contributed its share to the development of radio science, but still greater wonders are in store for 1934. We are on the verge of a new era in radio development, and we can look forward to developments in radio which will prove yet another step towards making the world into one united and peaceful community."

From J. M. G. REES, Managing Director, Varley (Oliver Pell Control, Ltd.).

"To the Editor.

"At this time of the year one naturally has a feeling of goodwill towards mankind; but, even so, there are some whom one particularly wishes to remember, and you, sir, are included in that particular group.

"You have, during the past year, in my opinion, furthered the great cause of home radio abundantly, and I would like to thank you, and to send through you to your readers our best wishes for Christmas, our thanks to them for the support which they have given to us—through the interest you have created—and for the encouragement they have given to our technicians, which has spurred them on to evolve still better and better components for the home constructor.

"May 1934 be for you as successful a year as must 1933 have been, and may your readers realise the amount of effort, work and patience expended by yourself and your most efficient staff, in producing your informative publication.

"Good luck."

From A. W. MACNAMARA, Managing Director, Telsen Electric Co., Ltd.

"The enthusiastic home constructor has done much to make radio the finest and most universal of entertainments. I therefore take special pleasure in offering my greetings to the numerous readers of 'Popular Wireless,' and assure them that 'Telsen' are planning to give all home constructors a bigger and better service in the coming year.

"Please accept my very best wishes for a Merry Christmas and a Prosperous New Year."

From J. JOSEPH, M.I.E.E., Managing Director of Radio Instruments, Ltd.

"The approach of Christmas is this year heralded by a more hopeful outlook than for some years past.

"This is particularly reflected in the radio industry, which has done so much to brighten the lives of listeners during the period of depression.

"The 'P.W.' weekly feature of 'Radio Notes and News' is an excellent tonic which I enjoy with other readers of your paper—only I would like to see it extended.

(Above) Mr. J. M. G. REES.

(Left) Mr. W. SCOTT-WORTHINGTON.

Mr F. H. McCREA. (Right)

XMAS IN TRADE CIRCLES

(Left) Mr. J. JOSEPH.

Mr. A. W. MACNAMARA. (Right)

Mr. A. H. WHITELEY. (Below)

"Will you and the readers of 'Popular Wireless' accept my best wishes for a happy Christmas and a still better New Year?"

From A. H. WHITELEY, Managing Director, Whiteley Electrical Radio Co., Ltd.

"May the readers of 'Popular Wireless' have the supreme joy during Christmastide of unspoiled radio reception, and during the coming year improved economic conditions that will enable them to purchase new and better apparatus to give them the perfection of reproduction which we of the radio industry are ever seeking and doing our best to turn out.

"I wish your readers good health and circumstances under which to enjoy their wireless to the full."

From F. H. McCREA, Sales Director, Dubilier Condenser Co., Ltd.

"We have pleasure in expressing our best wishes to your readers, and at the same time wishing your paper the continued success it deserves.

"As you know, it has always been our policy to give the radio constructor the finest value for money possible, and with our continuous research and production facilities there is every reason to believe that we shall be able to contribute in no small way towards development in the future."

From GRAHAM FARISH Managing Director, Graham Farish, Ltd.

"To the Editor.

"At this season of Good Will, allow me to express my heartiest good wishes for the continued success of your valued publication.

"This season has been, I think, an outstanding one with 'Popular Wireless,' and has made it undoubtedly one of the most stupendous and influential selling forces in the radio industry.

"As one of your largest advertisers you will realise that these words have no empty meaning, and I look forward with pleasure to still greater achievements.

"With all seasonal greetings to readers."

From W. SCOTT WORTHINGTON, Managing Director, The Peto-Scott Co., Ltd.

"To the Editor.

"In wishing all the readers of 'Popular Wireless' a Happy Christmas and a Prosperous New Year, may I add a message of good will?

"The traditions and fellowship ever present in our minds at this festive season mean more because of radio; to the advance of which your journal has made such a large contribution.

"By this one token I am proud of the share my company has taken during the past 14 years in popularising radio construction in the homes, and I share in the Christmas joys radio

(Continued on page 753.)

All the interesting news and views of current short-wave practice.

AN echo of the "two little D J B's" business comes from "R. W. R." (Southport). "R. W. R." confesses to noticing the same sort of thing, i.e. the proper carrier-wave in the middle and a little one on either side. We most of us have heard a station out of adjustment at some time or other, and I think it is fairly certain that that is what happened to D J B. I haven't noticed it lately.

They Love to Over-Modulate.

"R. W. R.," however, mentions quite another thing—the existence of "shadows" on either side of an interrupted C.W. station like J N J. These, of course, are genuine side-band effects produced by the modulation frequency of 500 cycles or so. We all know how some of these commercials love to over-modulate, too.

"R. W. R.'s" log seems to indicate that there is not much wrong with reception conditions in Southport. He recently broke all existing records by logging all six continents in 15 *seconds*! Morse stations were included, of course, but even then it's pretty good going. By the way, the prefix "L Y" is now being used by Lithuania.

"J. B. M." (Glasgow) reports W E B calling Moscow on about 19 metres. This is yet another of the Rocky Point group of stations, I believe. He wants to know whether the "Hello, Amsterrrdam" man on 31 metres is Bandoeng. If it is he has got his H.A.C. on the H.A.C. Three-valver (Modified).

Not the Venezuelan.

"W. S. C." (King's Lynn) has logged a station at R 10 (which is pretty loud) calling Riverhead, Long Island, and signing Y V Q or Y D Q on approximately 49 metres. I am sorry to damp "W. S. C.'s" ardour, but I'm afraid it was I D Q, an Italian, and not the Venezuelan that he suspected. I often hear I D Q myself, so it seems rather likely that he was the man.

"R. W." (Wraysbury) passes on some further information about the Graf Zeppelin and W 3 X L. On looking through it, however, it seems to me that the tests that he received were probably in connection with an American airship, possibly the Macon, which has been very active of late. If anyone can identify W 9 X Z we shall know all about it. The Graf Zepp.'s call-sign is D E N N E.

A New Short-Wave Superhet.

"L. C." (Uckfield) wants me to tell "P.W." readers all about my "Empire Super." That can't be done, as the set was completely described in "M.W." some long time back. I am at work, however, on a new short-wave superhet which seems very promising as yet. More of this later.

"V. I. E." (Liverpool) deplores the lack of co-operation between short-wave enthusiasts. He says that lots of "P.W." readers write to him with requests for circuit diagrams and innumerable questions. He answers every single one, but the matter usually finishes there.

More Ready to Take!

I'm afraid the majority of radio enthusiasts are more ready to seek information than to give it, or even to acknowledge the receipt of same! I'm sorry to have to say it, but I find just the same.

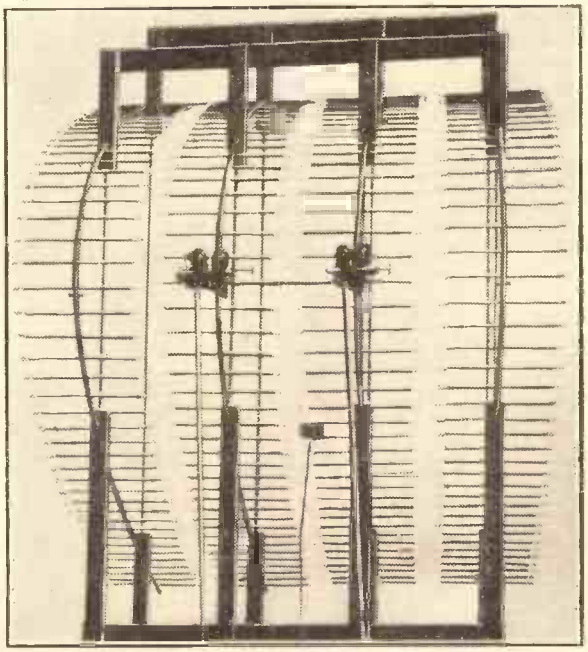
"V. I. E." suggests that it might be interesting to publish an actual short-wave log in "P.W." from time to time. The trouble is that it's only the people with outstandingly good "bags" that take the trouble to send them in, and they are much too lengthy to justify the space that they would take up.

Reports in Detail.

Here, at the last moment, is a letter with further details about the Graf Zeppelin. It appears that W 3 X L had been trying to receive him so as to re-broadcast messages to American listeners. The Zepp had been faintly received in Chicago on 30·3 metres, but after some trouble W 3 X L found him. My informant, "B. L." (Widnes), tuned rapidly to and fro and logged the whole two-way conversation. I quote this because it contains more detail than most of the other reports on the subject.

Don't let me discourage you from sending reports just because they cannot always be published. There may be at least one item of general interest in the most ordinary-looking log.

QUASI-OPTICAL ULTRA-SHORT WAVES



The quadruple directional transmitting aerial employed for the Marconi system of short-wave radio telephony on a wavelength of 50 *centimetres*, or 60,000,000 cycles per second!

ROUND THE RECORDS

Melville Gideon's last song—The "dogie bogy"—New Opera Discs

EVERY follower of the Co-optimists and every lover of light vocal records will want "Love Locked Out" and "A Song Without Words" on Imperial 2921. It is, I believe, Melville Gideon's last recording, sung very shortly before his untimely death. As ever, his voice is pleasing and his diction perfect in this record, which will remain an uncanny embodiment of that part of Gideon's self that made him famous, and by which only he was known to thousands.

Far More than a Memento.

I am not, I think, abnormally morbid, but to me the value of a late record of a departed artiste is tempered by the uncanny realism of the disc and the tragic inhumanity of the whole thing. To me, to hear the perfect reproduction of the voice of a person, well known to me and who has gone on, is far more than a priceless memento: it is almost the sacrilegious calling back of that person's ego to perform, almost willy-nilly, the particular piece on the disc, and the tragic effect is, of course, heightened if the number is of the light and humorous type.

But none of us, I am sure, however we feel, will not prize those black fragments of the artistes we knew in the flesh—Dame Melba, Wish Wynne, the Cole Brothers (whose combination was broken by the death of one of the pair soon after they commenced to record) and so on. And now we must perforce add Melville Gideon.

* * * *

To be more cheerful, let us have a look at some of the other records offered in the same list. "Night and Day" is still forging ahead, and more discs have appeared bearing its haunting strains. Jack Payne has coupled it with "I Live for Love" on Imperial 2915, and has made a very good job of it. Others of his that are worth hearing are "The Last Round-Up" (2916), "Who's Afraid of the Big Bad Wolf?" (2917) and "Dinner at Eight" (2919).

The "Last Round-Up" is also sung by Joseph Wagstaffe on 2920 with good effect. By the way, the "little dogie" that is so frequently urged to "get along" has been causing a great deal of anxiety among radio and gramophone fans. The exact meaning of the term is not clear, "authorities" varying in their "translations," but "dogie" is said by those who should know, to be a "stunted calf" and not, as has been stated, "a sick sheep." In the song I should imagine that the former would be the more likely of the two, but you must take your choice.

Wonderful Value.

Among the serious music some excellent recordings have been made of selections from "Madame Butterfly," "Cavalleria Rusticana" and others of the famous operas on twelve-inch Imperials. They have been made by the Carl Rosa Opera Co., and are really first class. At 2s. these operatic selections form almost ridiculous value, and I can recommend them. K. D. R.

ECKERSLEY EXPLAINS-

"Just what *is* an electron?" is a question which has probably occurred to many of you at one time or another. Here is a chance to get to the bottom of the matter, for our Chief Radio Consultant devotes his page this week to an answer of that very question.

M. H., of Tulse Hill, asks the simple little question: "Just what *is* an electron?"

My answer is that it is a name given to something which has changed its behaviour a lot since I first met it. I mean that the theories about matter and electrons have greatly changed since I was a student. This is perfectly healthy and right. A scientific theory is not something to lay down the absolute truth for ever; it is only a "convenience of expression" for the time being until, because new facts come to light, it is not so convenient as it was.

Our Changing Theories.

The Newtonian theory of the universe is a perfectly practical and excellent theory, and has kept ships sailing in awfully direct lines for many decades; the Einstein theory is only more complete. The Newtonian theory is not banished for ever by the Einstein theory. So the electron theory may have changed, and in years to come may be abandoned in favour of a more convenient or a more complete theory.

But as a convenience of expression we say that an electron is a "particle." It's a very small particle. Oh, so small! If I remembered how many noughts to put after the point and call it millimetres you wouldn't be any the wiser, nor should I. Just very small—so small that it can move about in the interstices of matter like a pedestrian in traffic. Very small.

Next, we say that the electron is "charged with negative electricity." Just a convenience of expression again. We don't know how to answer the question "what is electricity," but that doesn't matter terribly. We do know that if we have an accumulator and connect its poles together by a piece of wire, then something happens—the wire gets hot, and magnetic effects external to the wire take place.

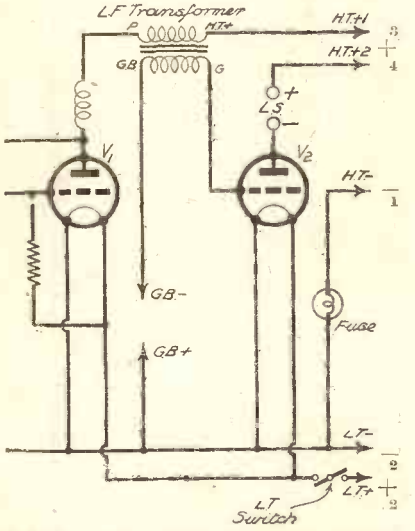
"Rather Like a Fluid."

When a wire gets hot like this and when this heating is accompanied by magnetic effects, then we say that a current of electricity is flowing in the wire. The pioneer people who discovered these effects thought that there must be a flow of some substance which they called electricity in the wire, since the effects were only set up when a circuit was completed. Electricity behaves, they thought, rather like a fluid. You take an accumulator which wants to pump the fluid out of one terminal and back into the other, but it can only do this when there is a pipe (or wire) connecting the two terminals.

And to distinguish one pole of a battery from the other they called one "positive" (or plus) and the other "negative" (or minus). Some said there were two fluids which flowed at one and the same time, one coming out of the (+) and going into the (−) and back to (+) again; the other coming out of (−) and going the other way round.

The electron theory says that to all intents and purposes there is only a one-way flow of electricity, and that from negative to positive.

A CIRCULAR PATH



A portion of the circuit of a recent "P.W." receiver (the "Unity" Two) is here used to illustrate our Radio Consultant's explanation. The H.T. electrons start at the negative point −1 and flow through the filaments of the valves V_1 and V_2, returning to the positive terminal of the H.T. battery through the points marked +3 and +4. Similarly, the L.T. electrons flow from point −2 through the filaments of the valves V_1 and V_2 back to the positive L.T. point marked +2.

The idea is that an accumulator, or a battery, or a dynamo, or any "source of volts" is a thing which fills one pole with electrons and empties the other pole of electrons. One set of accumulator plates has electrons (which carry negative electricity) surplus to establishment; the positive plate lacks electrons.

Electrons repel one another—they abhor a crowd. They are attracted to places which have room for them, which are empty, or, as we say, are positive because they lack electrons. So the surplus electrons in the negative plate want to get to the positive plate.

If the two plates are insulated they can only *want* to get back and so establish a pressure, or, as we say, an E.M.F., or an electro-motive force. If the plates get connected by a wire which conducts electrons along it, then these electrons can try to re-establish the equilibrium.

Millions of electrons set off from the surplus-to-establishment-negative plate for the promised and empty land of the positive plate, and in barging and banging their way along through the wire make the wire hot (red hot in lamps and valves!).

Keeping Up the E.M.F.

But the accumulator, directly electrons start leaving the (−) plate, sets to work to restore those missing, and so keeps up its E.M.F. At last it cannot do any more and "runs down." It can then be re-charged by pushing electrons backwards into the (−) plates.

A battery (dry) cannot be recharged. So long as a dynamo runs round, it fills its (−) pole with electrons.

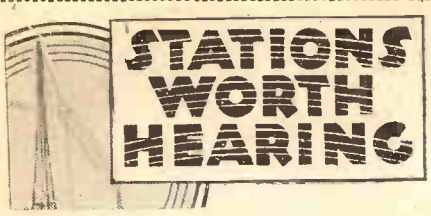
The rate of flow of electrons is measured in amperes and is called current. The higher the pressure (the more electrons surplus to establishment in one plate or the more taken away from the other) the bigger the current in a given piece of wire connecting the poles or plates. The easier the road joining negative and positive the more the electrons flow, or, as we say, the lower the resistance of the wire the greater the current.

When the Direction Alternates.

So an electron is a little mobile particle, able to move in conductors, carrying negative electricity, and, when millions of his kind move through a conductor, they carry electricity along through the wire, or create a current flow, or simply an electric current and more simply a current.

An alternating current is one in which the electrons surge one way, then the other, because one pole of the circuit is first made negative, then positive, then negative and so on.

In very high-frequency currents the electrons must just rock to and fro over the smallest possible distance—one, two: one, two!



A review of recent conditions on the "broadcast" bands, including details of stations that are coming in well, and other information that will enable you to get the best results when searching for foreigners.

By R. W. HALLOWS, M.A.

NOVEMBER was one of the best months for long-distance wireless that we have had for many a year, and so far as it has gone December is proving to be even better. There is very little fading, and what there is, is of the milder kind easily dealt with by a modern receiving set provided with automatic volume control. Atmospherics are few and far between, and spark-signal interference seems to be definitely on the wane.

What a wonderful thing the wireless set is nowadays, and what a boon it is to be able to hear not only home stations but also those on the Continent! You are not tied to the programmes of one station or even of one country, but can plan out an evening's entertainment selected from the programmes of all Europe.

Excellent Continental Reception.

Wireless has now reached such a stage of perfection that there are at least thirty stations of which one can say: "That looks an interesting item; I'll tune it in this evening." Not so long ago we would have said: "Leipzig or Berlin or Warsaw has a fine programme. I wonder whether I'll be able to tune in any of them so that they are really worth hearing."

There are, of course, far more than thirty stations that can be picked up on almost any set with a high-frequency stage after dusk nowadays; but if you want to listen to programmes instead of merely making the largest possible bag of stations thirty is about the average number to be received strongly and clear of interference on a given evening. After all, this offers a pretty wide choice.

The reception of American stations is quite extraordinary at the present time. I have no hesitation in saying that were it not for the crowding of the medium waveband by European stations many of them would be heard from about 9 p.m. onwards. As it is, they are usually drowned by transmissions on this side of the Atlantic until after midnight.

I have, though, heard WCAU, of Philadelphia, as early as half-past ten in the evening; and I have noticed not a few heterodynes at about that hour which seemed undoubtedly to be due to Americans.

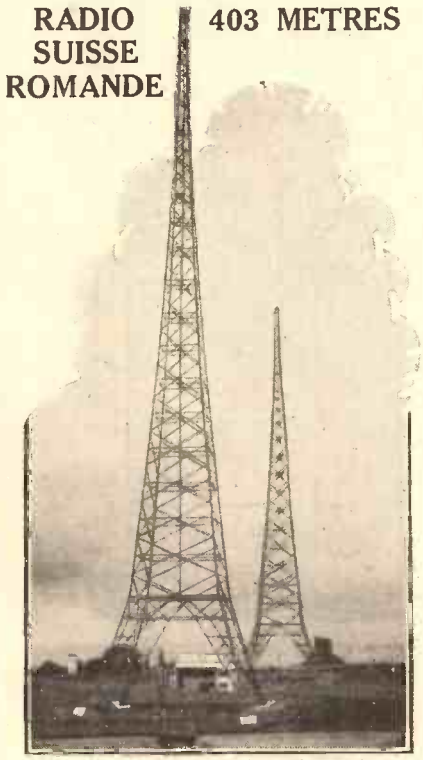
Transatlantic Listening.

On one or two recent nights I have had to be up until about one o'clock in the morning, and on none of these occasions have I failed to hear numerous American transmissions clearly and well. Most of the American stations seem to use every available watt during the Christmas season, and this, in combination with the fact that Christmas comes at the very best time of the year for transatlantic listening, means that it will be well worth while during the holidays to make use of the wireless set in the small hours.

Here is a list of the stations which have appeared most frequently in my log of late:

		Metres
WIOD	Miami, Florida	230·6
WKAQ	St. Juan, Porto Rico	241·8
WCAU	Philadelphia, Pennsylvania	256·3
WHAM	Rochester, New York	260·7
WPG	Atlantic City, New Jersey	272·6
WTAM	Cleveland, Ohio	280·2
WTIC	Hartford, Connecticut	282·8
WBZ	Springfield, Massachusetts	302·8
KDKA	Pittsburgh, Pennsylvania	305·9
WENR	Chicago, Illinois	344·6
WABC	New York City	348·6
WGY	Schenectady, New York	379·5
WJZ	New York City	394·5
WOR	Newark, New Jersey	422·3
WLW	Cincinnati, Ohio	428·3

WLW, by the way, will probably be conducting tests with its new 500 kw. transmitter by the time that these notes appear in print. The tests will take place between the hours of 1 a.m. and 6 a.m., Eastern Standard Time, which means



"Söttens" is well received by those who are outside the swamp area of the "Midland Regional."

6 a.m. and 11 a.m. by ours. As American stations are coming in well in the early mornings it will be well worth while to try for this giant between 6.30 and 8.30 a.m.

The interference with Huizen's transmissions continues. It appears to be due to two separate transmitters, one a Russian and the other a Roumanian. On about three days each week Huizen can be received clear of this interference. Radio-Paris, Zeesen, Kalundborg and Oslo are all fine transmissions on the long waves. Warsaw is usually good, and the Eiffel Tower can be relied upon if received at a time when Warsaw is silent. Luxembourg is now badly heterodyned on most days.

The new Budapest transmitter is now at work, and reception from this station is always good. By the way, if your set will tune some little way above Budapest you may find that Grenoble on 570·2 metres is a station well worth attention. Though it is rated at only 2 kw., its transmissions come through clearly and with great volume.

A Fine Quintet.

Vienna has now thoroughly settled down, the second aerial mast being in use. Good reception is always to be obtained. Brussels No. 1, Florence, Prague, Langenberg and Lyons Doua form a fine quintet in the upper part of the medium waveband.

Beromünster is apt to be heterodyned, but is a fine transmission when clear. The same applies to Paris Ecole Supérieure. Rome is one of the best received of European stations in Southern England and the Midlands, but in these parts Stockholm is not quite so good. In the north conditions are exactly reversed.

Belgrade has been coming through quite well on many recent evenings, and Katowice shows a welcome return to good volume and quality. Söttens is well received by those who are outside the swamp area of the Midland Regional.

Toulouse and Leipzig are always reliable, Hamburg does not give quite the same volume, but is generally to be heard clearly. Brno seems to have disappeared for the moment, but this station should always be tried for, since it has a way of coming in unexpectedly with great volume.

Brussels No. 2, Milan, the Poste Parisien and Breslau form a splendid group in the middle of the medium waveband. One or other of them have a heterodyne on occasion, but as a rule at least three out of the four are well heard. Göteborg, though not a reliable station, often provides good entertainment.

Three Reliable Transmissions.

Genoa is comparatively seldom in the first class of European stations, though there are nights when it is splendidly received. Bordeaux Lafayette is coming in much better than it was. Hilversum, Heilsberg and Turin are quite reliable.

Frankfurt has a wavelength too close to that of the London National to give good reception everywhere, but if you are outside the swamp area this is a station that should not be neglected.

Toulouse (P T T) often comes through at good loudspeaker volume, and both Gleiwitz and Hörby are stations from which good reception is to be obtained on nights when fading is absent.

Fading is the bugbear of reception near the bottom of the medium waveband. As I have said, it is very slight at the moment, and this gives one a chance of hearing Trieste, Nürnberg and Fécamp at their best.

During the Christmas holidays thousands of new receiving sets and millions of old ones will be in use. Here's good hunting to their owners and a heartfelt wish that conditions for long-distance reception may be at their very best!

OUR CHRISTMAS CAROL

What do you think of broadcasting at Christmas? Do you switch off your wireless set and spend the day in home-made revelry? Or does radio play a real part in your enjoyment of Christmas festivities? You will all have your own opinions; but you will be interested, all the same, to hear the views of famous broadcasting personalities in the messages which we have gathered from

COL. SIR ARTHUR HOLBROOK, TOMMY HANDLEY, GRACIE FIELDS, PHILIP RIDGEWAY, LEONARD HENRY, OLIVER BALDWIN, CLAPHAM AND DWYER, C. B. COCHRAN and MABEL CONSTANDUROS

COLONEL SIR ARTHUR HOLBROOK, K.B.E.

THE value of broadcasting is dependent to a large extent upon the intrinsic quality of the programmes disseminated. This is particularly so at Christmas-time, when, if the programmes are of a cheerful nature, they can be of inestimable value in brightening the lot of thousands of listeners who, without the benefit of broadcasting, would perhaps be very miserable indeed at a season which is more suitable for jollity.

CHARLES B. COCHRAN, the famous producer and theatrical impresario.

The power of broadcasting in improving the lot of humanity is far greater than was anticipated in the very early years of the broadcasting service in this country. While there will always be comment as to the suitability or otherwise of the general run of programmes given by the British Broadcasting Corporation, there can be no doubt that the very spirit of Christmas, as exemplified by the immortal "Christmas Carol," can be conveyed by the B.B.C. to millions of homes in this country.

TOMMY HANDLEY

Hello, folks! My idea of a Happy Xmas is to be able to sit in front of a huge log fire with my pipe, thousands of matches and somebody else's tobacco, a sprig of mistletoe handy—in case!—and, of course, my wireless set frightfully adjacent, so that I can, without the slightest effort, switch it on—at midnight, just in time to hear my favourite announcer saying "Good-night, everybody, *good*-night." A Merry Xmas, folks, from yours festively, "Tom-Mistletoe" Handley.

GRACIE FIELDS

I have had my Christmas party already. Throughout the year mother and father are the only members of the family who remain at home. I try to get back for week-ends, but Betty and Tommy are on the halls.

Tommy is an eccentric dancer of the "Fields and Rossini" act, whilst Betty dances and sings on the halls. My other sister, Edith, is with her husband, Douglas Wakefield, in America, and cannot be present at this impromptu party.

We are very sentimental as a family, and, whatever happens, we always try to be together at Christmas. We sit round the fire in the evenings and sing old favourites in harmony, and I have often thought what a good idea it would be if radio listeners could tune in. I have an idea that our family Christmas party represents the spirit of "A Christmas Carol," as told by the immortal Dickens.

TOMMY HANDLEY, one of radio's cheeriest personalities and a firm favourite of listeners.

We always wish we could invite all friends home for Christmas, but, as we have so many, this is impossible.

GRACIE FIELDS, one of the most popular of comediennes in the radio programme.

There are many difficulties in the way of broadcasting, too, so this year I have done the next best thing and made a gramophone record of one of our actual family parties.

A Christmas carol? Well, I don't know about that, but during that last party I sang "Land of My Fathers" in Welsh. And you can't beat that, can you, indeed to goodness?

PHILIP RIDGEWAY

We are used to listening at Christmas-time to the peal of bells, those lovely carols, village bands, the delightful cheer of children's voices and the joyous exclamations of our older relatives. It is Christmas-time when we all meet, and nowadays, thanks to modern inventions, we listen to cheerful entertainment broadcast into our homes by those who work to entertain us on Christmas Day.

I cannot help feeling that for the children (and don't forget we are all children on Christmas Day) to hear the light fare, especially pantomime (and who in this world does not like pantomime?), and then, by way of contrast, soft and soulful music coming through one's set, with the volume turned half up, whilst sitting before one's fireside with those we love, is one of our biggest rewards in life.

LEONARD HENRY

When I was young there used to be a little boy who went from door to door throughout December and made obnoxious noises in support of good Yuletide sentiments. Yule remember him on November 5th also. (Beg pardon!)

He called it carolling. What the victims called it is nobody's business.

His best-remembered classic is "Good King Watercress looked out on the Ink of Stephen."

Sometimes he got coppers for his pains; at others the coppers got *him*; and most times he got just pains if he didn't run fast enough when the door opened.

I know it's true. I was that little boy.

But it's all altered now. You just press Button A of your wireless and Christmas carols simply ooze out of the orifice.

What we *do* want, however, are some modern carols: carols that match people who clothe themselves in footwear, neck joy and slumber suitings instead of the old-fashioned shoes, ties, pyjamas and so forth. The following, I feel, is really *too* thrilling and so typical of this marvellous age.

OLIVER BALDWIN, the B.B.C.'s official film critic and a frequent broadcaster.

It is designed to be monotoned through a megaphone at a charity fork tea in aid of converted Cubists.

Modern Carol

Bilge, bilge, bilge and spinnach!
Why do an elephant's legs remind me
Of a man's tobacco pouch?
I don't know—I can't say.
Around, above, beneath,
Beneath, around, below,
Above, beneath, around,
Oh, oh! Oh, oh! Oh, oh

(*Continued on next page.*)

OUR CHRISTMAS CAROL

(Continued from previous page.)

OLIVER BALDWIN

I can imagine nothing nicer than to sit before a log fire listening to a wireless programme, provided the talker, the music or the actor is cheerful and entertaining. Nor can I imagine anything nicer as a Christmas gift than a wireless receiver with which to listen in.

The wireless brings the world to your fireside and helps you to understand something of other nations and peoples, without which Christmas Day can scarcely convey to you its real message.

CLAPHAM AND DWYER

Conundadiddle: What is the difference between Old Man Scrooge, a Christmas carol and a page boy at the B.B.C. ?

You don't know ? Well ! Don't bother about it. We shan't. That's where listeners are so fortunate. You don't have to bother about anything.

While the stars at the B.B.C. are ruining their Christmas appetites by worrying over Christmas fare, you listeners—each and every one of the five million licensees of you—can sit back in eager anticipation of the good things which you hope to hear on the wireless during Christmas week.

But be patient. It's hard enough for the B.B.C. to think out Brighter Programmes for fifty-one weeks out of the year ; but that remaining Christmas week, when the B.B.C.'s brain is devitalised by Christmas fare of another sort . . .

CHARLES B. COCHRAN

While I am not able to listen enough to be able to give a comprehensive opinion, I am nevertheless certain that the benefits of broadcasting are very real to millions of people at Christmas-time. I am grateful for the good music broadcast, and I do believe that a very large number of wireless listeners are dependent on this very cheap form of enjoyment for their Christmas entertainment.

Broadcasting has a great hold on the public, and this is particularly evident when, as at Christmas-time, it enters into the very spirit of the home.

Nevertheless, in spite of broadcasting, I am quite sure that the theatres and music-halls will be full to overflowing, as usual during Christmas week. It takes every section of the entertainment industry to satisfy the public.

MABEL CONSTANDUROS

Loneliness at Christmas-time must be one of the hardest things to bear, Christmas being the time when families reunite and friends send gifts and greetings to one another.

I think it is for its power of dispelling loneliness that radio will be most valuable this Christmas-time.

You need never feel really lonely if you have a wireless set. The announcers will be talking to *you*, the carols will be sung, the bells rung, the pantomimes played, the Christmas greetings given to *you*.

Last Christmas, if you remember, the King spoke to all his subjects: a message straight to every home.

Wireless surely does more than anything else for the lonely and the sick and and the poor.

MABEL CONSTANDUROS (left circle) is renowned for her "Mrs. Buggins" episodes. **LEONARD HENRY** (right circle) is one of the B.B.C.'s principal comedians and has appeared in many shows. **CLAPHAM and DWYER** are seen in the centre of the page after "another spot of bother." **COL. SIR ARTHUR HOLBROOK** is on the left and **PHILIP RIDGEWAY** (producer of the Ridgeway Parades) on the right.

THE SWING OF THE PENDULUM

Problems of reaction and how they have been solved—with special reference to the "S.T.500."

MANY of us remember the old type of three-valver with reaction bang on the aerial. For several reasons it lost popularity, though undoubtedly it got as much out of three stages as the valves of that early period permitted. Unfortunately, it was hopelessly unselective and, unless your aerial was taut as a violin string, distant listening, in windy weather, became a torture, the reaction varying with each swing of the aerial.

Worst of all, it caused one's neighbours to use naughty words on an average twice a minute, for in unskilled hands it could and did radiate ear-piercing shrieks and groans all over the neighbourhood.

As a consequence, the campaign against oscillation commenced, headed by the genial P. P. Eckersley with his "Don't ; please don't ! "

A Perfectly Reasonable Request.

Designers, in a laudable effort to comply with a perfectly reasonable request, switched over to H.F. amplification, with reaction safely applied to the anode.

Reaction on the aerial went out of fashion. It became one of those things only spoken of in whispers in the less exclusive radio circles.

This switch-over was all to the good, for did it not lead, in the long run, to the screened-grid valve, possibly the greatest advance in radio technique since the addition of the grid to the two-electrode valve ?

We Were So Well Drilled.

To most of us the coming of the S.G. valve seemed to put reaction on the aerial right off the map. Then we began to have little misgivings. Don't, please, misunderstand me. Not about applying reaction to the aerial. Oh, dear no !

By this time we had become so well drilled that the idea of such a thing in connection with a straight H.F. amplifier simply never entered our heads. But the enormous amplification factor of the S.G. valve raised such wild hopes in our untechnical breasts that the feeble twittering of distant foreigners, when our first S.G. outfit was built, sent us hunting round for flaws in our wiring that weren't there.

Many of us added another valve, only to find that now the foreigners twittered all too loudly. In fact, twittering broke out, like a rash, all over the dial. The palliative of series-aerial condenser reduced the trouble, but cut down volume that we were loath to sacrifice.

Then one man set out to solve the problem (no easy one) of reducing the heavy load of damping carried by the aerial circuit without sacrificing either volume or selectivity. In addition to anode reaction, he introduced aerial reaction in a safe and specialised form.

Enough that he succeeded triumphantly, and the result is the "S.T.500."

If you haven't built it you are missing something good.

Drowning in a Sea of Troubles.

The way it picks out a miserable little foreign station drowning in a sea of troubles, pilots him safely through to the L.S. end of the set, clear of interference, and hands him over to the listener full of pep has to be experienced to be believed.

In the words of our American friends, "Boys, it's a cinch ! "

E. O'M.

VOICES from EUROPE

MILAN—332·2 METRES

Luiza Rizzi-Marconi, who often announces the "Radio Milano" programmes. She was formerly Miss Luiza Rizzi.

(From the head woman announcer, who has been in office ever since the station opened eight years ago.)

Translation from the Italian:

"May the Christmas bells find an echo of peace in the hearts of all my listeners.

LUIZA RIZZI-MARCONI."

* * *

TOULOUSE—385 METRES

(From the chief announcer of this famous private station.)

Translation from the French:

"To my dear listeners of France and of foreign countries who give me so much sympathy I address my very best wishes for the New Year.

JEAN ROY."

Jean Roy, whose voice comes from Radio Toulouse.

* * *

BRATISLAVA—279·5 METRES

(From the chief announcer.)

Translation from the Slovakian:

"Sweet and merry Christmas Holidays to all dear listeners.

M. HORAKOVA."

Bratislava's chief announcer is the charming lady portrayed to the left—Madame Horakova. She was, until recently, Mlle. Hoffmanova.

Another Selection of Seasonal Greetings in which

The Announcers wish you all a Happy Xmas and New Year.

ROME—441 METRES

(From the only male announcer of Radio Roma.)

Translation from the Italian:

"A happy Christmas and a good New Year to all readers of 'Popular Wireless.'

CIUFFO."

* * *

SÖTTENS—403 METRES

(From the chief announcer of the Lausanne studio, which often supplies the programmes of Sottens, the National Transmitter for French-speaking Switzerland.)

Translation from the French:

"Happy Christmas and my best wishes to the amiable readers of 'Popular Wireless.'

ANGÈLE GOLAY."

When you hear a man's voice announcing "Radio Roma," you are listening to Gastone Ciuffo, whom you see above. He always appreciates a few lines of friendly greeting from readers of "Popular Wireless," who have heard his voice on 441 metres, or via the short-wave relay on 25·4 metres.

DEUTSCHLANDSENDER—1635 METRES

(From the chief announcer of the German National Station, formerly known as Königswusterhausen.)

Translation from the German:

"In the happy feeling to be able to serve the cause of the new Germany and of true peace among peoples as a radio announcer, I greet right heartily the listeners beyond the seas.

DR. CHRISTIAN RAU."

Hitler's Government announcements are made from the long-wave German National station (Deutschlandsender), on 1635 metres by Dr. Christian Rau. Note his reference to "true peace among peoples."

* * *

MILAN—332·2 METRES

Angèle Golay is in charge of the Lausanne studio, and her voice is usually heard from Sottens ("Radio Suisse Romande"). This is the French-speaking station immediately above Midland Regional's wavelength and below Katowice.

(From the head man announcer.)

Translation from the Italian:

"Like the ether waves of radio—wonderful miracle of science—which carries my voice to you all, may Holy Christmas—most tender miracle of God—make to enter into your houses and into your hearts the greatest joy.

FRANCESCO SORMANO."

This is Francesco Sormano. He is a colleague of the young lady whose portrait is first on this page, and he assists in announcing "Radio Milano."

RECEIVERS OF RENOWN

THE NEW EKCO MODEL 74 RECEIVER.

A MAGNIFICENT 5-VALVE, 7-STAGE SUPERHET FOR MAINS AND BATTERIES.

WITHOUT fear of contradiction, it is safe to say of the Ekco Model 74 receiver that it was one of the major sensations of the recent radio exhibitions. And no small wonder.

This year, more than ever before, the question of appearance ranks almost as highly as that of results, and no longer is it sufficient to be able to claim that a certain design will receive so many stations.

The Ekco Model 74 in the black bakelite cabinet with chromium-plated fittings looks particularly elegant when mounted on this chromium-plated stand available for an extra charge of 35s.

The Rut of Convention.

Ekco's were among the first to realise that. They were among the first to realise, moreover, that the artistic susceptibilities of the man who is responsible for the design technically are rarely a marked characteristic. He is essentially a specialist, and as such, if the present set is anything to go by, he excels. But ask him to combine technical skill with artistic ability, and as sure as fate he will fall into the rut of convention and produce a cabinet so utterly unoriginal that it might contain just any old set.

What, then, is the secret of this Ekco instrument in which amazing efficiency has been combined with beauty of appearance to such a marked degree as to provide one of the sensations of the season? Simply that Ekco's believe implicitly in leaving every man to his own job.

A Most Telling Argument.

The wisdom of that policy is strikingly exemplified in the design of their Model 74 receiver. Not only is it one of the most attractive sets on the market at the present time, but its technical efficiency is such that a member of the fair sex who was invited to try the model submitted to us succeeded in tuning in a total of 70 stations without even an elementary knowledge of tuning procedure! That, surely, is one of the most telling arguments that could be advanced in its favour, and in so far as the ordinary layman is concerned, is a complete test report in a nutshell.

The Ekco 74, a model of which is available for A.C. and D.C. mains and for batteries, is a seven-stage, five-valve super-heterodyne. The model submitted to us for test was the A.C. mains version, which is practically identical in general design to the one intended for D.C. supplies.

There is just one main tuning control which actuates a light-beam and shadow station finder, and which, in use, is a delight to handle.

Only Occasional Adjustment.

The only other controls are a combined wavechange and radiogram switch on the left and a combined on-off switch and volume control—which operates on both radio and gramophone—on the right. The local-distant switch, which is located below the main tuning control, is one that requires only occasional adjustment. Provision for the connection of a gramophone pick-up is made at the back of the instrument, where sockets are also provided for the connection of aerial and earth and, if required, external speakers.

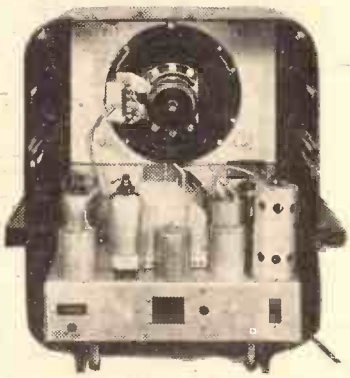
In our practical tests, not only did we receive 46 out of the 47 stations that are actually named on the dial, but we heard approximately 30 others as well!

Little Short of Amazing.

In the case of those stations that were actually marked by name we were particularly impressed to find that the markings were practically dead accurate, and not in one single case did we come across a station more than a tiny fraction of an inch away from the setting at which it was calibrated to be received. The delayed A.V.C., too, was commendably efficient in practice.

The selectivity of the set was little short of amazing, and the quality of reproduction, both on local and distant stations, left nothing to be desired. Without a doubt the Ekco Model 74 would be difficult to equal and impossible to excel at, or anywhere near, the price that is charged for it. It might well be regarded as one of the sensations of the season!

NEAT—OUTSIDE AND IN!



The interior of the A.C.74 is particularly neat and tidy.

TECHNICAL SPECIFICATION.

GENERAL DESCRIPTION: Seven-stage, five-valve super-heterodyne of the table consolette type. The cabinet is available either in walnut-finished bakelite or in black bakelite with chromium-plated fittings. A stand is available for either model.

CIRCUIT DETAILS: (A.C. and D.C. models). Two high-frequency pentodes, a double-diode triode, an output pentode and (A.C. only) a full-wave rectifier. Delayed automatic volume control of a particularly efficient type is incorporated. In the battery model, Class B output is employed, and the circuit incorporates two screened-grid high-frequency stages, a three-electrode detector, and a three-electrode Class B driver valve.

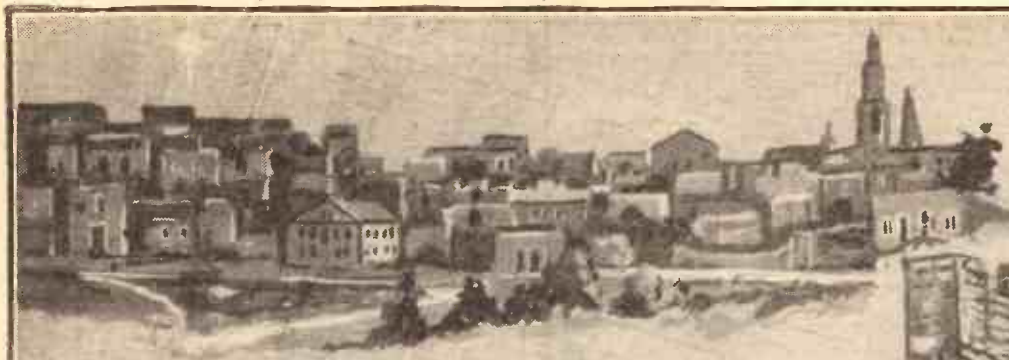
SPECIAL FEATURES: (1) Remarkable sensitivity coupled with a degree of selectivity more than adequate for modern conditions; (2) Extreme ease of operation; (3) "Station-names" calibration and light-beam and shadow station selector; (4) incorporation of delayed A.V.C.; (5) provision at the back for connection of pick-up and external speaker; (6) removable speaker fret, enabling silk behind to be changed to any colour that matches furnishing scheme.

PRICE: A.C. 74, D.C. 74 or B. 74 (in walnut-finished bakelite cabinet) 13 guineas. One guinea extra is charged for the black bakelite cabinet with chromium-plated fittings.

RUNNING COSTS: A.C. 74 (with electricity at 2d. unit), 10s. per 1,000 hours.
D.C. 74 (do.), 9s. per 1,000 hours.
The price of the B.74 includes batteries and valves.

DIMENSIONS: 18 in. × 17½ in. × 10½ in.

MAKERS: E. K. Cole, Ltd., Ekco Works, Southend-on-Sea, Essex.



It will be from the
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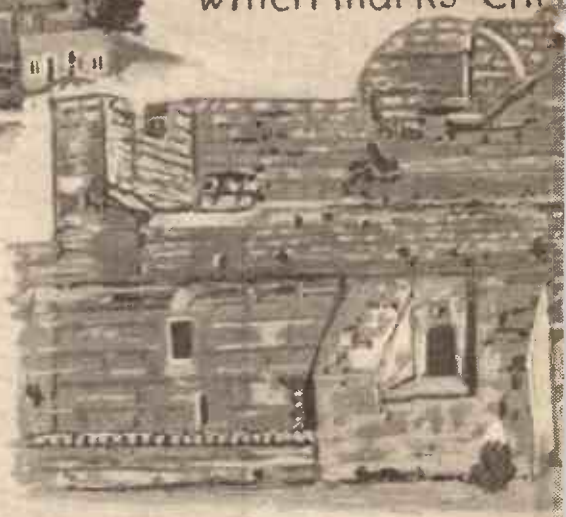
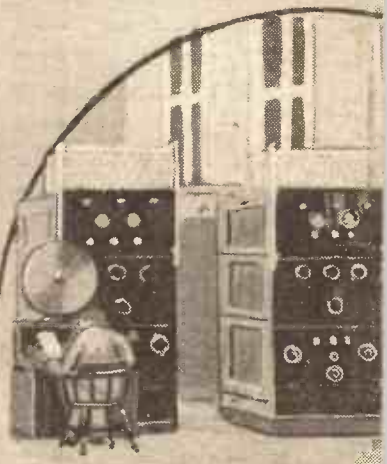
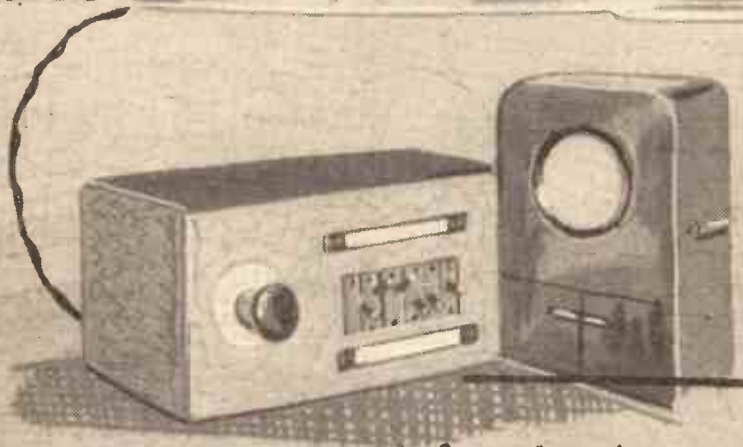


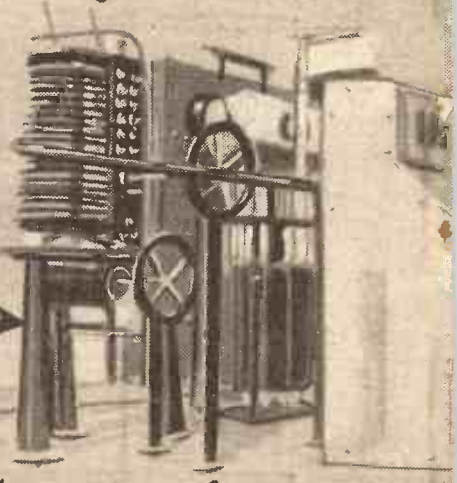
Bethlehem - the birthplace of Christ - is to feature in the B.B.C. programmes on Christmas Eve ~



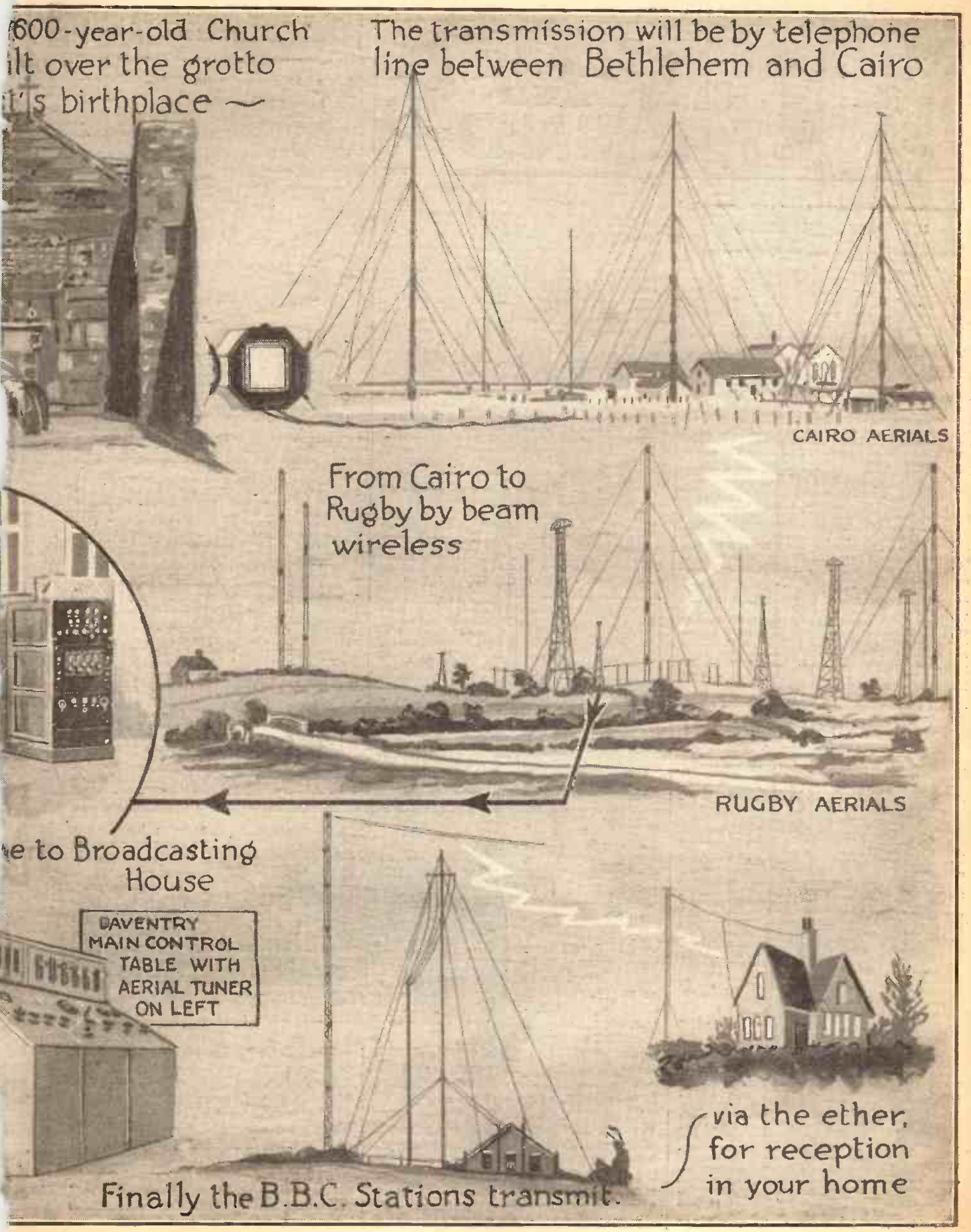
At Broadcasting House the quality is checked and tone controlled

Rugby sends the signals on by landli





Here is the instrument for checking quality on the transmitter lines against quality over the air.


600-year-old Church
ilt over the grotto
t's birthplace ~
The transmission will be by telephone line between Bethlehem and Cairo
CAIRO AERIALS
From Cairo to Rugby by beam wireless
RUGBY AERIALS
e to Broadcasting House
DAVENTRY MAIN CONTROL TABLE WITH AERIAL TUNER ON LEFT
via the ether, for reception in your home
Finally the B.B.C. Stations transmit.

UNIVERSAL BRACKETS

EVERY now and then a "wonder why" comes along. But at most it is a somewhat rare event. You know what I mean, of course. "Wonder why nobody thought of doing that before!" And every time one says to oneself "Well, that is one more gap closed. Soon we assuredly must arrive at the saturation point where there is nothing more to be done." But we don't!

The latest "wonder why" is the Graham Farish Universal Bracket, a gadget we constructors have been waiting for for a long time.

Often in the past I have found that the ideal position for a small, solid dielectric variable condenser or a potentiometer could only be utilised by specifying a bracket fixture. And I have had to ponder and puzzle over the two alternatives of (1) utilising the ideal position and inflicting a bracket fixture on the constructor or (2) adopting a less advantageous position.

I say "inflicting a bracket fixture" advisedly, because, to many, bracket fixings have hitherto been an infliction. Even those of us who can handle tools moderately well do not always take kindly to the fashioning of brackets.

Speaking for myself, I am often tempted to use thin, easily worked metal, with the result that the control flaps about! Perhaps we have been too strongly nurtured on simplicity of construction. Perhaps this is wrong, but the ethics of assembly simplification are beside the point.

The facts are that "bracketing" is often extremely convenient if not essential, and that to have to make one's own brackets is a darn nuisance.

Therefore, the Graham Farish Universal Bracket is in the nature of a god-send. It is strong, neat, and easy to use. Moreover, it really is universal, and besides being able to accommodate a condenser or potentiometer rigidly it can take a valve holder. The price is 4d. each, and, in my opinion, it is an item every constructor should possess.

A NEW HEAYBERD DEVELOPMENT

It is perfectly safe to build your own A.C. mains set. But, of course, certain commonsense precautions must be taken. No one would attempt to make hand adjustments to the gear box of a motor-car while the wheels in it were racing round, and it is equally foolish to tinker with the wiring of a mains set while it is connected to the mains.

So it is not so much on account of "running adjustments" that I, no doubt in common with many others, flinch from mains transformers carrying masses of bare metal terminals, because internal running adjustments should not be made on mains sets.

Safety plug and terminals on "Heayberd" mains transformers have electrical as well as "safety first" advantages.

If they are, then those who make them deserve all the shocks they probably get!

But I don't like bare terminals, because I regard a horde of bare live points bunched together as unsound electrical engineering. In any case, the home-constructor set is usually assembled by means of rather flimsy screw connections and soldering is seldom done.

That is bad enough, but the possibilities of short circuits occurring through loosened leads are strengthened by the deliberate introduction of bare high-potential points. Cut them out or reduce them considerably, and, given insulating wiring, the safety factor of the set is greatly increased.

I hope I have made my point, because I am certain that Heayberd's provision of protected plugs and sockets on their new mains transformer is not intended as an invitation to constructors to make "running adjustments." Nevertheless, as I have shown, an improvement of this nature is of prime importance.

A glance at the accompanying photo will show you exactly the forms adopted by these new safety terminal plugs and sockets. The sockets are on the transformer itself and the plugs are for the leads connecting to it. When the plugs are in position and properly insulated leads are used there is no bare "live" metal exposed at all.

Should a plug become detached, safety is still preserved, for both plug and socket have their metal parts "buried" in the insulating material.

I have said nothing about the tidiness and neatness of the method, for these are self-evident, as is also the fact that the plugs and sockets enable the connections to the transformer quickly and efficiently to be changed.

In sum, I consider that in this transformer we have the closest practical approximation to the ideals of perfect accessibility and general convenience with safety. And I am, of course, taking into consideration the excellent grouping of the various socket points and their general physical disposition.

Which leaves me no room to provide an adequate description of the purely electrical aspects of the components. However, it will no doubt suffice to say that in this it achieves the high standard of previous Heayberd transformers.

The Graham Farish Universal bracket can take a valve holder as well as the more usual small panel components.

It is designed for use with the Westinghouse H.T.12 rectifier, and there is an L.T. output of 4 volts at 4 amperes for A.C. valves.

There are two alternative H.T. outputs, these providing up to maximums of about 250 and 330 volts respectively with good regulation.

The price of this transformer is 22s. 6d.

VARLEY ELECTRONIC RESISTANCES

You might reasonably think that the manufacture of a fixed resistance is a comparatively simple business as compared with the larger components. But that is not the case, there are very special considerations to be observed and problems to solve every bit as difficult as with, for example, an L.F. transformer.

I don't suppose there are many constructors who have not encountered trouble due to resistances "breaking down" and giving rise to crackles and other troubles. But that is not often due to a failure on the part of the manufacturer to observe elementary precautions. It goes deeper than that.

Nor is a "breakdown" invariably due to a breakage in the resistance element itself. Mostly, in fact, it is caused by faulty connection developing between the resistance element and one or both of its connecting leads. And it is sometimes hard to see why such a fault should occur, given an adequate protective covering.

1-watt resistances in values from 100 ohms to 5 megohms are obtainable in the new Varley range, made by a special "electronic" process.

In the case of the more expensive wire-wound types spot welding the resistance wire to its leads provides an ample safeguard, but spot welding is impossible with the other types.

But Varley have solved the problem in a very ingenious manner. And they are now able to offer for 9d. a 1-watt resistance in any value from 100 ohms to 5 megohms that possesses real reliability as well as accuracy of rating and freedom from inductance.

Through the courtesy of my friend Mr. Higginson, Varley's chief engineer, I am able to disclose at least part of the interesting process that enables this desirable result to be achieved.

The wire ends of the resistance are not merely wrapped round the resistance element and reliance placed on mere pressure contacts, but are bound to the little former before the deposit of the resistance element. Then, by a special "electronic" process, the resistance material is deposited on the former and leads in such a way that the leads themselves become electrically integral with the resistance element.

These leads or wire ends are then passed through small holes in the apexes of the metal ends. You can snip them off if you want to use the resistance in a holder. Though if you desire to dispense with a holder the resistance can be joined directly in circuit with the aid of these invaluable wire ends.

And so has been accomplished yet one further step towards the perfection of radio for everyone.

The LINK BETWEEN

BY G. T. KELSEY

Weekly jottings of interest to buyers.

LAST week I concluded my notes with a real "stop-the-works" item of news concerning the very latest thing in kit-sets. Perhaps it would have been more appropriate to have referred to it as the very latest thing in *super* kit-sets, for now that I have had an opportunity of closely examining this British Radiophone effort I am convinced that it is one of the most ambitious commercial kit-sets that has ever been produced.

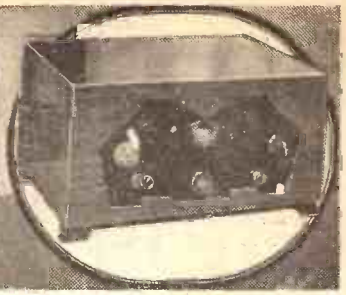
Those of you who saw my preliminary announcement last week and the reference to the fact that it was a seven-valver *for battery operation* will possibly have been investigating, meanwhile, the chances of erecting a special shed in the garden in which to house the necessary H.T. battery!

Have no fears, it's not nearly as bad as it sounds; for, the cat now being very much out of the Radiophone bag, I am able to reveal that, although it is strictly truthful to refer to it as a seven-valver, only five of the total number have the irksome "milliamp complex." The other two are Westectors, commonly known as "cold" valves. Joking aside, there is every indication that this new British Radiophone "Matched Perfection" 7-valve superheterodyne is going to be one of the sensations of the season in so far as commercial kit-sets are concerned, for in every sense of the word, it is ideal for modern conditions.

With the outstanding features of remarkable sensitivity and real "adjacent-channel" selectivity, and the provision of automatic

(*Continued on page* 753.)

The D.B. THREE



"Popular Wireless" again emphasises its pre-eminence in placing before the public exclusive news and circuit designs. Here is the full description of a set employing an entirely new type of valve—the very first time that this valve has ever been used.

CLASS B has been with us some seven or eight months now; it was in our issue dated March 25th, 1933, that the first receiver to use the new system of amplification was described. Since that date Class B valves and "drivers" have been common terms in the pages of radio journals, and the various improvements that have followed have been carefully weighed up and after due consideration put into use in the multitude of set designs that have incorporated B amplification.

"P.W."—ALWAYS AHEAD

Naturally, we keep in as close touch as possible with the various component manufacturers, and especially with the valve people, whence so many important developments have come during the last year.

The receiver we are about to describe—the first of its kind—is a direct result of such close watchfulness on impending developments. As a matter of fact, the special valve which is the basis of the set originated in a suggestion put forward by our chief of research, Mr. K. D. Rogers, when in May last the head of the firm producing it was discussing the question of Class B and its future.

A Combined Component.

This naturally brought up a certain amount of discussion on driver valves, and it was suggested that the inevitable outcome of Class B would be the inclusion of the driver valve with the Class B valve—a triple valve in one glass envelope.

This idea was immediately seized upon, and experiments were instigated into the structural requirements of such a valve. It would have to possess three anodes (one for the driver, and two for the Class B section), three filaments and three grids.

That made eight electrode-feed points, and, naturally, it was some time before finality in design was achieved. The result is particularly ingenious, however, for the triode (driver) section of the valve is situated between the two sections of the Class B amplifier, making a very compact and rigid structure.

Rigid Construction.

Special mica spacers, in the shape of combs, lock the three sections of the valve rigidly in position, and by using a seven-pin base, plus a terminal on the top of the valve, all the necessary feed points are satisfactorily provided.

The valve is smaller than most Class B valves, so that it definitely saves space, and it is also commendably inexpensive. Zero bias has been taken as the basis of the Class B section, while the driver is biased at about 3 to 4·5 volts. It is quite a normal valve in this respect, as it is in matters of characteristics.

The D.B. (driver B) Three is a simple receiver designed round the new valve, and capable, as it may well be imagined, of giving a performance every bit as good as a first-class four. It consists of a screened-grid stage, shunt transformer fed to a detector, after which we have the necessary circuits of driver and Class B arranged round one valve.

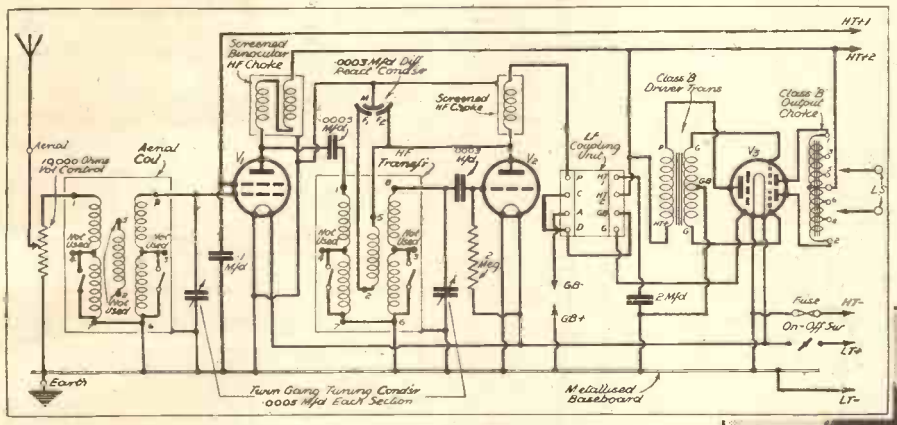
Straightforward Baseboard Layout.

In order to make construction as simple and straightforward as possible, we have not made the set as small as the new valve would easily allow. Chassis construction, with its above- and below-baseboard mounting and wiring, would enable quite a lot to be carved off the area of the receiver.

But chassis building is not so easy to follow as the straightforward flat baseboard

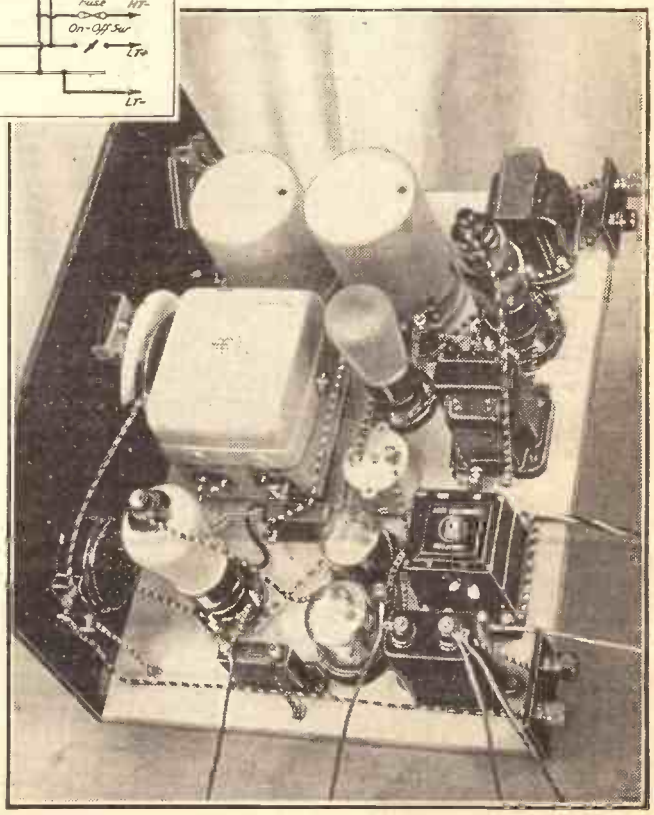
(Continued on next page.)

THREE VALVES WITH THE POWER OF FOUR



The circuit of the D.B. Three looks perfectly conventional until we come to the L.F. side, when it will be noticed that a new type of output valve is employed. This valve plays the part of both driver and Class B, and is virtually three valves in one envelope.

USES CLASS B OUTPUT



The S.G. valve is the one in the foreground. The valve near the coils with the anode cap being the new driver-B amplifier.

THE D.B. THREE

(Continued from previous page.)

method, and when an innovation of the type that is constituted by the driver-B valve is concerned it is sometimes best for a first set to be perfectly plain so that the intricacies of wiring shall be the more easily followed.

That is what we have done in this receiver. The layout certainly takes on an unusual aspect, but that is unavoidable with a valve of the character of the D.B.230. However, every circuit follows on logically, so that no difficulty should be experienced in tracing the connections, none of which are hidden in the way that would be experienced if under-baseboard wiring had been employed.

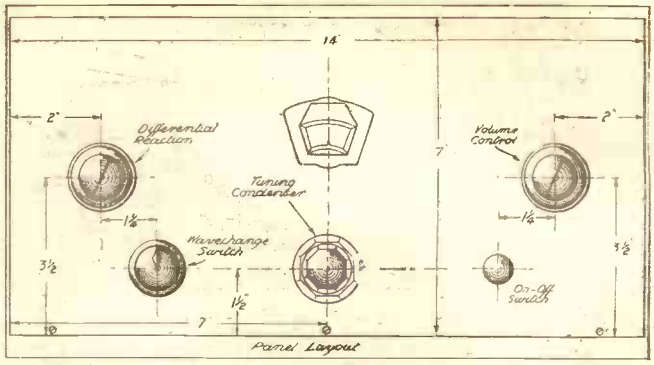
The aerial input is situated on an unusual side of the baseboard—the left, looking from the back—but this makes for much more satisfactory arranging of the components in this particular receiver than would the more familiar positioning of the aerial and earth terminals on the right-hand side.

From the aerial the received energy is passed to a potentiometer which is connected across the primary of the first screened coil. This allows adequate volume controlling without the need for a multi-mu valve. The secondary winding of this coil is tuned and connected across grid and filament of the screened-grid valve whose anode is shunt-fed to the primary of the second coil forming H.F. transformer coupling to the detector.

This provides a greater degree of selectivity than tuned anode, or tuned-grid coupling, and in a receiver of this nature is amply sufficient where sensitivity is concerned.

THE CORRECT VALVES

Make.	S.G.	Detector.	Combined Driver and Class B valve.
Mullard..	P.M.12 A	P.M.1 H.L.	—
Cossor ..	220 S.G.	210.H.F.	—
Mazda ..	215 S.G.	H.L.2	—
Osram ..	S.22	H.L.2	—
Marconi .	S.22	H.L.2	—
Hivac ..	S.G.210	H.210	D.B.230
Tungsram	S.210	H.R.210	—



Tuning is a particularly easy operation, since the aerial circuit tuning adjuster is brought out to a small knob concentric with the main tuning control.

Purity of Reproduction.

The detector is perfectly normal, operating on the leaky-grid principle and having differential reaction from its anode to grid circuit. Resistance-capacity feed from detector to intervalve transformer is employed, providing purity of reproduction and, by means of the double-tapped coupling unit, adequate battery decoupling for the detector stage.

From the secondary side of this unit connection is made to the grid of the driver section of the output valve—the pin that in normal Class B valves is left vacant on the seven-pin base. The anode connection of this part of the valve is, like the screened-grid valve, taken via a terminal on the top of the bulb, and this, of course, goes to the primary of the driver transformer.

The output of this transformer is split, as usual, the two halves of the secondary being fed to the two grids of the Class B section of the valve. The two Class B anodes then go to the output choke in the usual way.

Those who are not familiar with composite valves, such as the double-diode triode, will at first find it peculiar and seemingly quite wrong that the output from one transformer should be fed to the valve whose output is taken to a second transformer, and then that the output from this component should be fed "back" into the valve.

(Continued on page 748.)

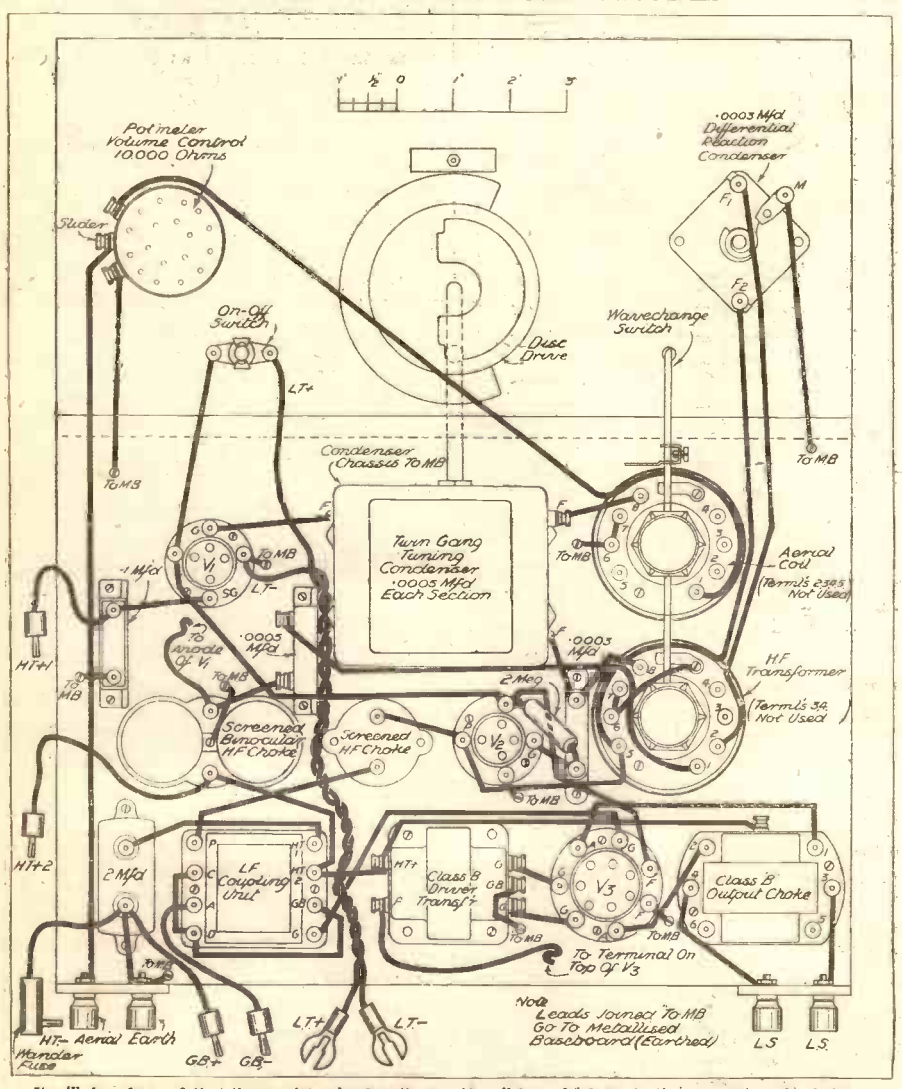
RECOMMENDED ACCESSORIES

BATTERIES.—H.T. (120 volts): G.E.C., Lissen, Ever Ready Siemens Pertrix, Marconiphone, Hellesens, Drydex, Ediswan or Block H.T. accumulators.
L.T. (2 volts): Lissen, Block, Pertrix G.E.C., Ediswan, Exide, Oldham.
G.B. (4½ volts): Lissen, Ever Ready, Siemens, Drydex.

LOUDSPEAKERS.—W.B., Blue Spot, Celestion, R. & A., Marconiphone, H.M.V., Amplion, G.E.C., Atlas, Cossor, Ferranti, Rola.

AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite." British Radiophone "Receptru" down lead, Bulgin lightning switch, Graham Farish "Filt" earthing device.

THREE GRIDS AND THREE ANODES



It will be observed that the special valve has three grids, all brought down to the seven-pin valve holder. Care must be taken that the right connections go to these terminals. An interesting feature of the new driver-B is the fact that it has three anodes as well.

GIVES AN OUTPUT POWER OF NEARLY 2 WATTS

Actually, of course, this does not take place, for the various sections of the valve are complete entities and are not electrically linked internally as regards low-frequency impulses. They feed from common L.T. and H.T. supplies, as do the other valves, but here the internal link ends.

The tendency of modern valve design is to make more use of the space available in the glass envelope, and to cut down the number of valves required, without reducing the number of electrical operations.

Connections to Baseboard.

A metallised baseboard assists in the wiring of the D.B. Three, for it allows a number of the "earthed" connections, such as L.T. — points, to be made via the metal covering, which itself is connected to the earth terminal of the set and to L.T. —. All connections to the baseboard should be carefully carried out, with washers over the wire loops that are to be clamped down to the board by screws.

The operation of the set is simplicity itself. The two H.T. taps are for the screening grid of the S.G. valve (H.T. + 1), and a maximum of between 120 and 150 volts for the other high-tension points of the set (H.T. + 2). These values should be 75–80 volts, and the full maximum of the battery or H.T. unit respectively. If a battery is used remember that it should be of the triple- or "super"-capacity variety, or, better still, of special Class B type.

With aerial and earth and batteries connected up (G.B. — should be about 3 volts for 120 volts H.T.) connect the speaker terminals to either 3 and 4 or 5 and 6 on the output choke. The better ratio will be found by test when the set is operating.

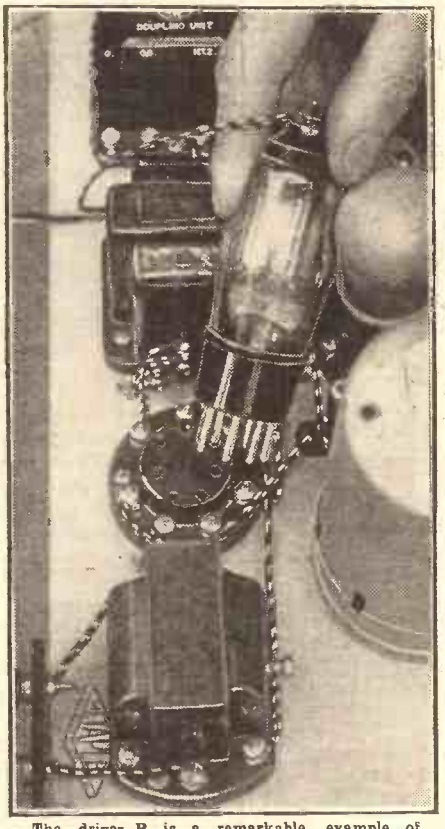
Employing a Class B Speaker.

We are assuming, of course, that an "ordinary" speaker is being employed. If one of the Class B variety is used we shall not need the output choke in the set, and can take the two anodes of the Class B section of the output valve direct to the two L.S. terminals of the set, taking the centre tap on the speaker transformer to H.T. + 2.

Place an ordinary S.G. valve (not multi-mu) in V_1, an H.L. type in V_2 and the special valve in V_3. Then switch on, and with the volume control fully to the right and the wavechange switch to "medium," tune in the local station. If possible, reduce to a whisper with the volume control and trim the variable condenser. If the station is too close for that, tune in a distant programme as low down on the medium waveband as possible.

Set the inner knob of the tuning control

EXTREMELY COMPACT



The driver B is a remarkable example of compactness in valve design. It is smaller than most Class B valves in spite of the fact that it contains a complete triode between the two "B" sections.

half-way round, and then adjust the trimmer for maximum volume. Once adjusted this need not be altered, for all setting of the trimming can then be done by the capacity controlled by the inner of the two concentric knobs. This control is adjusted (if required) wherever a station is tuned in, and enables exact tuning of the two coils to be obtained.

Reaction is operated in the normal fashion, but it must be remembered that the reaction and the volume controls should be used in conjunction to provide adjustable selectivity when listening to stations that are being interfered with by nearby wavelength users.

Sharpening the Tuning.

Reduction of the volume with increase of reaction will sharpen up the tuning to a surprising degree if judiciously used. And the method is not tricky in any way—it will soon be mastered after a little practice.

Someone will be sure to want to know the output wattage of the set. This is round about 2,000 milliwatts—like any ordinary Class B receiver—on peak modulation. This gives a safe maximum average volume of about 750 milliwatts, representing all that is required in most rooms.

The quiescent current of the set is, of course, but a few milliamps, but this rises on the reception of broadcasting, as it does with all Class B sets, and the greater the strength of reproduction the greater the anode current taken from the H.T. battery.

We mention this because, from correspondence, it appears that the point is not fully realised, and that many constructors are running their Class B sets from ordinary 10-milliamp batteries, and are therefore finding it not as economical as they had expected.

The Use of Mains Units.

If mains units are used with the D.B. Three they should be of the Class B variety, capable of giving adequate voltage regulation, with variations of current ranging from about 10 to 30 or 40 milliamps. These last currents are, of course, only momentary, and represent the peaks reached when sudden, extremely loud sounds are transmitted.

Unfortunately, the importance of choice of suitable mains units for Class B receivers is not sufficiently appreciated, and we frequently trace trouble with such receivers to the use of unsuitable H.T. supply. Make sure, therefore, when purchasing, or building a power pack for Class B, that the voltage regulation with varying current drain is reasonably constant. There should be little voltage change.

THE COMPONENTS REQUIRED FOR THIS OUTSTANDING "P.W." DESIGN

1 J.B. "Unitune" 2-gang tuning condenser.
1 pair Telsen twin-matched coils, type W.287.
2 W.B. 4-pin valve holders (small type), or Telsen, Benjamin, Lissen.
1 W.B. 7-pin valve holder, or Graham Farish, Telsen, Benjamin.
1 Dubilier 2-mfd. fixed condenser, type B.B., or T.C.C., Telsen, Graham Farish, Lissen.
1 Telsen ·1-mfd. fixed condenser, type W.231, or Dubilier, T.C.C., Lissen.
1 Graham Farish ·0005-mfd. fixed condenser, or T.C.C., Telsen, Dubilier, Lissen.
1 T.C.C. ·0003-mfd. fixed condenser, type 34, or Graham Farish, Dubilier, Lissen.
1 Graham Farish ·0003-mfd. differential reaction condenser, or Polar, Telsen, British Radiogram.
1 Graham Farish screened binocular H.F. choke, type L.M.S., or Telsen.
1 Bulgin "Midget" screened H.F. choke, or Graham Farish, Telsen, Wearite.
1 Varley 1-watt "Electronic" 2-meg. grid leak with wire ends, or Dubilier, Lissen, Bulgin, Igranic.
1 R.I. Parafeed L.F. coupling unit, or Bulgin, Benjamin.
1 Lissen Class B "driver" transformer, or Igranic, R.I., British Radiogram, Varley, Telsen, Multitone, Benjamin.
1 Multitone "Puchoke" Class B output choke, or as above.
1 Benjamin 2-pt. push-pull on-off switch, or Lissen, Telsen, Ready Radio, W.B., British Radiogram.
1 Igranic 10,000-ohm wire-wound potentiometer, type WIRCN, or Bulgin, Wearite.
1 Peto-Scott ebonite panel, 14 in. x 7 in., or Goltone, Permcol.
1 Peto-Scott "Metaplex" baseboard, 14 in. × 10 in.
2 Peto-Scott terminal strips, 2 in. × 1½ in., or Goltone.
4 Bulgin indicating terminals, or Belling-Lee, Clix, Igranic.
4 Belling-Lee wander-plugs, or Igranic, Bulgin, Clix.
2 Clix accumulator spades, or Belling-Lee, Bulgin.
2 Coils British Radiophone "Push-back" wire.
1 Belling-Lee wander-fuse.
1 Peto-Scott cabinet.
Flex, screws, etc. (Peto-Scott).

RADIO STEP-BY-STEP

OUR SPECIAL SUPPLEMENT for BEGINNERS

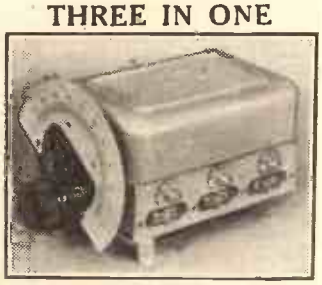
WHEN you adjust your set to a given wavelength you carry out an operation which, in radio parlance, is called *tuning*. When you place your controls in the positions for maximum volume you have adjusted your tuning circuits to exactly the same wavelength as that of the station whose programme you wish to listen to.

COIL AND CONDENSER.

Every radio set has one or more tuning circuits. A tuning circuit consists of a coil (called a tuning coil) and a condenser. The tuning coil, in its simplest form, is a length of insulated copper wire wound on a tube as a solenoid or single-layer winding.

One end of the coil is joined to the aerial and the other end to earth. A variable condenser is connected so that the moving vanes go to the earthed end of the winding and the fixed vanes to the aerial end of the coil. The coil and condenser then become a tuning circuit, and can be joined to a detector, amplifier and loudspeaker.

THREE IN ONE



A typical commercial gang condenser showing, at the side, the trimmers for the three condensers, which are enclosed in the one case and controlled by the one knob

VERY INEFFICIENT.

It would be possible to receive programmes, although very inefficiently, without a tuning circuit. The aerial and earth could be joined direct to the detector. In these conditions several programmes would be received together and none would be satisfactory. The volume would be poor, and the various transmissions, that is those which had enough strength to produce audible results, would interfere with each other, thus producing a useless jumble of programmes.

Tuning the receiver does two things. It provides the maximum power from the desired programme, and it enables this programme to be received with the minimum of interference from unwanted transmissions working on nearby wavelengths.

The ability of a set to separate one transmission from another is known as its selectivity. A selective receiver is one whose tuning is "sharp," and a non-selective receiver has what is called "flat" tuning.

VARYING WAVELENGTH.

Let us consider what happens when the tuning control on the set is adjusted, say, for London Regional. The London Regional transmits on a wavelength of 356 metres, and the tuning circuits of the transmitter are adjusted to maintain this wavelength at all times.

This wavelength is fixed by combining inductance and capacity, in the form of tuning coils and condensers, to the required degree. The wavelength can be altered merely by changing the value of either the inductance or capacity. But we are not concerned with the wavelength of the broadcasting station, because this is fixed. What we have to do is to adjust the receiver's tuning circuit or circuits to exactly the same wavelength as that of the transmitting station. In the case in point the receiver would have to be adjusted to 356 metres. When the set is properly adjusted it is said to be in tune.

Now, we have already mentioned that a simple tuning circuit consists of a coil and variable condenser. The coil has inductance and the condenser has capacity, the value of the latter depending upon the position of the moving vanes relative to the fixed.

By rotating the tuning control the position of the moving vanes can be varied. When the moving vanes are completely engaged with the fixed, the capacity has reached its maximum. It is at its minimum when the moving vanes are fully disengaged from the fixed vanes.

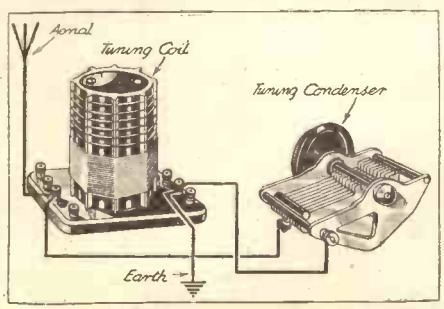
EASILY CONTROLLED.

Since the wavelength of a tuning circuit depends upon the values of inductance and capacity, it will be seen that, within certain definite limits, we can choose any wavelength we please simply by rotating the tuning control, or, in other words, altering the capacity of the condenser.

Another way of achieving the same end would be to keep the capacity constant and to vary the inductance or size of the tuning coil. But this is not a convenient method in practice, and it is easier to use a fixed inductance and a variable capacity.

This seems all very simple, doesn't it? You have a coil of wire possessing inductance and a condenser which has capacity. You combine these two properties by joining the coil and condenser together. Then you turn a knob, so varying the capacity until you arrive at the correct wavelength.

THE PRACTICAL ASPECT



In this pictorial diagram of a simple tuning circuit the connections between condenser and coil, in relation to the aerial and earth, are made clear.

A SIMPLE EXPERIMENT.

But there is more in it than this. Have you ever noticed that by striking a certain note, say on a piano, you can start some object in the room vibrating in sympathy.

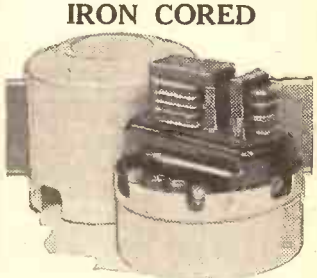
There is a simple experiment with two similar tuning forks. One of the forks is set into vibration by giving it a sharp tap, and upon being held near the second fork causes this to vibrate, both forks emitting the same note. Such a condition is due to resonance, the second fork resonating with the first.

Resonance is a transference of energy from one system to another in a series of impulses or waves (air waves in the case of the tuning forks) timed exactly to coincide with the natural period of vibration of the second system.

IN RESONANCE.

When a radio receiver is tuned to the same wavelength as that of a broadcasting station it is said to be in resonance. "In tune" is another way of saying "in resonance."

IRON CORED



Iron-cored coils are the most recent development in tuning technique. Amongst other advantages, a big saving of space is obtained, as you can see by comparing this photograph with that of an air-cored coil of a similar type.

Of course, the simple tuning circuit which we have taken as our example would not give sufficient selectivity to cope with modern conditions; but the basic principles of tuning hold good, however complicated the circuit may be.

RADIO TERMS
A PRACTICAL REVIEW
BY G.V. DOWDING, ASSOCIATE I.E.E.

BATTERIES

There are two types of battery commonly used in radio—the "dry" battery and the accumulator. The "dry" battery is made in two forms—one for grid-bias purposes and the other for supplying high tension.

Essentially they are identical, each comprising a number of *cells* in accordance with the voltage desired, the "H.T." battery having more than the "G.B." battery.

Each of these cells is a miniature replica of those 1½-volt dry cells used for operating bells. It is not really "dry," but a paste is used instead of the sal-ammoniac solution that is employed in the wet type of Leclanché cell (see Fig. 1).

The zinc is chemically attacked by this paste and gradually eaten away; the gas film that tends to collect on the carbon, and would otherwise interfere with the cell's action, is absorbed by the manganese dioxide which surrounds the carbon.

A cell of this kind is known as a Primary Cell, because it initiates an electrical current by its own action. An accumulator is a Secondary Cell, and is sometimes referred to as a Storage Battery, for the reason that it is brought to the chemical condition necessary for developing electrical current by first having current passed through it.

Literally, this may not be a storage action, but it is sufficiently near to it for the term to be apposite.

An accumulator cell comprises two sets of plates immersed in a solution of sulphuric acid, the negative plates being composed of lead and the positive plates of a lead grid in which a red lead paste is forced. We will now discuss these various batteries in detail.

ACCUMULATORS

These are used for supplying the L.T. (low tension) current of a set. (There are also H.T. accumulator batteries, but these are not very popular.)

An accumulator cell provides an average voltage of 2 volts. Its capacity is rated in ampere hours. This rating may be fixed on either a continuous or intermittent basis. The latter is generally double the former, and denotes the output to be anticipated if only small currents for short periods are taken.

The continuous rating is necessary to indicate the useful life per charge an accumulator will have when used with a radio set.

Accumulator cells can be joined in *series* (Fig. 2), and then the resultant voltage is the sum of the individual voltages. When connected in *parallel* the voltage remains that of one cell, but the ampere-hour capacity is augmented, two cells of similar capacity providing a capacity of twice that of the one.

A simple charging circuit for D.C. mains is shown at Fig. 4. It will be seen that the positive mains connection is joined to the positive of the cell and the negative mains to the negative of the cell. A lamp is interposed to provide the resistance necessary to regulate the charging current. An electric fire or iron could be employed so long as it effected the required regulation.

If the lamp, fire or iron is suitable for the mains voltage the current it will pass can be worked out from its wattage by means of this simple formula:

$$\text{Current} = \frac{\text{Watts}}{\text{Mains Voltage}}$$

Here is an example: The mains are 200 volts; the lamp is of the 100-watt type.

$$C = \frac{100}{200} = \frac{1}{2} \text{ amperes.}$$

When an accumulator cell is fully charged bubbles rise from the negative plates, which should then be of a palish grey colour. The positive plates should be darkish chocolate in colour. The voltage rises to about 2·5 and the specific gravity of the acid solution to 1·25 or so.

The discharged condition is denoted by a change in the colour of the plates, the negative ones assuming a pale brown colour and the positive ones a dark grey. The specific gravity of the electrolyte (acid solution) falls to 1·12 or so. The voltage must not be allowed to drop below 1·8 volts.

Specific gravity indicates the density of the acid solution, so a good test for the condition of a cell can be made with a hydrometer (Fig. 5). Because the fluid varies in density the differently weighted beads float or sink to give the required information.

A hydrometer test is a good one, and as a hydrometer is also convenient for "topping up" the cell with water, it should be in every accumulator user's hands.

"Topping up" at intervals is necessary for making good evaporation. It is the water which evaporates, not necessarily the acid, though some acid will be lost in the course of time through spraying while charging is going on. The plates of an accumulator should always be kept covered by the acid solution. A small quantity of hard mineral oil (a special oil known as Blancol is made for the purpose) can be poured in to form a layer to reduce acid spraying and creeping.

If the terminals are regularly cleaned and greased with vaseline, corrosion of them will be checked.

Sulphation is a disease which attacks neglected cells—that is, cells which are discharged to voltage levels below 1·8 and are left idle for long periods. White deposits form on the plates and reduce their effectiveness. Long, slow charges, changing the acid, and washing out the cell may cure sulphation if it is tackled in its early stages.

If an accumulator is to be left idle for a long period its acid solution should be emptied out and its plates thoroughly washed.

H.T. BATTERIES

Unlike the accumulator, an H.T. battery of the dry type possesses an appreciable internal resistance which rises considerably towards the end of its life (dry batteries cannot be recharged).

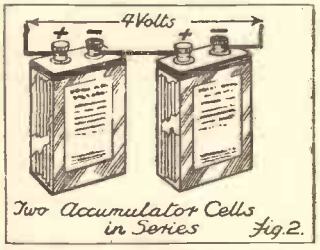
This resistance sometimes causes instability in a set. H.T. batteries are sold in various capacities, the larger capacity types providing greater currents.

The "standard" type is suitable for sets requiring up to 7 or 8 milliamperes. Above that it is economical to buy the double- or treble-capacity types. Class B sets demand H.T. batteries able to deliver spurts of heavy current.

G.B. BATTERIES

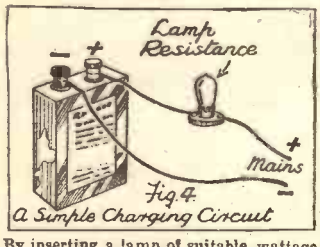
These do not have to supply current, and so their cells may be small. The voltages of a grid-bias battery should be checked at regular intervals.

MORE VOLTAGE



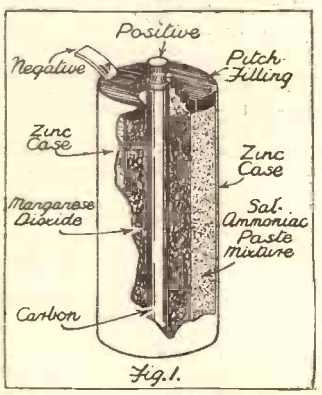
By connecting the positive plate of one cell to the negative plate of the other two similar accumulators are joined in series, and a voltage equal to the sum of the individual voltages is the result, the capacity remaining the same.

FOR CHARGING



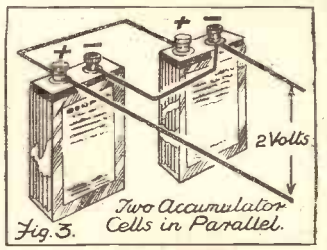
By inserting a lamp of suitable wattage in one lead of D.C. mains an accumulator may be charged without trouble at home.

HIGH TENSION CELL



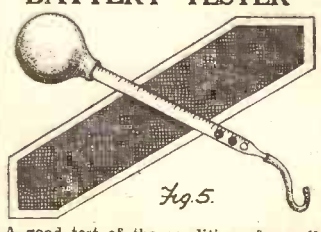
The construction of an H.T. battery cell is clearly shown in this sectional drawing.

DOUBLE CAPACITY



In this illustration two similar accumulators have their positive and their negative plates joined each to each. The voltage in this case remains the same, but the capacity is doubled.

BATTERY TESTER



A good test of the condition of a cell is made with a hydrometer. Because the acid-solution varies in density, the various weighted beads float or sink, and so give the required information.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos.

Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelop must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

CONNECTIONS FOR SHUNT-FED L.F. TRANSFORMER.

C. F. S. (Hatfield).—"Instead of passing the plate current through the primary I want to 'shunt-feed' the L.F. transformer. Will it be right as follows? Join the coupling resistance in the position formerly occupied by the primary of the transformer. Join the side of the resistance, which goes to plate of valve, to one side of the new coupling condenser. 'A' terminal of transformer to other side of coupling condenser. Filament of valve holder to 'H.T.' terminal of transformer. The other two terminals as marked, i.e. G. to grid of following valve and G.B. to grid-bias lead."

The connections are correct as described; but don't forget that it is important that the values of the coupling resistance and condenser should line up with the transformer maker's recommendations if quality is to be improved, which is apparently your object in freeing the primary of H.T. current.

INSTABILITY WHEN H.T. VOLTAGES ARE CORRECTLY ADJUSTED.

D. F. (Dingle, Liverpool).—"The valves are new and the parts are all as recommended, but I cannot put on the voltages recommended for H.T. without a howl. It is the 'Apex' S.G.3 with Extenser tuning.

"If it is put on low voltage the set is all right as far as quality goes. But there is not enough volume.

"As soon as I put it up and begin to get the full power out of it I get the howl and instability, and have to shut off.

"What shall I do to get rid of this?"

With the canned coils and Extensers of the "Apex" 3 no instability should be experienced, so we imagine that all is not well with these. Are you sure that the screens are making good contact and are effectively earthed?

It is essential that the cans on the coils are making good contact with the coil bases.

Try inserting a 600-ohm resistance in the lead between H.T.+ 1 and A of V1 valve holder, and connect the A terminal to one side of a 1-mfd. condenser, the other side of which is connected to the earthed wiring.

Other modifications likely to be of assistance are the following:

The No. 8 terminal on the anode coil should be connected to one side of a good quality 1-mfd. fixed condenser, the other side of which should be joined to one of the spare switch contacts of the anode extenser.

The flex lead from V1 can then be placed on the 1, 2, 4 or 5 terminal of the anode coil, instead of on 6 as at present.

If necessary a larger decoupling condenser for the detector anode circuit would afford further freedom from risk of feed-back. But it certainly should not be necessary, as any remaining trouble would ordinarily only be due to a very faulty H.T. supply, whereas your own battery is new.

But remember that a dud bias battery, or faulty valve, or badly spaced output circuit may give rise to instability and howls of this class.

CONVERTING THE "MAGIC FOUR."

H. S. (Gateshead).—"Somehow I have never had the heart to break up the good old 'Magic' Four. And now I have a mind to give it a new lease of life, with the aid of the latest improvements.

"It seems to me that with such a fine old set as a foundation, fitted with the new high-efficiency iron-core coils and a modern S.G. valve, I could knock spots off some of these much-talked-of and more modern circuits.

"If any extra decoupling, etc., is necessary, please give full details, as I want it to be a very-last-word set."

We are sorry to have to say it, H. S., but it would be a case of putting new wine into an old bottle!

Good as the "Magic" Four was in its day, it has certain very clearly defined limits. And those limits would be overstepped by introducing such radical alterations as a modern high-stage-gain screened-grid valve and iron-core coils.

Theoretically, there are certain difficulties which would have to be guarded against. In practice it is almost certain that others would crop up. And they might be very difficult to overcome.

Such a conversion, therefore, would form the basis of some interesting experiments. But as a practical proposition we do not recommend it. Apart from any question of conversion, you must remember that many of your existing components can be used in some other set.

THE WIRING OF THE UNIVERSAL AMPLIFIER.

S. B. A. (Horley).—"I am putting up the 'Universal Amplifier,' which you gave in the number of 'P.W.' for November 11th.

"I generally check up the wiring from the theoretical diagram, and in doing this I have come across a difficulty with the connections. It seems to me there is a wire missing from the 2-mfd. condenser, near the 80,000-ohms resistance, in the wiring diagram. Should it be joined to the heater wiring?"

Yes. Referring to the wiring diagram on page 466, the illustration shows one 2-mfd. condenser standing between the rectifier valve holder and the 80,000-ohms resistance.

There should be a lead from this 2-mfd. condenser's terminal (the one near to the 80,000-ohms resistance) to that end of the 80,000-ohms resistance which is almost touching the end of the 2-mfd. condenser in question.

If more convenient it may be taken to the nearer terminal of the 2-mfd. condenser which stands between the two 4-mfds. instead. (As this point is already joined to the resistance terminal in question it comes to the same thing.)

ADDING AUTOMATIC VOLUME CONTROL.

E. V. S. (Beckenham, Kent).—"Would it be easy to add an automatic volume control to the 'S.T.500'? One might suppose so, after proving how easy a set it is to build, but I do not see anything about Mr. Scott-Taggart advising it.

"In one sense I am reluctant to add anything to it or to alter it in any way, so if there is any doubt about it I would much rather leave it as it stands than try a doubtful 'improvement.' But if it can be done easily I should like to try."

We gather, from the fact that you say "add an automatic volume control," that you think it is merely a question of affixing a new component or two in place, and thus attaining the desired result. But this is not the case.

Automatic volume control—generally styled A.V.C.—operates by varying the amplification efficiency of an H.F. valve (or valves) in inverse proportion to the strength of the carrier-wave of the station that is being received.

Thus, for a strong station, the amplification is greatly reduced. And vice versa. This enables the set automatically to compensate for continuous fluctuations caused by fading, etc.

Such a scheme necessitates considerable modification of an existing set. And the necessary continual variation of amplification efficiency would prevent the correct reaction effects from being obtained in the "S.T.500" without extensive modifications.

BRIGHTENING UP THE CHRISTMAS PARTY.

G. P. (Norwich).—"Last year I saw a description for connecting up the pick-up terminals and loudspeaker and listening-in in the next room, unbeknown to the people chattering round the set.

"I have forgotten the connections, but I should like to try this for a word-guessing competition, where the party chooses an uncommon word like 'Mesopotamia,' and one or more persons go out of the room and try to guess it when they come back to the party.

"All they are supposed to have to go on, are the initial letter, whether 'animal,' 'vegetable,' etc., and the last letter but one. Four guesses each.

"But when it comes to my turn I want to spring a surprise on them all by getting it

(*Continued on next page.*)

"P.W." PANELS, No. 149.—RABAT, MOROCCO.

This African station is generally considered to be in the "European" group. It is on the Mediterranean, and is operated in French interests.

* * *

Although well received in this country last year it has not been picked up so frequently of late, possibly because its wavelength (415·7 metres) is sandwiched in between Athlone and Berlin.

* * *

Rabat is about 1,250 miles from London, and the power employed is 6 kw. Calls "Ici Radio-Maroc," and closes down with "La Marseillaise." In the intervals a metronome is sometimes switched on—60 beats per minute.

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from previous page.*)

right first time, every time! (Simply by listening-in, in the other room, whilst they are choosing a word to get me down!)

"Can I do it with an old telephone earpiece, which was my first 'loudspeaker'? It is still quite sensitive, I believe, but gives no results when connected to the pick-up terminals, which I remember were used in the previous stunt. (But I am not sure what the connections should be, perhaps the earpiece is O.K., and I have done wrong in joining it to the pick-up terminals.)."

From your letter it would appear that you have not seen the article on page 699 of last week's issue of "P.W."

In your circumstances you need the distant loudspeaker to act as an unsuspected microphone, so that when the party are innocently talking around it their conversation is picked up and passed to the set for amplification.

It can then be heard on another loudspeaker in the other room, or on a telephone earpiece, such as you have on hand when the set is one incorporating an output-filter system of some kind—either choke or transformer.

It is easy to arrange for this. You simply disconnect the loudspeaker from its usual terminals and join it instead (by fine "invisible" wires, if necessary) to the pick-up terminals on the set. It thus becomes the input.

You now have two vacant output terminals where the loudspeaker was connected, so you join the earpiece (or other loudspeaker, if used) to these. And you will then be able to hear on it quite well what is being said in front of the other loudspeaker!

HE HEARS THE RADIO WHEN WORKING ON "GRAMOPHONE."

P. C. (Bournemouth).—"What beats me is that although it is very good on gramophone, I can still hear the wireless coming through. I have checked wiring and switch, etc., and everything is in perfect order.

"What is wrong?"

Nothing much. With many forms of simple switching there is only a slight alteration to the radio side, and if the switch employed is not of a low-capacity type, or if the wiring is not well spaced, you get a "jump-across" effect, enabling you to hear the programme which is supposed to be cut off.

Better wiring or the use of a low-capacity switch will cure the trouble. But if it is not easily put right by attention to these details, you can easily get rid of a radio background simply by detuning the set a little.

THE A.C. DOUBLE X.

S. R. S. (Eastoft).—"In your description of the A.C. Double X in the December 2nd 'P.W.' I got interested in the remarks on input voltage on page 626 (under the heading 'Small Grid Voltage Required').

"But when working out the figures it seems to me that if amplification is as stated, much less than one volt is needed on the detector grid to give full loading of the output valve."

Your assumption is quite correct. Actually only $\frac{1}{4}$th of a volt is needed but owing to a printer's error "$\frac{1}{2}$th of" was omitted.

THE BATTLE OF TELEVISION WAVES

(*Continued from page* 731.)

something of a problem. Perfect transmission of speech and music can be accomplished with amplifiers whose fidelity goes as high as 8,000 to 10,000 cycles.

The newest audio-frequency amplifiers (which are being developed to take the fullest advantage of the ultra-faithful "velocity" microphone and the latest development in vertically cut "hill-and-dale" recordings) are claimed to give virtually perfect flat-line frequency response from 20 up to 17,000 cycles. But even these achievements, notable as they are, will have to be bettered for perfect television. But there is much intensive research work being done in the ultra-short-wave field, and this steady but sure progress will inevitably bring to us eventually perfect television, with none of the limitations of restricted detail which the present 30-line medium-wave system must of necessity impose.

APPRECIATIONS OF OUR GREAT GIFT BOOK

"MORE THAN DEL. GHTED."

From L. Witherington, 16, Railway Terrace, Caerphilly, Glam.

I beg to acknowledge receipt of "The Manual of Modern Radio," with which I am more than delighted. It far exceeds all expectations.

Thanks for the prompt delivery.

"OF THE UTMOST VALUE."

From A. E. Hemsley, Elmina, Cross Roads, Newton-by-Frankby, Wirral, Cheshire.

Very many thanks for the Presentation Copy of The Manual of Modern Radio" received yesterday.

This is undoubtedly the finest and most comprehensive work it has been my good fortune to come across, and it should be of the utmost value to both the amateur and the expert.

May I also take this opportunity to thank Mr. John Scott-Taggart for the "S.T.500." This receiver is easily the finest home constructor's set yet designed at anything like a reasonable price, and it very easily holds its own with the majority of the new season's super-selective receivers that have been commercially put on the market, and it surpasses them in being more likely to be able to meet the ever-changing conditions that the ever-increasing power of foreign transmitters brings in its train.

"NOTHING TO TOUCH IT."

From R. S. Ogle, 19, Baxter Place, Seaton Delaval, North.

Just received my copy of "Manual of Modern Radio," and wish to take this opportunity of thanking POPULAR WIRELESS, also Mr. John Scott-Taggart, for a gift which I can hardly describe. Both for looks and reading there is nothing to touch it.

"A REAL MINE OF INFORMATION."

From F. G. Upton, Victoria Road, Horley, Surrey.

I have great pleasure in acknowledging with many thanks the receipt of the "Manual of Modern Radio."

I only posted my completed form on Wednesday, hoping to receive the book before Christmas, and was pleasantly surprised to receive it on Friday.

With regard to the book itself, it is difficult to know where to start praising it—and, more so, where to stop. It is certainly correctly named, for it is right up to date—in fact, in advance of much present practice—and is a real mine of information. (And really *mine*, as Tommy Handley would say.) The illustrations are very good indeed, and the diagrams also. It is a great achievement of Mr. J. Scott-Taggart.

GETTING THE COIL RIGHT

A hint on making slots in a ribbed coil former.

IF you wind your own "S.T.500" coils here are a few hints that may prove useful: The slots for the reaction and long-wave windings prove a bugbear to many. A hacksaw blade makes a very narrow cut, and widening with a file is tedious, besides dangerous if any side pressure is accidentally brought to bear.

The best plan, I have found, is to cut the slots with a hacksaw and then make a second cut with the blade just on the edge of the first cut, using the thumb as a guide to keep the blade in position (see diagram).

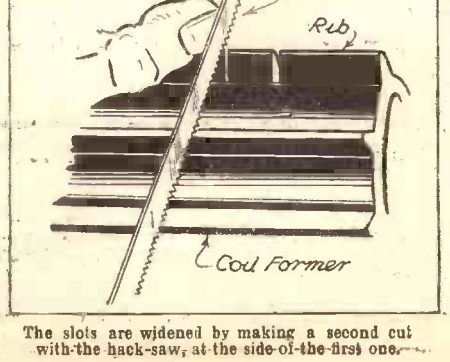
It is risky to put the coil former in a vice, but, if you feel you must, protect its ends with two pieces of wood. Incidentally, the average household vice is unlikely to have the necessary length of travel to take the former and protecting woods.

Should this prove the case, don't be tempted to put the coil former in sideways. This is quite fatal and simply means buying a new one. The safest method is to hold it firmly by hand on a flat surface, and don't try to do the job too speedily. Let the saw cut more or less by its own weight. This makes for safety and accuracy.

When winding the coils a good plan is to clearly identify each winding as you finish it. Small squares of stout paper marked M.B. (beginning of medium-wave coil), M.E. (end of medium-wave coil), etc., attached to the six endings, will identify each winding perfectly and save unnecessary worry.

There is no need to deny yourself the pleasure of winding your own coils on the grounds of difficulty. It is really quite easy, and will provide you with at least one evening's entertainment, while the glow of pride that runs through you as you survey the finished product will amply compensate you for the trouble taken.

A SECOND CUT



The slots are widened by making a second cut with the hack-saw, at the side of the first one.

A FINE OSRAM VALVE

ANOTHER newcomer must be welcomed to the ranks of the Osram mains valves now available. It is a steep-slope defector of the triode type, with specially designed anti-hum heater, and designated the M.H.41.

Here are its characteristics: The impedance is of the order of 13,000 ohms but the amplification factor is as much as 80, giving a mutual conductance of round about 6 ma/V. Thus, as a detector to be followed by resistance coupling, the valve is ideal, providing ample magnification to fully load the average pentode power valve.

The valve is non-microphonic and the specially non-inductive spiral-wound heater seems to be very effective in keeping out mains hum. It is available with plain or metallised glass bulb, and the average anode current with maximum H.T and correct G.B. is about 5 milliamps. The price is 13s. 6d., and this valve should have an exceedingly warm welcome from set designers. The high amplification factor and the remarkably low impedance enable an excellent stage gain to be obtained with the M.H.41, and in it we have a very valuable valve.—K. D. R.

THE LISTENER'S NOTEBOOK

(*Continued from page 732.*)

has discovered a great entertainer in Tubby Harold. In his first appearance in a pukka variety bill he was undoubtedly the star. I don't think he was at the top of his form, either, on this occasion. Most people aren't when they are making their début. But it was easy to see that Tubby will be the goods when he's completely at home before the mike.

Something new in songs, something new in stories and something new in the way he dispenses both that makes you roar with laughter. That's Tubby. Look out, you stars; there's a rival star in the ascendant.

* * *

While on this question of singers and singing, why does the B.B.C. so persistently shun the treble singer? Apart from the beauty of the treble voice, there's another equally good reason for encouraging child broadcasting. The child of to-day is the adult of to-morrow who, with experience of broadcasting gained in childhood, will be all the better adult broadcaster for that experience.

THE RADIO INDUSTRY GREETS YOU

(*Continued from page 733.*)

brings to all your readers who, to me, are more than customers. They are my friends to whom I am linked by the magic of radio.

"The closing year has meant for us much hard work, and I myself have derived great pleasure in supplying the enormous demands occasioned by the wonderful circuits and sets you and your staff have provided.

"In thanking you for placing this valuable space at my disposal I take this opportunity of once again wishing you and your readers a Happy Christmas and a Prosperous New Year."

From C. P. BEARDSALL, Radio Sales Manager, Ferranti, Ltd.

"It is customary at this season of the year to send greetings to one's friends and acquaintances—in many instances, one fears, largely as a matter of form.

"This, however, is far from being so in the present case, as it gives us much pleasure to associate ourselves with 'Popular Wireless,' a journal which has done so much to further the interests of the home constructor. We send our best wishes for the festive season to all constructors, and at the same time we look forward to long-continued interest in home construction of radio in all its forms, for which purpose constructors may be assured this company will do its utmost to furnish apparatus and service to the best of its ability."

From R. F. COLLINSON, Director, Colvern, Ltd.

"Christmas is almost here again, and another year has passed, marking many important advances in radio reception.

Mr. R. F. Collinson.

"The fascination of constructing receivers at home is the hobby of many thousands of listeners. Each year they can incorporate in their sets the very latest developments. With the help of 'Popular Wireless,' the latest information collected from all over the world is put in front of their readers in such a way as to enable them to add, alter, or reconstruct their receivers as they wish.

"To these constructors we offer our greetings and we know they will appreciate the advantages of their up-to-date receivers by selecting one of the many programmes to suit their tastes."

THE LINK BETWEEN

(*Continued from page 744.*)

volume control to bring the set in line with the very latest tendencies, I am convinced that there are few who will not agree with me.

For the special benefit of "P.W." readers, I am glad to be able to announce (a) that tentative arrangements have been made for a complete test report of this new kit-set to appear in a forthcoming issue, and (b) that a free blue print, with constructional and operating details, is available through our postcard literature service. Take my advice, apply early and avoid the rush! **(No. 69)**

Topical Note.

Counting our day of publication, there are only four shopping days to Christmas. That means to say that you will just have nice time to go out and buy a "Solon" electric soldering iron as a Christmas present from you to yourself! And why not?

Think of the hundred and one things that you could do with an iron that really takes the "hard labour" out of soldering, and that 7s. 6d. will be as good as spent. You won't regret it.

I've been waiting for some enterprising concern to bring out a foolproof electric soldering iron, and this Henley's "Solon" certainly seems to fill the bill.

"Good Reception" of Another Kind.

I went along one evening recently to see a performance of "The Whole Town's Talking," by the Lewcos Staff Dramatic Society, but I'm afraid I should make a very poor critic if all the plays I had to see were like this one. To be quite truthful, I was so convulsed with laughter during the major part of the performance that I was quite incapable of surveying it at all with a critical eye! Anyway, I am content to pronounce the general verdict of excellent, and to convey my hearty congratulations to the society as a whole.

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way—just quote the number or numbers.

THE MIRROR OF THE B.B.C.

(*Continued from page* 732.)

from the Pavilion, Bath, on Saturdays and Wednesdays, December 23rd and 27th, respectively.

On the first evening Layton and Johnstone will be heard at 8 p.m., and on the second Bransby Williams will appear before the microphone at 8.20 p.m. On Tuesday, December 26th, the County Borough of Swansea Police Band is giving a concert.

This band has been in existence since 1878, and consists mostly of musicians who have served in the various Guards and line regiments.

The Toytown Stories.

Pantomime of a unique sort comes into the programmes on Wednesday, December 27th, at 7.15 p.m., in a relay from the "Theatre Royal, Toytown." The Toytown stories, which were written by S. G. Hulme Beaman in order that he could illustrate them as an artist, have been extremely popular in the Children's Hour programmes, and it is felt that "A Christmas Pantomime" will be equally acceptable to adults.

Christmas in Scotland is a very different festival from what it was before broadcasting began. Even now it is not a public holiday, but it is running New Year's Day very close to becoming the important day of the year, as it is in England.

Now that the churches in Scotland are observing Christmas, and the big shops and offices and banks are closed, it may not be long before Scotsmen take the same view of the festival as do other people in the British Isles.

Broadcasting must take its share of responsibility for the change. For ten years now Scottish listeners have been compelled to take part in the observance of Christmas through the wireless programmes, until the time has come when Scotland is anxious to give as well as to receive.

Service from Paisley Abbey.

On Christmas morning Scottish listeners are to hear a service relayed from Paisley Abbey. It will be conducted by the Rev. Guthrie Cooper, D.D. Later in the day the Scottish Region will make a contribution to the National programme in the form of a fireside scene and a short relay from a Glasgow pantomime.

The outstanding Scottish item, however, comes on the following night in a broadcast entitled "Blue Bonnets Over the Border," in which Wullie Lindsay, Dan Donald, Kathleen Garscadden, Robert Watson and Chalmers Wood and his Strathspey and Reel Orchestra will take part.

The Children's Hour programmes for the week are chock-a-block with Christmas fare, so that there is no doubt that by the time the younger generation takes charge of affairs Christmas will have so shaken the supremacy of the New Year that the two festivals will have to be combined.

Excerpts from "Aladdin."

Excerpts from the pantomime "Aladdin," relayed from the Theatre Royal, Edinburgh, are down for Saturday, December 23rd, at 8 p.m. This is only one of several pantomime broadcasts to be heard by Scottish listeners within the next few weeks, but it will be one of the most attractive because the Theatre Royal has been famous for its Christmas productions for over a century.

Across the water to Belfast, where the broadcasters must needs look after themselves and their affairs a little more than their colleagues do in England. Good, lighthearted entertainment is the order for the whole week, but worthy of special mention, perhaps, are the programmes on Wednesday, December 20th, beginning with a recital of gramophone records of old-time music-hall songs in which the singers will include Charles Coborn, Vesta Victoria, Florrie Ford and Violet Lorraine.

On the following evening is a programme devoted to musical comedies, and boasting the title "Petticoat Influence," while on Friday, December 22nd, Herbert Westerby is devoting the whole of his organ recital from the Grosvenor Hall to Christmas carols.

These things are among the best which the Regions are putting out in the week before Christmas. The trouble from the listener's point of view is that the National programmes are also full of good things.

More "Songs from the Shows."

Here is good news for those who are looking forward to the new series of "Songs from the Shows" which is starting in January. The series will take place weekly instead of monthly as before, and they will continue through January and February.

The first theatre to be dealt with will be the Adelphi, and the cast will include Anona Winn, George Baker, Reginald Purdell and Olive Groves. John Watt, who of course devised the original idea of the show, will compère. An innovation will be that two performances will be given—one evening performance, probably on the Friday or Saturday night, and one afternoon performance, a Saturday matinée. These Saturday matinée shows will displace the present 4.30 p.m. tea-time entertainments by artistes new to the microphone, which for some time have been given under the title of "First Time Here." Other theatres to be included in the series will be the old Empire, Drury Lane, the Vaudeville and the Shaftesbury.

"DON'T PUT OFF TILL TO-MORROW . . !"

The last of the Presentation Book Tokens—No. 10—for Mr. John Scott-Taggart's remarkable new wireless book

THE MANUAL OF MODERN RADIO

will be found on the back cover of this week's issue of "POPULAR WIRELESS." Will you please note that *no more tokens will appear?*

Those of you who took advantage of the special extension offer of November 4th to reserve your copy of the Manual will now have collected the necessary 8 tokens. These tokens should be attached to your Gift Voucher, and the completed Voucher sent in *at once*, together with the necessary remittance according to whether you have reserved the Standard or the De Luxe Edition.

THERE'S NO OTHER WAY

to secure a copy of THE MANUAL OF MODERN RADIO except by attaching 8 tokens to the Gift Voucher and enclosing the amount necessary to cover postage, packing, insurance, etc. The sooner you send in your Voucher, the sooner you will receive your Manual, for there are tens of thousands of copies to be sent out, and *applications must be dealt with in strict rotation.* If you do not receive your Manual within a fortnight of sending the Voucher, you should send a postcard giving the date of posting and the number of the Postal Order. Do not write before a fortnight has elapsed.

A REMINDER ! !

If you had your 8 tokens before this week and have not yet posted your Voucher, please do so at once. The address is "POPULAR WIRELESS," Presentation Book Dept. (G.P.O. Box No. 184a), Cobb's Court, Broadway, London, E.C.4.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Modulation Hum.

I DARE say a good many of my readers have noticed that with an all-mains set a loud hum is often produced when a strong station is tuned in. A typical case is when you use, say, a three-valve mains set, screened-grid high-frequency amplifier, detector and one L.F. stage, and tune in on the London station. You will often find that, apart from the very loud hum when the London station is tuned in, the set behaves itself at other parts of the dial perfectly well, and even though you try smoothing and other dodges the hum still crops up when this station is tuned in.

In such a case the trouble is almost certainly due to what is called tunable hum, which has its origin in the heterodyning or modulating effect between the natural hum of the mains part of the set and the strong incoming signal. You can easily see from this why it is called tunable hum, as distinct from the regular A.C. hum which, of course, is not tunable.

Use a Buffer Condenser.

If you have this bother with the set the best thing you can do is to connect a buffer condenser, consisting of a pair of condensers in series, the mid-point of the condensers being connected to earth, whilst the two outside terminals are connected to the two anodes of the rectifying valve.

If you do not want to buy a special buffer condenser for the purpose you can easily make one by taking two separate condensers of 0·1-microfarad capacity each and joining these together in series, connecting them as already described above. This should cure the trouble completely.

Raw A.C.

Talking about interference generally, I have mentioned in these Notes lately something about the interference which you get from electric signs, lift motors and so on. In addition to all this, I know from readers' letters that a good many are bothered with interference of a somewhat different kind, namely that due to the alternating current supply being of the "rough" variety. Most A.C. nowadays is not too bad in this respect, and the conventional smoothing arrangements will deal with it, but in a few districts the A.C. supply is not quite up to the same standard.

Anyway, a very simple dodge you can try, and in most cases it is successful, is to connect a condenser of fairly large capacity, a couple of microfarads, across the mains leads to the set, with a suitable heavy duty H.F. choke in series with each of the mains leads and on the mains side of the condenser.

Double Tuning.

Some of my readers may not have noticed that with certain types of set (for instance, a band-pass set with gang condensers) you sometimes get a double-hump effect when tuning in nearby or powerful stations. You will perhaps find that if you are tuning in continental or other distant stations, or if you have the aerial circuit arranged so that the input is reduced, you will get single tuning over the dial; but when you change over to a powerful station or alter the aerial circuit so that the input is increased, you get this double-hump effect, the station being tuned in, apparently normally, but at two different places on the dial.

Overloading.

If you do get this effect you may be pretty sure that it is due to overloading of the first valve, this overloading only taking place when the set is tuned to a powerful incoming signal. You can easily verify this by reducing the strength of the signals coming in on the aerial.

This can be done by any of the well-known dodges for high-frequency control: for example, by the simple process of putting a small fixed condenser in series with the aerial. If the input is reduced sufficiently you will find that the double-hump effect disappears and the tuning dial behaves itself properly.

Instability.

Often enough when you get instability in a set this is due to something wrong with the wiring of the high-frequency side. It is not a bad plan to shield the grid wires, and this can quite easily be done by using wire with a metal braiding outside, although you have to be very careful with the question of capacity. As you know, the central wire which you use as the lead, together with the outside metal covering and the insulation between, forms an excellent condenser which is bound to have an influence on the circuit, particularly when the outside metal covering is connected to earth.

Earthing Tuning Condensers

Another point to watch when you get instability is the earthing of tuning condensers. Some people think that there is no difference between one earth connection and another, and that if there is a convenient metal conductor handy, which is itself connected to something else that is connected to earth, it will do. But for some curious reason you will often find that you get different results when you connect a component *direct* to earth from those you get when you connect it to some other adjacent part which is indirectly connected to earth.

I know this seems rather contradictory, and it is difficult to give any very precise reason for it; but the fact that it is quite definitely so in practice shows that there must be oscillatory potentials set up even in these short lengths of low-resistance wire. At any rate, there it is, and you can take it in all experimental work, whether radio work or any other scientific work, that if theory does not agree with practice, then the theory must be wrong.

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

Watch the High Notes.

The H.F. currents in the detector output circuit are relatively much stronger than those in the part of the circuit preceding the detector, and this is another point to watch when instability arises. If you are troubled in this direction it is a good plan to use a fixed condenser connected between the anode and filament of the detector.

As to the value of this condenser, the higher the value the better, except that if the capacity is too large it will cut down the higher notes, so this consideration imposes a limit to the capacity which you can use. If the valve is a mains valve, then the condenser is, of course, connected between the anode and the cathode, and, needless to say, the condenser should be above suspicion.

Permeability Tuning.

Several readers have asked me about permeability tuning, which I mentioned in these Notes some time back. Permeability-tuning devices were on view at the last Radio Exhibition at Olympia, and no doubt a good many of you saw them there.

It would be wrong, however, to say that permeability tuning has really "arrived" in the full sense of the term, though I have no doubt personally that before very long we shall see it widely adopted. Some people, in fact, go so far as to predict that permeability tuning will revolutionise set design and control. With a three-valve or four-valve set it becomes a matter of turning one knob, just as with a tuning condenser, but a relatively very small component is necessary at the back of the panel instead of having, say, a fairly bulky double- or triple-gang condenser.

Aerial Capacity.

With a set having two high-frequency amplifying stages and one L.F. stage it would be necessary in the ordinary way to use a four-gang condenser for tuning the band-pass and detector-grid coils. A set of permeability tuners will, however, serve the same purpose at a much lower cost and with a great saving in space. As regards the operation of the permeability tuner, I do not suppose very many of you have had actual experience of it, and naturally it has one or two points which are rather peculiar to itself, or at any rate a little different from ordinary tuning. For one thing, the aerial should not have too great a length or, perhaps I should say, too great a capacity.

With an ordinary air-core coil a good deal of latitude is allowable in regard to the aerial damping; but when you change over to permeability tuning you find that you have to be rather more careful to get the aerial damping about right. For medium-wave work a small preset condenser is used in order to bring down the minimum wavelength tunable.

Waveband Switching.

In this permeability tuning the core is movable so that it can go in and out of the windings. Some people think that this arrangement will give us a really satisfactory solution to the old problem of waveband switching, since it ought to be possible to cover a range of 200 to 2,000 metres with a single permeability tuning coil, provided the shifting core is ganged up to a variable condenser.

A Handy Adjustment.

If you are using a circuit with gang condensers and there is trouble in getting the ganging right you can sometimes get over it by using a small tuning condenser across one of the tuning circuits. This small tuning condenser, for convenience, can be mounted on the panel. The trouble is with the ganging that one of the parts of the ganged condenser may not be accurately matched with the rest, or the same thing may apply to the coils.

If you fit this small variable condenser you can quite easily use this as a "trimmer," as it were, when you adjust the tuning.

Mechanical Distortion.

I do not know whether you have noticed it, but quite a number of gang condensers can be distorted—I mean mechanically, of course—when they are fitted, owing to the fact that their construction is really not sufficiently rigid at all. When you consider how very small a movement of any of the movable parts of a gang condenser is sufficient to put the tuning out, you realise how important it is that the whole affair should be as rigid as possible. But quite a large number of gang condensers on the market are very bad in this respect.

Presentation Book Token 10

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POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
Technical Editor: C. V. DOWDING, Associate I.E.E.
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Assistant Editor: A. JOHNSON-RANDALL.
Chief of Research: K. D. ROGERS.

A PROSPEROUS YEAR
BROADCAST TOURS
MORE INTERFERENCE
"SUPES SPIELERS"

RADIO NOTES & NEWS

UNDER THE WEATHER
NEW RADIO "STAR"
FINANCIERS FORWARD
SOME SPEAKER!

A New Year Wish.

WHAT we all are wishing for is the return of world prosperity, and I think that I cannot do better than make that my New Year wish for the great family of "P.W." readers, who may truly be said to represent the world, so widespread are they. When folk are on Easy Street they can indulge in their hobbies more freely, and so better times generally will increase the radio fraternity, strengthen the amateur movement, inject a tonic into technical development, and benefit the radio trade. Matters already seem to be mending, and 1934 is another year. So here's to it and you!

New Hospital Radio Set.

THE Radio Manufacturers' Association has presented a fine new receiver to the Charing Cross Hospital to replace the battery-driven set which has been used for a number of years. The new receiver operates twelve M.C. loudspeakers and about 500 pairs of telephones. It has a separate circuit which ensures continuity of operation in the event of the dial-illumination lamps failing, they being in series with the filament-heating circuit. There is a monitor speaker which allows tuning to be done without alarming the patients.

The Business Touch.

I LEARN that whereas visitors to broadcasts at Radio City, New York, are admitted free, by invitation, those people who wish to tour the wonderful "city" are charged 40 cents (1s. 8d. at par).

I recommend this idea to the B.B.C., and would add the suggestion that a graduated scale of charges should be fixed. "H. Hall's autograph, 2s. 6d." "To change a needle for Stone, 2s. 6d." "To play with the Sound Effects, 5s." "To cough into an Empire Service microphone, 10s." "To see the very place where the D. G. tripped over a pail, 3d." "To wrap up 'three pieces and a penn'orth' in a last year's Bach cantata, 2d." And so on. A most attractive programme could be devised on these lines.

How S. W. Helps Trade.

WOULD you believe it if Uncle Ariel did not tell you? There's a boom in telephone head-sets now on! But let not the diehard crystal veterans jump up and exclaim, "I told you so!" for these telephones are being supplied to short-wave enthusiasts. One firm alone claims to be selling an average of 250 pairs a week at £2 10s. each. So you see that short waves and "P.W." and W. L. S. and the Heaviside Layer are all helping to keep the wheels going round.

Aunt Jane's Corner.

IT is rarely that I am asked to help a reader out of a domestic "jam," and still rarer are the occasions when I comply in print; but here is a case which, because it may be similar to many more, I propose to deal with *pro bono publico*.

A Cardiff reader says that his wife complains that since he adopted radio as a hobby he has neither the time nor the money to take her out and about as he used in the dear dead days beyond recall. He, for his part, retorts that she ought to be glad he does not stay out drinking and gambling. My friend must adopt that sovereign remedy—*compromise*.

It is fair, *it is wise*, it is good, to give a wife no less than one gives a *fiancée*, or as nearly as funds will permit. So go fifty-fifty, and remember that a contented wife is better than a few signals from a radio station, however remote.

Radio and Public Taste.

FACTS are sometimes very rummy, and upset our finest hopes and theories. An expert observer in America has come to the conclusion that "over there," whilst the listening public will put up with the same old comedians' stuff and the same primitive drama, it has become very exacting in its demands concerning football broadcasts and—O heavens!—symphony concerts.

The football commentators must be experts and the symphonies must be "way up." Not a bad taste, either, says me. Good sport and good music.

The Future of Radio.

A DUNDEE reader, with a faith in my vision, asks me what will be the future of radio waves. Well, as I have reported, they are going to suffer from sun-spots for eleven years. They will have an up-and-down career, but will, nevertheless, be received by the "best people."

So much for the humour of it. Considering what has been done with them since 1914, it would be ridiculous to try to forecast the further uses which may be found for very high-frequency waves. Long waves, I take it, are just about "back numbers." I myself would not be surprised to hear of discoveries tending to show that the body, and, in particular, the brain, radiate ether waves, and throwing light on what we call "personality."

A Good Time Coming.

ACCORDING to an astronomer at the Mount Wilson Observatory, California, a cycle of sun-spots is about to begin, and the cheery fellow says that it will last for about eleven years.

With increasing gaiety he tells us that amongst the effects observable here will be increased magnetic disturbances, with occasional disruption of the telegraph and telephone services.

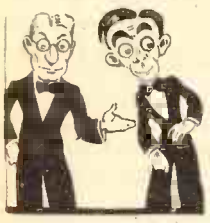
I suppose that, somehow or other, all this will mean "atmospherics" or poor conditions for radio; but I am not unduly alarmed, for these scientific prophecies have a charming way of confounding their originators by not coming out of the hat.

(*Continued on next page.*)

BRITISH BROADCASTING AND GERMAN MUSIC

What is a "Stooge"?

I NOTICE in the American papers frequent references to gentlemen who are called "stooges." They are something to do with broadcasting and, so I infer, work in the studios, but I cannot discover just what they do when they "stooge." In reference to one of them, a newspaper says: "He is about to start stooging for Eddie Cantor every Sunday night." Does "stooge" mean "foil" or "compère"? I hazard the guess that a "stooge" is the fellow who plays the silly ass to a sparkling comedian, but I await confirmation of this.



A New Language.

HAVING been accustomed to the straightforward English of "P.W.," you would find the reading of some of the American radio papers a very difficult task. In fact, I gather that the ambition of many American journalists is to invent a thousand and one ways of avoiding calling a spade a spade. Now listen to this: "Totten Supes Spielers in Chi.N.B.C. Switches." That, fellow-sufferers, is American for "N.B.C. staff changes in Chicago have made Mr. Totten a supervisor of announcers." So easy to translate if you have been to Harvard. But wouldn't Geo. Wash. have had a fit if he could have foreseen "Supes spielers"?

"In Penny Numbers."

AGAIN an amazing lapse from common sense and good showmanship on the part of the B.B.C.! That rattling yarn by Conrad and Hueffer, "Romance," was turned into a radio play of sorts and then presented in halves on successive evenings—and on two wavelengths!

I submit that the avoidance of such an arrangement should not have been in question for one moment; it is wholly bad to present a play as a serial story, and the film people abandoned the method years ago. There was the play—and we *had* to have it, even if the B.B.C. had to depart from rational organisation.

Or am I unduly captious in this regard?

SHORT WAVES

THE CRASH.

Black: I hear that Robinson completely lost control of his wireless last week.

Brown: Good heavens! How did that happen?

Black: Well, he was several payments behind.

* * *

Agony Column Extract: "My darling Mabel, come back to your heart-broken Henry. I miss you terribly, especially now that I have sold the loudspeaker."

Another Side of the Picture.

IN spite of the bludgeonings of chance, the disillusions of experience and the cynicism which is bred by the humbug, hypocrisy and "bluff" which, one realises, makes the world go round, I have miraculously preserved a real meat core to my heart, and this made me fall into friendly doings with a beggar in the Strand.

He was as well dressed as myself, and had a finely cut, intelligent face. "You are not dressed for the part," I said. "I am not yet sufficiently rehearsed," he replied. In short, he was a musician—a violinist—ruined by wireless music and the talkies. Too old to begin a new career; not skilled enough to find a place in the famous orchestras. Friends, if you find one such as he, be kind.

Not a High Rating.

I READ somewhere that authorities suspected a man of harbouring a radio set without a licence. Never could catch him indoors for interrogation. On one classic occasion they ran him to earth, when his wife promptly told them that he was not Mr. ——, but "a man to see to the clock."

Much as I admire these watch and clock fellows, especially for the manner in which they keep that glass thing in their eye, I should hate to be snatched from the hounds of justice by such a hackneyed alias. I should prefer to be "the young man from the Pru." or even "the gas-meter gentleman."

What Next?

SO inspired are Mullard's representatives by their principals' publicity methods that they stop at nothing to emulate them. Here the Mullard Newcastle manager goes and wins a contest with his baby boy, leaving a "field" of 5,999 other babies necks behind. But does the charming mamma get a look in? I have not noticed it. No, Baby Tony of "Mullard's manager at Newcastle" is the "star." And I shall not be surprised if he emerges as the Mullard Baby: no howling!

Byrd and the Cow.

BESIDES taking a broadcasting station to the Antarctic, Admiral Byrd is said to have with him a cow. *Café au lait* is what no bold explorer should be without. Mix a few vanilla beans with her feed and she should deliver ice-cream. Get her to chew the cud in front of the "mike," and there is your interval signal.

An Unfair Criticism.

I HAD hardly finished admonishing those who objected to German music in the programmes on Armistice Day when I came upon an article by Sir M. Bruce, Bart., in which he deplores the large amount of foreign music broadcast by the B.B.C. at the expense of our own.

He begins to wonder whether the B.B.C. is entitled to the adjective "British." This is unfair. Sir Michael looks at the matter from the wrong angle. The B.B.C. is not a branch of the Empire Marketing Board. One of its duties is to broadcast music—not English music or German music, but *music*; and, considering that there is so much more foreign music than British, and the enormous quantity of music required, I do not see what else the B.B.C. can do.

BRIGHT BROADCASTS

A suitable New Year present for the wireless announcer who gives us our weather reports might take the form of a cloud with a silver lining.

* * *

MARCONI'S GREAT RIVAL.

Casey: My static eliminator was invented by an Irishman.

Jones: What was his name?

Casey: Pat Pending. —"Radio News."

"P.W.'s" Television Survey.

WITH lots of changes promised for next year in the world of Television, you'll just have to read the new series of articles which starts in this week's "P.W." if you want to keep up to date.

Though we says it as shouldn't, it's the most comprehensive survey of Television ever published.

A Financial Paragraph.

IT is not often that I am insulted by being taken for a pigeon ripe for the plucking.

Therefore I do not hesitate to reply in print to B. B. (of never-mind-where), who has kindly proposed that I should hand over to him certain moneys and receive in return a half-share in his marvellous invention—a radio perpetual-motion machine. He displays his ignorance at the outset by assuming that any journalist beneath the status of Lord Rothermere has any real money. Apart from that, I hate the thought of perpetual motion, radio or otherwise. I prefer repose. And I don't like those initials, for they correspond to Blackbeard, the famous pirate. Other financiers, please note.

The Big Noise.

THE Soviet Government is reported to have bought a loudspeaker which can be heard over a radius of thirty miles. It is nearly a ton in weight and is to be installed in an aeroplane. Evidently the hammer-and-sickle folk are going to have something well rubbed into them; though the aeroplane factor gives me a sickly feeling that the sons of freedom may not be the only hearers of this super-stentor. My neighbour will be jealous when he hears of this. His loudspeaker is designed for a range of little more than a mile.

ARIEL.

P.W.'s COMPLETE SURVEY OF MODERN TELEVISION

Six years ago "Popular Wireless" was a lone voice in a wilderness of hysterical television ballyhoo. We risked unpopularity by presenting the facts in a logical, dispassionate manner.

Time has provided ample proof that our attitude was fully justified. The startling prophecies then freely made have not come to pass.

Nevertheless, there has been progress, and television remains, as ever, a most fascinating subject, and one which, as the years roll by, gathers to itself a wider and wider diversity of ingenious and intriguing processes.

The final links in the chain necessary to render possible a "television-for-all" broadcasting service have not yet been forged, but recent researches indicate that the elusive "somethings" needed may even now be maturing in one or other of the world's radio laboratories.

We ourselves have not been idle in this glamorous search for the key to service television, as our regular readers will know, and we feel that the time is now opportune for the presentation in our pages of a complete television survey.

Mr. G. P. Kendall, B.Sc., was invited to undertake this task, and he accepted the offer with enthusiasm.

His weekly contributions are to be divided into two sections. In the one he will present an outline of a general character; and we feel sure our readers will agree that it is a captivating and most illuminative story he has to unfold.

Also he will describe week by week every up-to-the-minute development and give all the latest television news. In short, our new feature is to be a *complete* survey, and those who read it will be kept *au fait* with every phase of progress of this most fascinating subject.

THE EDITOR.

"TELEVISION" means "seeing at a distance," or "seeing afar off."

Now, at first glance it might seem that this is exactly what we do when we look through a telescope, but actually there is an important instructive difference.

The telescope takes in light from the distant scene and assembles it into an image which is present continuously and is complete in every detail at any given instant.

In television this has never been done. In all the systems which are capable of practical use by radio it is necessary to transmit the picture one tiny piece at a time, these minute fragments being sent out one after another in rapid succession.

"Scanning" The Picture.

It is done in an orderly way, so that by degrees the whole area of the picture is covered. Now, when I say "by degrees" I don't mean "slowly." On the contrary, the process must be so quick that a complete set of pieces to make a picture of the scene which is being transmitted takes only a fraction of a second to send out.

As soon as the set of pieces is complete the transmitter repeats the process and sends out another series of bits. It goes right on doing so as long as it is kept in operation, the actual number of complete pictures per second being 12½ in the case of the present B.B.C. transmissions.

At the receiving end the series of little pieces must be reassembled into a complete picture, a process which can be visualised as follows:

Imagine that each piece is projected upon a screen in the form of a tiny spot of light which is strong or weak according to whether the particular piece of the picture should be light or dark.

The "Building" Process.

The spot only stays on the screen for a very small fraction of a second, and then it shifts to the next position, where it indicates the next little bit of the picture. Each piece must, of course, be placed in the correct position on the screen, and the whole operation must be completed and repeated 12½ times in every second.

Even then we should not get the desired impression of a complete picture were it not for a most convenient defect of the eye called "persistence of vision." The whole principle of the cinematograph is based upon this phenomenon, whereby the eye goes on seeing things for a fraction of a second after they have stopped.

The result is that our series of fleeting spots of light will appear to the eye to persist and blend together into a complete picture if the process is rapid enough.

That, in essence, is how television works on the systems most used at the present time.

In practice it does not exactly follow my description, because the spot of light does

(*Continued on next page.*)

HAVE YOU EVER WONDERED HOW A PICTURE IS PRINTED?

In his informative account of the making of a television picture, Mr. Kendall reminds us that in some respects it is analogous to the printing of a photograph by the "half-tone" process, which is illustrated in this series of pictures. As you see, it is the same photograph in all five versions, but the first is much inferior to number two, which is not so good as number three, and so on. The quality is all a matter of the number of separate elements (dots) of which the picture is built up. When the dots are relatively few in number (as on the left) the picture is crude. But good detail is obtained in the fourth picture, while the fifth, best of all, gives even greater likeness to the original photograph.

A NEW LIGHT CONTROL

An exclusive account of an important development. Readers who remember Mr. Kendall's previous articles in "P.W." will note with pleasure that his vivid freshness of phrasing still makes him delightfully easy to read.

ONE of the most difficult problems associated with the present systems of television is that of light control at the receiving end. We want to produce a beam of light which shall vary in brightness in exact accordance with the incoming impulses which represent the picture, and that is by no means so easy a task as it looks.

A special form of neon lamp was used a good deal in the early days, the much-amplified "signal" impulses themselves being used to light the lamp. The fluctuations in the impulses caused corresponding variations in the light given out by the lamp, and quite a workable arrangement resulted.

The amount of light obtainable in this way is comparatively small, however, and this in turn severely limits the possible size of the picture. The method also gives the picture a rather unnatural colour, and for these reasons it is going out of favour except for comparatively simple outfits.

The Kerr Cell.

Instead of depending on the picture impulses themselves to provide the light, it is obviously better from an illumination standpoint to make them control or "modulate" a beam of light produced by a lamp fed from the electric mains or an accumulator. The lamp can then be a powerful one and the beam sufficiently intense to give us a much more brilliant picture.

The difficulty is to devise some sort of "light valve" which can be operated by the picture impulses in such a way as to produce exactly equivalent variations in the beam of light which is passing through it. Mechanical devices such as are used for sound-on-film talkie recording are not suitable for television purposes on account of the very wide range of frequencies with which we have to deal.

Some of the most successful results so far obtained have been achieved by means of the Kerr cell, which is a device for producing electrically controlled rotational effects on the plane of polarisation of a beam of polarised light.

By combining it with other polarising devices called Nicol prisms it is possible to arrange an optical system which passes more or less light when varying voltages are applied to the Kerr cell, and quite good modulation effects can be achieved.

The Kerr cell, however, has certain defects, notably that its light transmission efficiency is rather low and that its response is not quite linear—i.e. the variations in the amount of light which it passes are not *exactly* proportional to the variations in the applied voltage.

Making It Permanent.

In practice this means that we do not get quite correct light-and-shade effects in our picture, although the defect is not really very noticeable. As a practical drawback it may be mentioned that the cell is filled with a rather smelly liquid (nitro-benzole) which tends to evaporate in time.

In the search for a substitute which should be free from these troubles the Hungarian experimenter, Okolicsanyi, has recently found one for which he claims greatly improved transmission efficiency, perfectly proportional response and entire permanence.

Instead of the liquid cell, he uses a mineral crystal, usually zinc sulphide, ground to a thin plate and held between metal electrodes so that the whole thing forms a condenser. It then functions just as does the Kerr cell, with the exception that the dielectric of the condenser is now a permanent solid material of improved characteristics instead of a liquid.

A Further Advance.

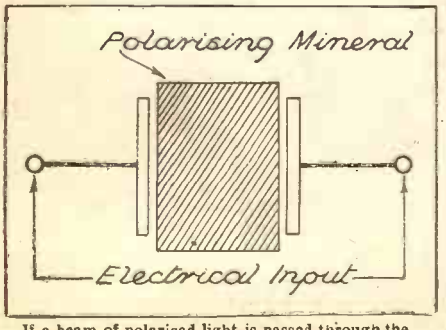
All this happened some months ago, but now I hear that a further step has been taken in America which enables the Nicol prisms themselves to be dispensed with, giving still less loss of light and yet a brighter picture.

It appears that a larger plate of mineral is used and additional pairs of electrodes are fitted at the ends, the control or "picture" electrodes being placed in the middle. By applying steady biasing voltages to the extra electrodes it is claimed that the end portions of the crystal plate perform the functions of our present Nicol prisms.

It sounds almost too good to be true, and I am looking forward to further details with considerable interest.

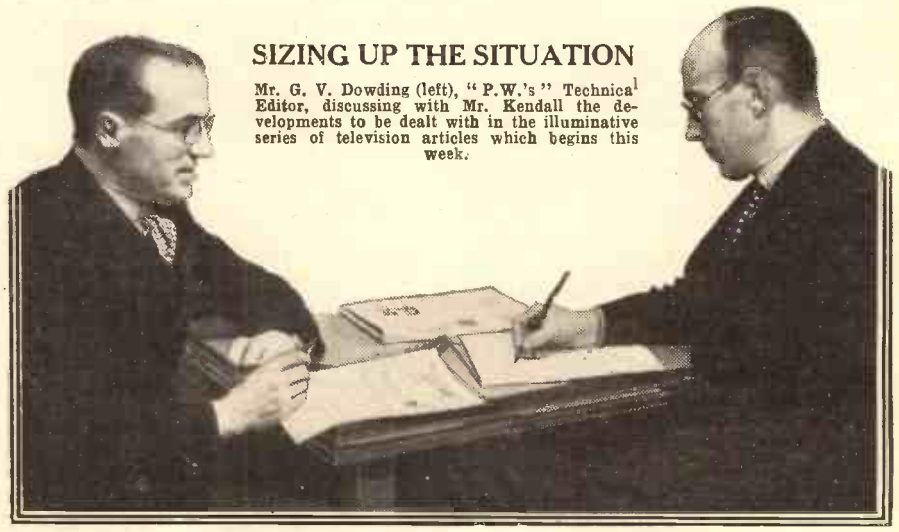
G. P. K.

TWISTED BY ELECTRICITY



If a beam of polarised light is passed through the mineral, the momentary strains imposed upon it by electrical forces on the side plates will result in the beam being rotated.

SIZING UP THE SITUATION



Mr. G. V. Dowding (left), "P.W.'s" Technical Editor, discussing with Mr. Kendall the developments to be dealt with in the illuminative series of television articles which begins this week.

"P.W.'s" COMPLETE SURVEY OF MODERN TELEVISION

(*Continued from previous page.*)

not actually jump from point to point on the screen. Instead, it travels steadily in a line across or down the screen, varying in brightness as it goes and so recording the detail of the picture.

As soon as it has completed its crossing of the screen it goes back and repeats the process along a new line just beside the previous one, and goes on making these carefully placed sweeps until it has covered the whole picture, whereupon it starts again.

The Question of Quality.

Now an important point about the quality of the picture. A few moments of reflection will serve to convince you that the fineness of detail and general quality of the "reproduction" will depend upon the size of the tracing spot, and hence upon the number of the sweeps it must make to cover completely the area of the picture.

If the spot is large, and so covers the picture in only a small number of sweeps, only coarse detail will be visible, and the general quality of the picture will be poor. A small spot, which requires many lines to cover the area, on the other hand, means that fine detail will be seen and a much better picture results.

A very good analogy may be found in the case of the "half-tone" system used in reproducing photographs for printing. Here a series of fine light and dark dots are used to make up the picture, and various sizes of dots are used for different purposes.

When very fine dots can be used the picture contains much more detail than when they are coarse, a point I have endeavoured to demonstrate by means of a series of illustrations on the previous page.

That, I think, is enough for our first general survey of the elementary principles of television. Next week we will start to go into detail a little, and see how some of these interesting processes are actually carried out in practice.

RADIO from the STARS?

A continuous stream of radio waves seems to be coming from space, and investigations into their origin are described in this article.

By

M. G. SCROGGIE, B.Sc., A.M.I.E.E.

THE faintest rumour of signals from any celestial body, preferably Mars, is usually sufficient to incite the newspaper journalist to the highest pitch of his fertile imagination. When the imagination has been filtered off, the residue of solid fact is found to be a mere sediment.

So far as intelligible signals are concerned, that is likely to continue to be the case. But a fascinating field for speculation has been opened up by some recent researches of Karl Jansky, of the famous Bell Telephone Laboratories in New York.

What Causes Them?

Mr. Jansky has discovered a continuous stream of radio waves which appear to come from a definite region many billions of miles away, out among the stars.

What exactly is the cause and origin of these waves, which obviously must be immensely powerful to cover such a distance even in the freedom of open space? So far no answer has been found to this question.

Cautious people may even be inclined to doubt the conclusion that the wireless waves that are being received have really come over a distance millions of times greater than any previously known range. Yet it seems difficult to find any other explanation.

Three Different Types.

Here is the story: A year or two ago Mr. Jansky was busy taking records of atmospherics on short waves—14·6 metres, to be exact. As you know, these short wavelengths are particularly free from atmospherics, so the reception he got was exceedingly feeble. Yet he succeeded in distinguishing no less than three different sorts.

One lot could be traced to local thunderstorms. As a single flash of lightning lets loose more power (while it lasts!) than all the broadcasting stations in the world put together, it is not surprising that at close quarters it forces itself upon a receiver of almost any wavelength.

The second sort was due to distant thunderstorms, and corresponded—but much more weakly—with unusually strong atmospherics received on long waves.

A Steady Hiss.

Having accounted for all these, which, of course, give completely irregular reception, there still remained a continuous, steady hiss. Most people would have put it down to valve noise and let it go at that. At the strongest it could be measured only in fractions of a millionth of a volt.

But the valve-noise explanation was ruled out by the nature of the experiments, which were aimed at finding the direction from which the atmospherics were arriving. A special type of directional aerial was kept slowly rotating; one revolution every 20 minutes. The signals were continuously recorded on a moving chart, marked in directions.

For example, when the aerial was pointing to receive from the north, the pen of the recorder was on the part of the chart marked N. The same spot was marked with the time of day. A glance at the record would show when and from what direction the greatest disturbance was coming. Fig. 1 is a sample of the type of thing, and indicates a thunderstorm moving from south to west in a period of about 3 hours, gradually increasing in strength and then dying away again.

RECORDING A STORM

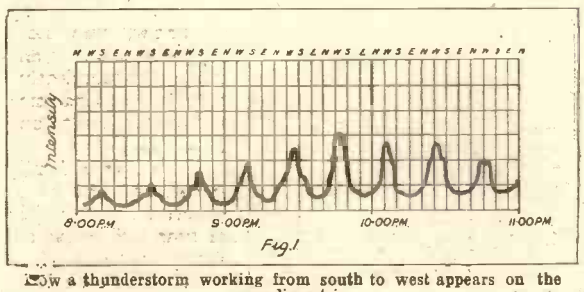


Fig. 1

How a thunderstorm working from south to west appears on the recording strip.

When there were no storms to disturb the peace of the neighbourhood it was possible to trace the direction of the weaker "mystery" waves. These performed a remarkable tour of the compass, making one complete revolution every 24 hours.

The most familiar example of a 24-hour rotation is the sun—as seen from the earth, of course. Could these waves be coming from the sun? It is known that the sun is an enormously powerful radiator of all sorts of waves.

This possibility looked more promising still when it was noted that the records didn't show a perfectly regular and uniform reception throughout the 24 hours; but as night fell it died off from the N.W.—the direction of sunset—and then began to appear from the N.E., where the sun would shortly be rising. It seemed just as if during the night the radio rays were impeded and bent by the interposition of the earth.

Quite good evidence, this: but gradually a new piece of evidence was unrolled that wouldn't fit in at all with the sun theory.

The daily sequence around the compass started earlier and earlier every day. In a month it was two hours ahead of the original schedule. In six months it was so far ahead that all the directions were reversed. In a year it was back again at the starting-point.

The Yearly Cycle.

If you imagine all the stars as fixed in space, at enormous distances, and around one of them (the sun) you have a relatively tiny earth revolving like a top once per day, and at the same time moving round the sun once per year, then a little thought will show that anybody situated on the earth will see the sun *apparently* making about 365 revolutions a year, but the stars appear to be making one more revolution in that time, due to the earth's motion around the sun.

That corresponds exactly to the yearly cycle of mystery-wave directions. Fig. 2 shows how in January (say) they happen to come from the same direction as the sun, but in July they come from precisely the opposite direction.

Although the distance travelled by the earth round the sun amounts to the respectable mileage of nearly 600,000,000 every year, that is utterly negligible compared with the distances to any of the stars. They are so far off that our little annual tour doesn't seem to make our relationship to them change at all, except when extraordinarily exact observations are made.

So the present conclusion is that, *if* there isn't still some unknown element coming into the observations, the source of the mysterious hiss "atmospheric" disturbance is somewhere far out in space.

What natural transmitter is responsible for producing it nobody yet knows. Perhaps the investigation of the source of these mysterious waves may help on research in some unexpectedly profitable way.

NOT FROM THE SUN

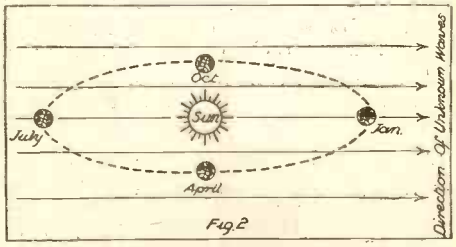


Fig. 2

This diagram shows how the theory that the waves emanate from the sun is disproved.

THE MIRROR OF THE B.B.C.

THE WIRELESS TRADE AND THE B.B.C.

Programme Officials to Travel—Fewer Auditions—A Surprise for Broadcasting Circles—Some Midland Regional Items.

By O. H. M.

THE wireless trade, at the lead of the Radio Manufacturers' Association, is about to take a much more active interest in broadcasting than at any time since the Board of the B.B.C. consisted of radio manufacturers. The reason for this is primarily one of business.

There has been a growing feeling in the trade that the B.B.C. is apt to become remote from the wishes and requirements of the average listener, who is, of course, the trade's best customer. Therefore, the R.M.A. would like to have a definite say as to the working of the broadcasting service and the principles guiding those who are responsible for the programmes.

Compulsory Holidays.

I heard the other day that certain members of the staff of the B.B.C. have been practically ordered to go on holiday. This probably reflects a new policy aimed at preventing breakdowns in health which had been giving some anxiety. It is curious, however, that holidays should have to be made the subject of orders.

Programme Builders to Travel.

At least one of the results of Sir John Reith's visit to America appears to be the encouragement of more travel on the part of B.B.C. programme officials. This is something quite different from the journeys of Mr. Malcolm Frost, who is trying to sell electrical recordings of B.B.C. programmes.

The new idea is that the programme chiefs themselves should see how corresponding tasks are performed in other countries. I hear that Mr. Roger Eckersley, the Director of Entertainment, and Mr. Charles Siepman, the Director of Talks, are likely to make a world tour next year with particular attention to America.

B.B.C. CRITIC BRINGS FILM STARS TO THE STUDIO

Oliver Baldwin, B.B.C. film critic, has adopted a new procedure in his talks. He brings famous film personalities to Broadcasting House and argues with them in front of the microphone for the benefit of listeners.

The Auditions.

The announcement that auditions for variety artistes are being suspended means that there are already so many artistes regarded as acceptable and waiting for microphone engagements that to continue auditions would be ridiculous. This decision follows a similar one taken with reference to musicians a year ago. The probability is that the system of general auditions would not be revived.

While, no doubt, the change will suit the convenience of Broadcasting House, it is another matter whether it is in accord with the kind of attitude which should characterise a public corporation such as the B.B.C. If the change is made effective on lines now indicated there will be a great deal of disappointment not only among artistes, but also among aspiring students.

Parliamentary Inquiry 1934.

The Postmaster-General is credited with the firm intention to set up a parliamentary inquiry into the B.B.C. before the end of 1934. This will come as a surprise to many in broadcasting circles who were confident that if there was any inquiry it would not take place until a year later—that is, just in time to arrange for the renewal of the B.B.C. licence and charter, which expires at the end of 1936.

That Architectural Medal.

I am sorry I was wrong when I announced three weeks ago that Commander Val H. Goldsmith, of the B.B.C., had been awarded a gold medal by the Royal Institute of British Architects. The fact is that Commander Goldsmith has been appointed to be a member of an adjudicating committee under the Royal Institute. This committee is to make the awards of gold medals.

All about Birmingham.

In five years' time Birmingham will celebrate the centenary of the grant of a Charter of Incorporation, which makes all the more interesting a talk which Mr. Walter Barrow, F.S.A., Pro.-Chancellor of the University, is giving in the Midland Programme on Thursday, January 4th.

Mr. Barrow has lived all his life in Birmingham, and for six years he was a city councillor. His father, Alderman Richard Cadbury Barrow, was Lord Mayor of the city, and his great-grandfather was the last Chairman of the Old Street Commissioners.

With such a family record he must be an expert on the subject of how our cities are kept fit to live in, about which he is to speak on January 4th.

A Beecham Feature.

Adrian Welles Beecham, a son of Sir Thomas Beecham, will be at the piano when some of his compositions are sung by Peter Howard (baritone) in the Midland Regional programme on Friday, January 5th.

(*Continued on page 777.*)

THE LISTENER'S NOTEBOOK

Frank comments on recent programme events and on microphone personalities of the moment.

AT this season of the year it isn't inappropriate to review the B.B.C.'s doings during the last twelve months. Generally speaking, there seems to have been very little experimental work done, but rather has it been a year of consolidation. The several revivals, particularly of the plays, suggest this as much as anything.

There have been few stunt performances. The surprise items, when they occurred, were very ordinary. The talks, though on a variety of subjects, have all been stolid in substance and essentially safe in character. The outside broadcasts—the one brand of item that offers opportunities for the extraordinary—have exploited nothing fresh.

* * *

The few Soccer broadcasts came only as concessions. George Allison was clearly out of training for these. Commentating will soon be a lost art with him if he doesn't get more practice. His "*ers*" were most frequent, by the way. And he gave the wrong scores, too. But we mustn't blame him.

* * *

Music, as usual, has dominated the year's programmes. The big musical concerts (of which there seemed no end) reached a high standard of excellence. Lovers of big music have been well served. Smaller combinations have scored their successes, too, but orchestras of café and tea-room status seem to have become smaller than ever, and usually deserve no more than divided attention.

Municipal orchestras appear to have lost a little in favour, while brass bands have gained more.

The greatest improvements are most apparent in variety and music-hall. Eric Maschwitz has amply justified his appointment as director of these.

I know I shall incur some people's wrath when I urge him to continue his policy of inviting an audience (the bigger the better) to all his shows. It wasn't until Radiolympia that I had any use for variety. But while these performances gave variety an undisputed place in broadcasting programmes, they also showed how indispensable a seen audience could be. For some time now these audiences have been getting larger and larger, with a corresponding improvement in the quality of the turns. Atmosphere is essential to successful variety, and only an audience can supply this. I speak from the listener's point of view, and not from the artiste's.

* * *

Compare the cold and moribund character of those "First Time Here." shows with a typical variety hour. There is no comparison. Who wants a better show, for instance, than that one in which Gracie Fields topped the bill? It had none of the devices for carrying a show along. It relied on its own merits alone, and a competent compère, perhaps, like those single music-hall turns of some years ago when the comedian had only a backcloth to help him. Good broadcast variety needs no extraneous help, as was thought necessary at one time, beyond that which the audience gives.

(*Continued on page 777.*)

ECKERSLEY EXPLAINS-

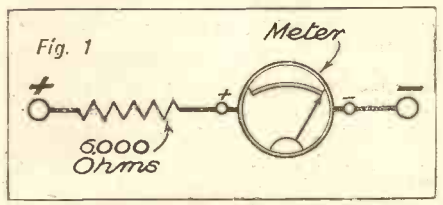
"Science always measures, and tries to measure accurately," says our Chief Radio Consultant, in support of his contention that the only real way to diagnose trouble in a receiver is systematic checking of all the quantities involved. That is why this page is devoted to an explanation—full and lucid—of how a milliammeter can be made to measure various values, conditions of voltages and currents.

PEOPLE write:

"My set is a bit 'off colour.' I have tried . . ." And then a list of things, batteries, valves and so on and so forth. And lastly: "What do you think it is?" *It* being the question.

How can one tell?

AS AN L.T. VOLTMETER—



The insertion of a 6,000-ohm resistance, in series with the standard milliammeter, allows readings up to 6 volts to be taken.

Doctors diagnose—and sometimes even rightly—after a thorough examination of a "patient." (What an appropriate word!)

My advice is sought, firstly, on the vaguest description of trouble; secondly, without any description of the set, circuits and so on. And I am expected to propose the certain cure! Frankly, it cannot be done. Someone who has an "off-colour" set has three possible courses open to him if he wants to cure the trouble: the first is to have an expert come to the house; the second is to be the expert in the house; the third is to send the set away to an expert.

And in all cases the business will only go well if the expert is equipped with apparatus to measure quantities. There's the rub, on the pocket linings, and too much rub means a big hole!

But, apart from sending the set away, the best—no, the only plan—is systematic checking of all the quantities involved.

Meters are Essential.

In this page, week after week, I try, with a wide sweep, to embrace all difficulties. It is hard work, but one is often rewarded. The other day someone told me he had gone through my "Answers-to-Questions" book and had cured a trouble. Well, it is worth while!

But measurement is the thing. Science always measures, and tries to measure accurately.

* * *

Now, if I were an experimenter I would have a milliammeter, full-scale deflection 1 milliamp. And I would make it into a voltmeter or a current measurer this way:

For a Voltmeter.—To measure 0–6 volts, get a resistance of 6,000 ohms. Put it in series with the 1-milliamp ammeter as per diagram, Fig. 1.

Then full-scale reading is 6 volts and and other parts of the scale pro rata.

High Voltage Readings.

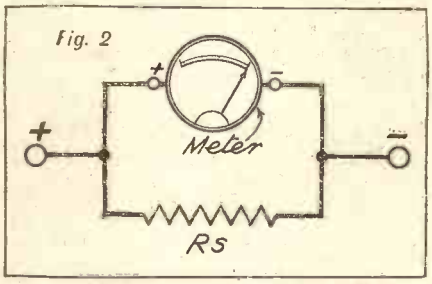
To measure to 200 volts:

Connect a resistance of 200,000 ohms in series with the meter, instead of the 6,000 ohms (Fig. 3).

Then full-scale reading is 200 volts and the other parts of the scale pro rata.

For an Ammeter.—Connect the milliammeter like Fig. 2.

—AN AMMETER—



By varying the value of the resistance Rs the meter can be made to read up to 1 amp. The smaller the resistance the larger the current which can be read by the meter.

The smaller Rs the larger the current that will be read by the milliammeter.

To read 0–1 milliamp, Rs is disconnected: it equals infinity.

Now, you will have to know the resistance of the milliammeter before you can measure other currents. The makers will tell you. Let it be, for this argument, 50 ohms. Then to read 0–10 milliamps with a 50-ohm 0–1 milliammeter Rs must be 5·56 ohms, (actually 5·5) or for 100 milliamps ·56 ohms.

Thus, with only a milliammeter and some resistances, you can measure H.T. volts, L.T. volts and "feeds" to valves. The current resistances or shunts (Rs) can be made by buying some resistance wire and winding it on little bobbins. For instance, 40-gauge wire has a high resistance per length. You can find out what it is.

You can then wind up a little spool of the right length. You can buy the series resistances ready made, but you must be prepared to face an error of plus or minus 10 per cent, though I don't think this is very important.

For a little extra charge, perhaps, the makers would sell you a resistance that is as near as makes no odds exactly right.

* * *

I assure you that a bad valve or badly adjusted tuned circuit, a high-resistance earth and all like things can destroy all pleasure in listening. And there's no way to smell or feel what's wrong. The senses are a poor guide except to tell you that something *is* wrong. But an instrument is for ever right. (Well, you know what I mean!)

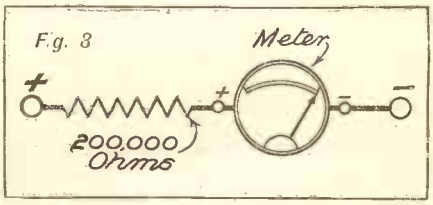
* * *

I've been "with wireless" since 1908. But I could no more put an "off-colour" set right, unless I fluked the solution, without measuring instruments, and a diagram of connections, than I could disguise my admiration for new ideas.

A Voltage Query.

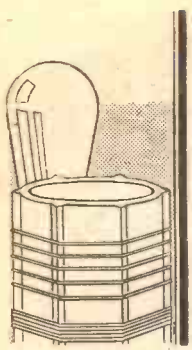
Here is a query I have received from H. C. B. of London, N.W., who says: "I am desirous of constructing an A.C. mains unit, but note that my supply is only 105 volts. Assuming that the drop in the smoothing system is 10 volts, the supply available will be a voltage of only 95, which is insufficient for my requirements."

—OR FOR H.T. READINGS

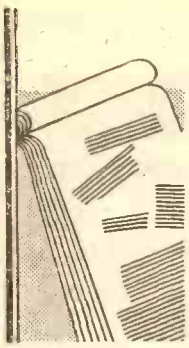


In this third example H.T. voltages up to 200 volts can be read on the same meter by the use of a 200,000-ohm resistance in series.

But H. C. B. misses the point. With A.C. mains you can *raise* the voltage of the mains by a transformer and make it what you like. A two-to-one transformer converts the mains A.C. from 105 volts to 210 volts and there's no need for batteries at all.



Short Wave Notes



Notes of interest concerning stations and conditions on the short-wave band, written in an entertaining manner by the foremost expert of short-wave practice.

I AM asked by Mr. Leslie W. Orton, the Hon. President of the Anglo-American Radio and Television Society, to correct a false impression that might have been gained from my note on the society in the December 9th issue.

I was informed that free membership until January, 1934, was a "special offer," but Mr. Orton wants me to make it clear that the society has made no charge for membership during the past three years, and has no intention of doing so now.

The Persevering Scots.

In connection with J. B. M.'s feat of receiving Sydney on seven consecutive Sundays on the H.A.C. Three-Valver, I am now asked by G. F. K. (Edinburgh) to mention that he has heard Sydney on every Sunday since September 3rd, with the exception of one, on which he did not listen! How these Scots stick to it! G. F. K. doesn't wish to appear competitive, but rightly surmises that I might think it worthy of mention.

C. H. R. N. (Chard) is a recent recruit to the short-wave battalion, but finds it all well worth while. Already he has joined the ranks of the "Sydney-every-Sunday" fraternity, and he finds it quicker to tell me what stations he has heard by saying "everything on 25-metre band except ——," and so on!

He wants me to give dates when I refer to spells of bad or poor conditions, so that readers can check their logs against mine. By the way, I should like to make it clear that I imagine that there are five types of "conditions," designated "bad, poor, fair, good, excellent." I should be glad if readers reporting would stick to one or other of these, leaving out "rotten," "punk," "hopeless" and other adjectives from now on.

Ideal for Tropical Use.

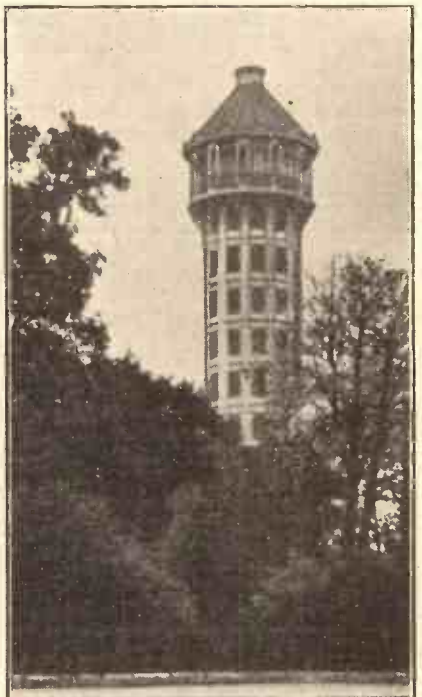
J. N. D., at present sailing the wintry sea, sends me an interesting circuit of his own short-waver, specially built for quiet background. He uses a S.G. H.F. stage, S.G. detector with a triode as separate reactor, one R.C. stage and one transformer-coupled stage. Not exactly a headphone receiver, one imagines, but rather an attractive proposition for loudspeaker work.

J. N. D. finds it ideal for tropical use, which speaks for itself. He also tells me that he finds a superhet quite useless for work at sea on account of noisy background. I have an idea that if he expended the years of trouble on a superhet that he has devoted to the set mentioned he would be a little more pleased, but we can't *all* try *every* set! In any case, I should like to hear of a few more readers really putting some hard work into the development and improvement of their own pet circuit. J. N. D. has been amply repaid, judging by his description of results.

An Answer to Recent Queries.

J. W. (Lanarkshire) informs me that "Radio Brazil" is transmitting on 36·65 metres, and signs off half an hour after midnight. I fancy that this supplies an answer to some recent queries about a station in this part of the spectrum.

A SUBSTANTIAL "MAST"



One of the towers of the Crystal Palace, London, from which television tests on ultra-short wavelengths are being carried out at more or less regular intervals by the Baird process. Reports from readers on reception of these tests would be welcome.

J. B. M. (Glasgow) kindly offers to forward the issue of "P.W." with my single-valve circuit in to G. E. F. (Leicester), if the latter gentleman will promise to return it within reasonable time. J. B. M. concludes thuswise: "My eyes are now better: I strained them looking for your page in the Christmas number!" Sorry, J. B. M., but space is precious, and the Powers That Be are occasionally faced with the unpleasant task of deciding what shall be left out. On that occasion it unavoidably occurred that "Short-Wave Notes" were axed!

W. E. B. (Watford) wants the identity of a station on 4615 kc. (65 metres odd) that carries out various mysterious tests and reads papers and lectures. Can anyone enlighten him?

Not Caught Like That!

Phew! A 16-page letter from W. M. (Hanley) has just been devoured, and I can't possibly remember every point without reading through it again. However, I will make the best of it. (1) My *real* initials are not W. L. S., so don't worry the transmitters whose initials *are*. You won't catch me that way. (2) I should imagine that your particular dead spots are due to the aerial. You can easily find out by altering its length slightly and seeing whether they shift.

(3) Ploppy reaction low down on the scale, even though it is smooth higher up, quite a common phenomenon. All I can diagnose is instability somewhere.

(4) H.A.C. application granted. (5) No; one certainly can't mistake a genuine American once one has heard one or two announcements from over the pond.

(6) I am interested to know that you have heard S. P. B. Mais direct from W 2 X A F. Naturally, most of the other Americans will be taking the same programme at that time on Fridays

"Short-Wave Fiend" Wanted.

The last of the correspondents (whom I have tried to clear up this week) is friend M. S. (Harlow), who is very keen to get into touch with a "young short-wave fiend" in his locality. Will any interested person in Essex answering to that description please make himself known to Mr. B. M. Selby, Tye Cottage, Tye Green, near Harlow, Essex?

Wintry weather conditions are with us, but there has not been much sign of real winter about radio conditions as yet. I have found the amateur bands particularly disappointing, with the exception of certain "bright periods" during the day.

On 20 metres I have heard West Coast Americans coming across wonderfully well between 4 and 5 p.m., although the band has apparently been quite dead for the rest of the day.

Very Few Additions.

Referring to broadcasts, I still find the most reliable stations W 3 X A L on 16·87 metres and W 3 X L on 46 metres. The latter has been especially good lately, and may often be heard as early as 9 p.m. By 11 p.m. he is usually excellent. W 3 X A L, of course, doesn't last much after 3.30 or 4 p.m. nowadays. As the days get longer he should be heard at a maximum at about 5 p.m.

I am disappointed by the small number of additions to the list of short-wave stations this winter.

There are 80 or more of them now, which is not bad, but we look for a steady growth. The one bright spot is that short-wave work seems to be unanimously described as "worth while" by those who have tried it. I am still waiting to hear a condemnation of short-wave listening which "holds water."

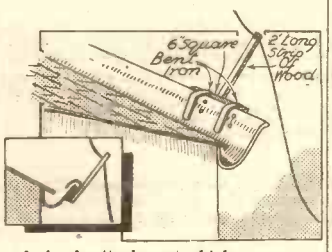
W. L. S.

SHORT-WAVE AERIALS

MANY short-wave (and broadcast) listeners lose a certain amount of efficiency by using poor aerials owing to the fact that where the down lead comes over the gutter it is not spaced away. Below is a gadget which is easy to make and *more easy to fix.*

Materials required: One piece of wood, 1 in. thick, 6 in. square; two pieces of iron, 1 ft. long each; one 2-ft. long wooden rod.

Bend the iron as shown in sketch; the curved part is bent to fit the guttering. Next screw the two bent pieces of iron to the square piece of wood, and finally screw the long piece of wood on to the opposite side of the wood, as shown in the smaller sketch.



A simple attachment which successfully keeps the aerial lead-in away from the roof.

This gadget can either have an insulator or hole drilled in the long rod, and then all it needs is clipping on to the gutter-pipe and then thread the down lead through the hole.

PREVENTING CREEPING.

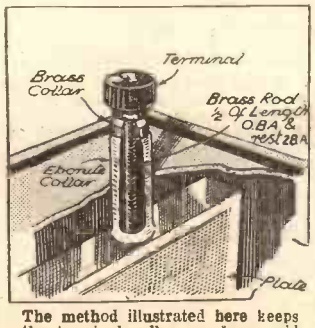
WHEN an accumulator is suffering from creeping around the terminals it is possible to adopt the following expedient if they are of the screw-in variety.

The internal thread will usually be found to be O.B.A. (some of the cheaper varieties are 2B.A.), and a piece of brass rod of suitable diameter should be taken about two inches long. This should be threaded one end for half its length O.B.A. and the other half 2B.A.

The rod after threading should be quite clean and should be immediately rubbed over lightly with flux. A little molten solder should next be prepared in the lid of a tin, and the rod rolled quickly and lightly in it.

It should then be firmly screwed in the accumulator and a piece of ebonite rod about ¾ in. long and of the same diameter drilled to take the rod, slipped on. Next screw on a brass collar of the same diameter and finish with a screw-on terminal.

This will, of course, keep the point of contact well above the creeping point, and the tinning of the rod will also help to prevent creeping.



The method illustrated here keeps the terminal well away from acid spray.

TESTING FOR VOLTAGE.

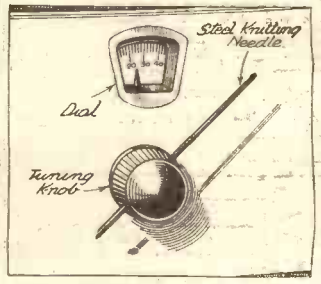
WITHOUT a high-resistance voltmeter, which is an expensive article, it is difficult to know whether mains current is being supplied to the set. A milliammeter, though usually sufficient, will give no reading on a "dud" valve, for instance.

An easy test, though it gives little indication of voltage, is to connect any plus and minus terminal desired respectively to each terminal of, say, a 2-mfd. condenser, and switch on for a few seconds. After switching off, and if current is there, the condenser will be charged, which can be proved by the spark obtained if terminals are shorted with a screwdriver.

AN EXTENSION-HANDLE TIP.

I HAVE found the following idea invaluable for short-wave tuning. The advantages are that the necessary needle can be bought for one penny, and when the station is tuned in the needle can be taken out.

A hole slightly larger than the thickness of the needle should be drilled through the knob, care being taken that no part of the hole touches the grub screw or condenser spindle. The hole may be drilled slightly to the left or right of the knob centre, if preferred. I have used this for some years with great success.



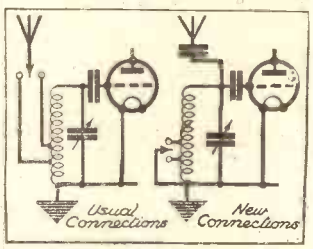
When drilling the knob do not touch the grub screw.

ON "GETTING DOWN."

FROM recent reports in "P.W." it appears that many sets will not tune down low enough on the wavelength scale to take in stations, such as Radio Normandie on 223 metres.

While a condenser, in series with the aerial, will slightly reduce the wavelength, and a small coil of wire aperiodically coupled to the aerial coil will do the same, neither of these methods will make a great difference. But where a centre-tapped or X coil is used a novel means of effecting a reduction in wavelength is available.

Remove the lead which goes to aerial terminal and tapping on coil, and connect to aerial side of grid condenser or tuning condenser. From the other side of tuning condenser take a wire to centre tapping on coil. (In the case of an X coil the best tapping can be found by experiment.)



An alternative method of connecting a centre-tapped coil.

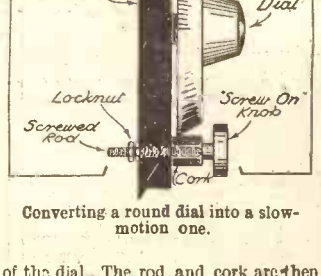
This will, in many cases, reduce the wavelengths covered by the coil by about 30 to 50 per cent.

VERNIER DIALS.

MOST wireless "fans" have, lying hidden in the junk box, a few old "screw-on" knobs and screwed rods from old condensers.

With the help of these and a cork an ordinary condenser with a plain round dial may be converted into a slow-motion one. A hole is pierced in the centre of the cork, and it is threaded on the rod, which also bears the knob. (See sketch.)

Then a hole slightly smaller than the diameter of the rod is bored about half an inch below the bottom edge of the dial. The rod and cork are then threaded through this hole until they cause the dial to revolve.



Converting a round dial into a slow-motion one.

If desired, a locknut may be fixed on the rod behind the panel, but it will not usually be necessary. This will be found to give quite an efficient slow-motion drive.

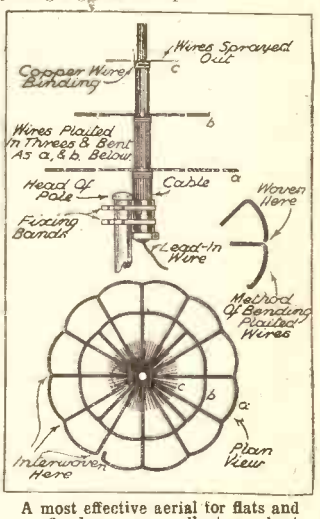
A NOVEL AERIAL.

OBTAIN about 30 in. of 1-in. multi-strand rubber-covered cable from a local electrician. Cut off insulation for about ¾ in. at one end, and put a copper earth clip round to keep wires together, also a little solder on the bottom to ensure contact with all strands.

Measure 6 in. from same end, and cut off remainder of insulation. About 9 in. from same end bind tightly with copper wire, and bend out first layer of wires.

Cut out six or so, and plait remainder in threes. Bend each plait, as shown in sketch, a little over half-way up and weave into next plait.

Bind cable again a further 8 in. up, and repeat plaiting as before. Still another 8 in. up bind tightly again and spray out next layer of wires, but do not plait. Leave remainder of wires projecting together at top.



A most effective aerial for flats and confined areas—excellent on short waves.

The down lead is now soldered to the bottom of the cable and to the copper clip. By means of two metal bands round the insulated portion the aerial is fixed to a pole, as shown in sketch.

When only raised to a height of 18 to 20 ft. this aerial was found to be very effective, particularly on short waves, and would be most convenient in confined areas, such as flats, etc. I have tested it thoroughly and found it better than an ordinary outdoor wire aerial.

A NEON WARNING.

Constructors who use an electric soldering iron have probably been annoyed at times to find that it has been left switched on. Not only does this waste power, but in some cases may considerably shorten the life of the iron's heating element.

This possibility can be avoided by simple warning light.

The idea is to fix a small neon lamp in a holder near to the socket into which the iron is plugged. It should be wired up in parallel with the iron so that it will glow the whole time the latter is switched on.

(Continued on next page.)

ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstance, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear?

The best Wrinkle in our Nov. 25th issue was sent by Mr. Thomas Helliwell, 16, Cheviot Road, Romford, Essex.

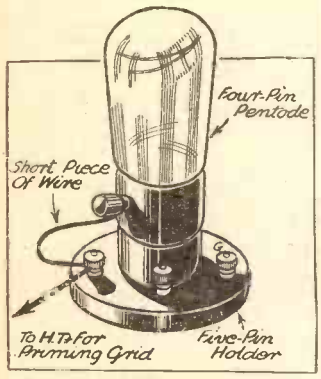
RECOMMENDED WRINKLES

(Continued from previous page.)

A STITCH IN TIME.

WHEN making a new receiver which is to incorporate a pentode valve in the output stage it is a good plan not to be tempted to economise by using an existing four-pin valve holder, if the pentode is one of those which is equipped with a priming-grid side terminal.

This type of pentode is gradually being superseded by those which have the priming-grid connected to a fifth pin on the valve base. When, therefore, the time comes to replace your present pentode it may prove difficult—and even impossible—to obtain one with a side terminal.



The flex lead ½ enables side-terminal pentodes to be used in addition to the 5-pin variety.

It is better by far to include in your set the five-socket holder required for the five-pin type of pentode. This should be wired (as shown in the accompanying sketch) as if a five-pin pentode were to be used.

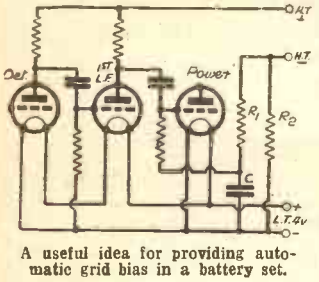
To accommodate the side-terminal valve, all that is required is a short piece of wire from the "C" terminal of the holder to the side terminal of the valve, which can be removed when changing to a new five-pin pentode.

Failure to observe this precaution when building the set would, of course, necessitate changing the valve holder for the new pentode.

ELIMINATING THE BIAS BATTERY.

SOMETIMES the experimenter, for reasons of convenience, "mixes" the valves in his receiver, using (with due precautions, of course) 4-volt valves in some positions and 2-volters in others.

It is not generally known, however, that it is possible to obtain additional advantages from a "mixture" of voltage ratings among the valves in a receiver.



A useful idea for providing automatic grid bias in a battery set.

The sketch herewith shows an "outline" of a det. and 2 L.F. set where the detector and first L.F. valves have 2-volt filaments, while a 4-volt valve occupies the output position.

Since the first two valves have their filaments in series they may be connected to the set's L.T. terminals, which are fed from a 4-volt accumulator. By this arrangement the first L.F. valve has in its "cathode" lead the resistance of the detector valve's filament, across which, of course, two volts are "dropped."

By returning the first L.F. valve's grid to L.T. —, as shown, this voltage drop achieves automatic "cathode biasing" to the extent of two volts, which is just right for the average first L.F. valve.

Biasing of the output valve can then be arranged for by the well-known expedient of a resistance between L.T. — and H.T. —, across which voltage is dropped by the passage of the *whole set's* anode current. From Ohm's Law, the value of the resistance (R2) is chosen so that this voltage drop is what the power valve requires for bias. Connecting the power valve's grid as shown ensures that negative bias is applied.

Decoupling is a refinement provided for by R1 (100,000 ohms) and C (2-mfd.).

HOME-MADE CHOKES.

SOMETIMES, in a moment of enthusiasm, we become possessed with a bursting desire to wind and experiment with our own H.T. chokes, and we are at a loss to obtain a suitable former.

An excellent former can be made at a moment's notice by using about a 3-in. length cut off of an ordinary household candle. The wire, wound over the slightly warmed surface of the candle, will make its own serrations in the wax and so prevent any chance of slipping.

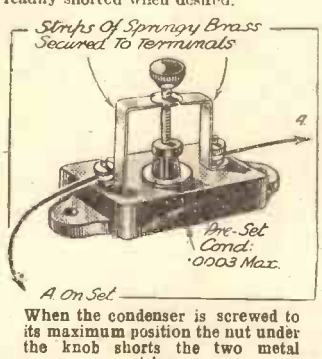
The length of candle, besides being an excellent insulator, can be cut down easily to any desired length or diameter.

A similar idea can be employed in making up cheap and effective coil formers.

Firstly, take a short length of cardboard tube and brush over with melted candle grease; then apply 6 or 8 strips, say ⅛-in. square, of candle wax. The wire can then be wound, simply and easily, over waxen ribs.

SERIES AERIAL CONDENSERS.

THE accompanying sketch is a scheme for shorting one of the preset types of aerial series condensers. It is a very useful idea and is quite simple to carry out. The condenser can be readily shorted when desired.

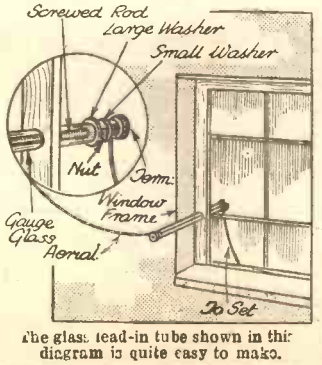


When the condenser is screwed to its maximum position the nut under the knob shorts the two metal strips.

GLASS LEAD-IN TUBES.

A VERY efficient lead-in tube can be made by obtaining ½-in. gauge-glass tube, such as used on steam boilers, and a piece of screwed brass rod. The rod should be an inch longer than the tube to allow for terminals, etc., each end.

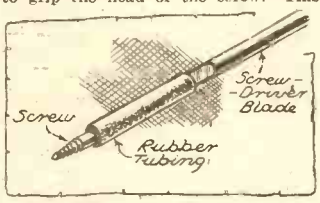
Insert rod, leaving ¼ in. each end; next put a washer a little larger than tube on the ends, then screw a small lock nut on to keep rod in the centre and also to keep it tight; then put another smaller washer on. Now put on your aerial, fixing with terminal. Tighten up both ends the same time.



The glass lead-in tube shown in this diagram is quite easy to make.

HANDLING AWKWARD SCREWS.

SLIP a piece of rubber tubing over the screwdriver blade, leaving enough tubing extending over the end to grip the head of the screw. This will hold the screw till started and release it automatically when the head is flush or in a countersunk hole.

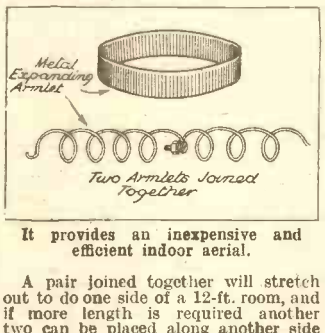


You will find this tip very useful when building a compact receiver.

The rubber tubing should be pushed up on the blade when not in use.

A NOVEL IDEA.

HERE is a cheap and efficient aerial that can be made with two metal-expanding armlets which can be purchased for 1½d. a pair. These armlets are made with a join and are easily separated, two being joined together with equal facility.



It provides an inexpensive and efficient indoor aerial.

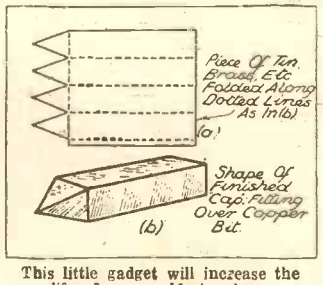
A pair joined together will stretch out to do one side of a 12-ft. room, and if more length is required another two can be placed along another side and joined to the first two. They should be fixed 2 or 3 ins. out from the picture rail.

The surface of these armlets is plated, and they give excellent results, while they are hardly noticeable when in position.

FOR YOUR SOLDERING IRON.

THE great difficulty about heating a soldering iron in a fire (or over gas-ring, for that matter) is to keep the copper clean.

I have found that a sheath made on the lines of the accompanying drawing enables the iron to be used with any form of heat and keeps the copper portion absolutely clean, thus making it possible to use the iron immediately it is withdrawn from the fire, etc., and preventing the usual continual filing.

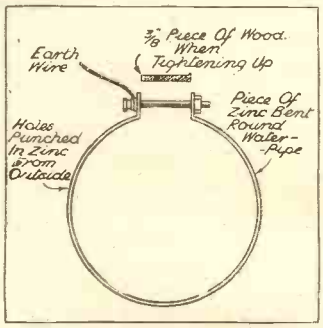


This little gadget will increase the life of your soldering iron.

The sheath can be made from any thin metal (I used tin), and is made to slide fairly easily over the copper portion. As the cap fits closely to the iron there is no wastage of heat. If it is found that the cap springs open a length of wire can be wound round it in the middle to keep it in shape.

THE EARTH CONNECTION.

FOR a good earth connection to water-pipe: Procure a piece of stout zinc or tin about 1 in. wide,

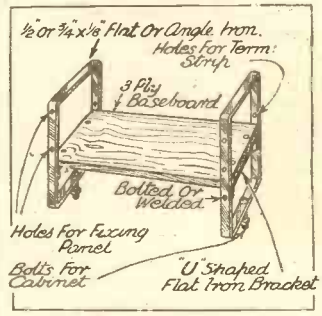


Obtaining a good water-pipe earth will be assisted by this clip.

measure the circumference of the pipe, and cut zinc or tin accordingly. Turn up zinc ¼ in. or so at the ends, and punch hole in both ends, then pass a terminal through.

A HANDY CHASSIS.

FOR ease of handling, and for safety of the component parts when constructing a set I have come across nothing to beat the following type of layout, which I should like to bring to the notice of other readers.



A set built on this type of chassis is particularly accessible.

A sketch is shown of the arrangement, which consists of a three-ply panel with metal end frames. As you will see from the sketch, the chassis can be turned over on to any side without the necessity for props. This is a great advantage when the set is being wired, or has to be taken out to trace a fault. This latter process can be carried out without removing the valves.

The metal end frames can be of flat or angle iron, and need not be very heavy. In fact, quite thin metal is rigid when bolted to the wood.

A FINISH FOR LOUDSPEAKER BAFFLES.

A VERY good finish may be given to a large baffleboard in the following manner:

Fix one of the thin, cheap mouldings, obtainable at any woodworking shop, around its edge. The whole should then be given a coat of enamel to match with the furnishing scheme of the room in which the set is to be used.

A packet of either gold, silver or bronze metallic powder should be obtained, and a little at a time spread on the enamel very lightly and irregularly. The powder can be blown on while the enamel is wet if a little of the powder is taken at a time and spread out on a piece of stiff paper.

CLASS B AND Q.P.P.

Some practical hints on two widely used systems of amplification—Class B and Quiescent Push-Pull.

By C. ROBINSON.

GREAT advances have recently been made in battery-set design by the introduction of output circuits giving large volume with comparatively low H.T. consumption. These are circuits of the push-pull type known as Quiescent Push-Pull (Q.P.P.) and Class B.

These arrangements can undoubtedly give very excellent results for low initial and running expenditure, but certain precautions are necessary if entirely satisfactory results are to be obtained.

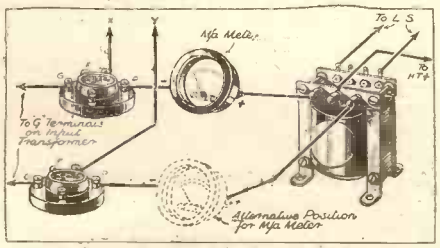
Class B output is a power-operated arrangement, and it is therefore necessary to use a special driver transformer and a driver valve. This driver valve and transformer should be considered as part of the Class B stage. Q.P.P. is a voltage-operated stage of similar type to a normal-push-pull output stage, except that the Q.P.P. valves are biased to the "bottom bend" of their characteristic.

Matching the Valves.

To obtain the best results from Q.P.P. using pentodes it is essential that the valve characteristics be carefully matched. This can be done by adjustments of the priming (auxiliary) grid voltage of each valve. The method adopted is to set the grid-bias voltage to approximately double that required if the valve were used normally by itself.

A milliammeter should then be connected in the anode lead of one valve and the current noted. The meter is then inserted in the anode lead of the other pentode and the current again noted. By carefully adjusting the voltages applied to the priming grids the two anode currents can be made identical.

"MATCHING" Q.P.P. VALVES



The Q.P.P. valves should be "matched" by means of the anode current test. "X" and "Y" are the two priming grid leads and are joined to H.T.+.

For example, if the anode current of one valve is more than that of the other, the priming-grid voltage should be reduced step by step, the priming-grid voltage of the other valve being increased slightly if more convenient. It is most important that this matching be carried out with great care.

If it is found that satisfactory results cannot be obtained when using a high-grid bias, but that with a bias approximating to the value required if the valve were used singly satisfactory quality is obtained, the trouble is due either to the matching not being sufficiently correct or to the output impedance being too low.

The Effects of Output Load.

With both Class B and Q.P.P. it is essential that the output impedance load be sufficiently high. Too low an impedance load will inevitably cause distortion and poor output volume, but on the other hand too high a load impedance will have no adverse effect on quality. Therefore if there is any doubt as to the correct value of load, it is infinitely preferable to err on the high side.

The value of load impedance is determined by the impedance of the speaker and the step-down ratio of the output transformer or choke. Increasing the step-down ratio of the output transformer has the effect of raising the load impedance, and vice versa.

Another point in connection with Class B and Q.P.P. output transformers and chokes which is important is that the iron core must be of generous dimensions. The anode current of an output stage of this type varies in sympathy with the volume, and on peaks could be as much as 50 milliamps.

Using the Mains.

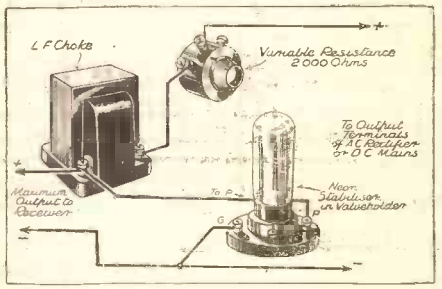
In an ordinary push-pull stage there is a steady current flowing through each half of the output transformer in opposite directions, and this prevents magnetisation of the core. This does not apply with Q.P.P. or Class B, where one half of the output valve or valves is quiescent at any particular time.

Therefore it is essential that the core of the output transformer or choke be designed so that the peak anode current can be carried without the iron circuit saturating, as if this happens severe distortion will occur.

Class B and Q.P.P. were originally intended only for use in battery sets, but many users of mains H.T. units may wish to adopt one of these output circuits. As the anode current of these output stages is continually fluctuating, it is necessary to use some form of voltage stabiliser, such as the special neon lamp available for this purpose.

It is essential that the eliminator is capable of giving 50–60 milliamps for the Class B or Q.P.P. stage without being overloaded, as otherwise all the voltages applied to the receiver would fall on peak signals. The neon stabiliser will come into effect when the total H.T. current falls, and will apply a load sufficient to maintain the voltage at a constant value.

STABILISING THE H.T.



When H.T. is derived from the mains for a Class B receiver, it is advisable to use a voltage stabiliser across the mains unit as shown.

Providing the components are chosen with care and the various little snags considered, no difficulty should be experienced in obtaining entirely satisfactory results.

WHAT READERS SAY

A Popular Set—New Use for The Valvonium.

"THE NORTHERN STAR."

The Editor, POPULAR WIRELESS.

Dear Sir,—I have just completed "The Northern Star," details of which were published in your issue of the 30th Sept. last, No. 591.

I am very pleased with the results, and it is indeed a very efficient receiver.

I have built various receivers from "P.W." during the past eight years and have always found them reliable.

Yours faithfully,
P. C. BOMPAS.

133, Antill Road, Bow, E.3

THE VALVONIUM AND MORSE.

The Editor, POPULAR WIRELESS.

Dear Sir,—There is a true saying to the effect that there are two uses for everything; incidentally, there is another use for the "Valvonium." By reducing the power and using phones it makes an excellent device to practise Morse code. A 16-volt grid-bias battery will supply the power required, and this is split from the negative end at about 3 volts for filaments, leaving the rest for high tension as needed.

I find this very satisfactory in more senses than one, since I have two instruments in one, and whilst practising Morse code I disturb no one, because any listener other than the operator would find it somewhat nerve-racking.

And as a regular reader of POPULAR WIRELESS I look forward to those pleasant surprises you are so apt to spring on us—and always first!

Yours faithfully,
A. L. DOBINSON

South Kirkby, Pontefract.

DO WE USE TOO MANY COMPONENTS?

A reader writes to us wondering why so many small components are used in home-constructor designs when, apparently, commercial sets do not make use of them. This state of affairs is fully explained below by our Technical Editor.

THE other day I received a letter from a reader which ran as follows:

"I note that in most of the 'home-constructors' sets there is included a large number of small components, such as resistances, fixed condensers, etc., etc., while nearly all the factory-built sets are almost devoid of these small parts, including even a choke in some cases.

"What purpose do these small components serve? Do they make for better quality, and, if so, why can the factory sets get the results without their inclusion?

"Some of my friends say they are unnecessary.

"Perhaps you will kindly explain in an early issue of your delightful and helpful magazine."

It is rather surprising that we haven't had more letters like that, because there does often seem to be room for criticism against the home-constructor design on the grounds outlined above.

Stark Simplicity

Some commercial sets appear to be almost severe in their stark simplicity and freedom from "small components." Indeed, many listeners must wonder how they can work! You open the back of an "X Y Z" four-valve mains set to inspect the works, but there don't seem to be any works.

Just a kind of metal platform, with two or three metal boxes and valves grouped on it—that's all!

On the other hand, the average home-constructor outfit is like a neatly arranged show case of components, large and small, a round score or more of them of all shapes and sizes.

Actually, the factory-built set seldom has fewer parts than a home-constructor receiver, but, as service men know to their cost, they are generally compacted away into all kinds of hidden corners.

A simple-looking metal platform may hide a mass of tiny parts beneath its innocent, shiny surface.

It is one of the great advantages of a home-constructor design that all its components are immediately accessible and easily replaceable, perhaps even for other makes, though the appearance may not be as neat.

Each part of a commercial set is designed for the one set or type of set, and in this way great compactness can be achieved, although, as I have said, not without attendant drawbacks.

Sometimes more parts are used in a factory set for a given circuit arrangement,

EASY TO GET AT

Not all commercial receivers have their small components in inaccessible places. This photograph of the new Telsen 464 receiver, for instance, shows the open and orderly arrangement of the resistances and electrolytic condensers.

because a factory set must stand or fall as an entity. The home-built set need not necessarily take account of every extreme of local condition and requirement. It is a simple matter for its designer to cover such extremes by small additions and refinements of an optional character.

But it must be admitted that, even when every odd resistance and choke has been located, a component census occasionally reveals that a factory set actually has less components than an apparently equivalent home-constructor set.

I say "apparently" because, if the two sets were identical, they would obviously use the same parts to the same number.

Components are not slung haphazardly into any design due to a reputable designer, and there is no fundamental difference between the two types of designs It has been said that by building each part to specific characteristics for one specific circuit an economy of components can be wrought.

The argument seems to be that, for example, smoothing in a mains set can be as good when the set is tonally adjusted to exclude low notes, and only slight smoothing of a normal character is used, as when a full reproduction and efficient smoothing (more components) are employed.

Restricted Response

O.K. as far as it goes. But it doesn't go far enough for the discriminating home constructor. He has heard commercial sets with a more restricted response and, even so, with more hum than he would tolerate. Probably plenty of them. And he doesn't like them.

But a careful inspection of a first-class factory instrument reveals little scamping of components. In the wild competitive rush of last year many sets arrived on the market that were better never made.

I had felt tempted to publish a few diagrams, but comparisons are difficult to make, for there are so many things that need to be taken into consideration.

However, I can assure my correspondent that there is always a very good reason for every component used in at least a "P.W." design.

G. V. D.

THE NEW MULTIPLE VALVES

A review of a fine handbook for constructors.

THE types of special valves now obtainable are apt to be a little confusing, due to their wide variety. But an explanation of their functions, and complete technical data regarding all makes and types of valves on the market, are two of the valuable features available in "The Wireless and Gramophone Trader" Year Book and Diary for 1934.

"Practical Methods of Fault Finding" and the "Classified Buyers' Guide" are other sections that will appeal to all radio enthusiasts. (The Buyers' Guide contains some 250 classifications, together with the names of firms who supply the various items.)

A Public Address Amplifier

Then there are two how-to-build contributions which should prove of considerable interest to every constructor. One of these deals with a "Universal Valve-Testing Panel," and the other gives details of an A.C. Public Address Amplifier capable of providing anything up to 15 watts of undistorted output.

Readers of POPULAR WIRELESS, as well as radio traders, will find this work a great asset throughout the coming year. It is good value at 5s. 6d., post free, and may be obtained from The Trader Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1.

A. S. C.

MAPPING The ETHER

This ingenious and unique scheme for mapping the ether in its relation to your set tells you just how well a certain station should be received before you even attempt to tune it in. You have, at a glance, a picture of the exact conditions existing in the band of wavelengths covered by your tuning.

Full details of the method are given below by A. S. CLARK.

EVEN if you have never visited a certain town, you can gain much valuable information about it by reference to a map. You can instantly find out whether it is on high- or low-lying ground, if it's easy of access by road or by rail, what the surrounding country is like, and so on—in fact, you can estimate quite accurately if it is worth your while visiting that town or not.

What It Tells You

Similarly, with the following simple scheme for mapping the ether in its relation to your receiver, you can tell just how well such-and-such a station should be received before you even attempt to tune it in. You have, at a glance, a picture of the exact conditions existing in the band of wavelengths covered by your tuning. You know just where stations are grouped together, how a powerful one stands out above those adjacent to it, which stations interfere with one another, which are distorted, and "a whole heap" of other information.

The map is as fascinating to prepare as it is useful in practice.

Most listeners who tune in to foreign stations keep some sort of a log of the dial readings. Usually it takes the form of a list of stations with the readings at which they are received against them. Once a fair number of stations are placed on the chart, the approximate dial readings of other stations can easily be estimated.

The ether map is based on a similar method of logging, but the station positions are marked in such a way that considerable information is put on record. The diagram on this page (Fig. 1) will make the idea clear.

AN ENTIRELY NEW SCHEME

Three Important Facts

A large piece of ordinary graph paper is used, and two parallel lines are drawn on it, one at the bottom and one near the top. Along the bottom line figures representing the degrees of the dial are marked, one small division being allocated to each degree. The names of stations as they are identified are marked along the top opposite their corresponding dial readings.

In the special method of marking in the characteristics of the stations note is taken of three items—volume, quality and spread.

The first of these is denoted by the length of the vertical line, the second by whether this vertical line is drawn straight or wavy, and the third by the horizontal line drawn at right angles to the vertical line.

EASY TO PREPARE AND SIMPLE TO USE

A pencil, a ruler and a piece of graph paper. That's all you require!

In the illustration no specific stations are indicated, because the conditions of reception will vary with each individual case.

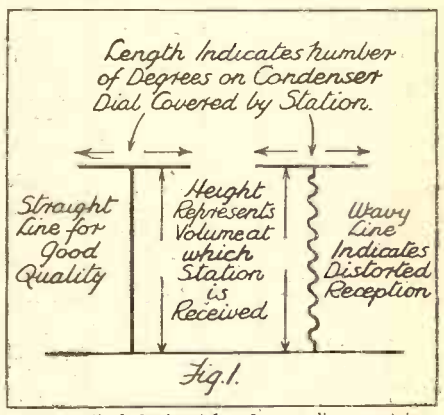
The volume of reception is decided by a completely arbitrary scale. If you have a local station, that can decide the maximum. Stations that are only just loud enough to justify the term "loudspeaker strength" can determine the minimum.

Deciding the Volume Level

In between these all other strengths will fall. The actual strength of stations is really unimportant so long as the relative values are more or less correctly recorded.

The position of the volume control for normal strength will help to indicate volume for stations that do not require reaction. When the latter is used, care must be taken in deciding the volume level.

THE THREE SYMBOLS



The vertical, horizontal and wavy lines contain a mine of information about the way stations are received on your set.

The best scheme to adopt is to turn the reaction just far enough to give satisfactory loudspeaker strength, the less reaction required to do this the greater being the estimated strength of the station. When deciding how much reaction is in use you should note how far the setting is below the point where oscillation starts, because the distance that the reaction knob is from zero is largely dependent upon whether you are tuning at the top or the bottom of the dial.

Indicating Quality

So far as quality is concerned, there are only two degrees. Either it is O.K. or it is not. In the latter case, as already mentioned, the vertical line is drawn wavy.

This method of indicating spoilt quality is adopted whether it be due to a loud heterodyne or to straightforward distortion. What it denotes in total is simply that the station is not worth listening to so far as its reproduction is concerned.

(Continued on next page.)

MAPPING THE ETHER

(*Continued from previous page.*)

The consideration of spread will vary immensely with the type of set employed, but it is nevertheless highly important. The length of the horizontal line indicates the number of degrees on the dial over which any particular station can be heard.

Suppose, for instance, the local station is heard as a background to a distant programme that tunes in six degrees away from it; then the horizontal line will extend six points on either side of the vertical power line.

The "Spread" Line.

The best indication of the length to make the "spread" line is actual interference with other stations rather than the number of degrees over which the station can be heard irrespective of whether any other stations are received. The reason for this is that the other stations, when fully tuned in, might drown the "background" that is heard when simply detuning.

Also remember that if you do decide to spread in certain cases by detuning, and there are two or more dials on the set, then they must both be turned together so that both circuits are approximately the same amount off tune.

Stations that come in well, with good quality and without interference, could be marked in with red ink. These red marks would then indicate transmissions of real alternative programme value.

Here is an example of how the "map" can aid reception forecasts to be made: To the left of Fig. 2 is a powerful local spreading over twelve degrees; next to it is a German station loudly interfered with and distorted.

To the right of the German station is a French station that is received free from the local.

Suppose we find from a list that a wanted station will tune in approximately at 41 degrees. What can we find out about it?

Practical Examples.

The list tells us its power is less than that of the French station and it is also farther away, so its spread will certainly not overlap that of the French station. But as its tuning point is on the edge of the local spread we are bound to get this station as a background, because the power will be represented by quite a short line in relation to the local and the wanted station will not be able to overcome the local's interference.

Let's take another example. There happens to be a station that should by rights tune in somewhere about 74 degrees on the dial. It is a station of which we have heard a good deal, but not as yet tuned in.

It is not one of the super-powered stations, and a glance at our ether map explains in a flash why we have not heard him. There is certainly a blank degree on the dial at the setting of this station, but then this degree is sandwiched in between two other stations which are more powerful than the station we are after.

As a matter of fact, there are quite a bunch of interfering stations at this point, and we can say almost for certain that it is not a bit of good going after the fresh station, because even if it could be heard it would be too badly jammed to be intelligible.

These two examples also serve to show how the map is read. At 35 degrees we have the powerful local, supreme above everything, and of course a "marked-in-red" station.

The Frenchman at 45 degrees would also be a "red" station. At 55 and 63 degrees are two easily received stations, which, though not very powerful, are nicely clear from others.

Between 70 and 80 degrees there is a very crowded patch, and it is certain that none of these can be marked as "red-ink" stations. Of course, the more powerful the set the more crowded the chart will become, but then the more powerful sets generally have better selectivity, so the stations are better separated.

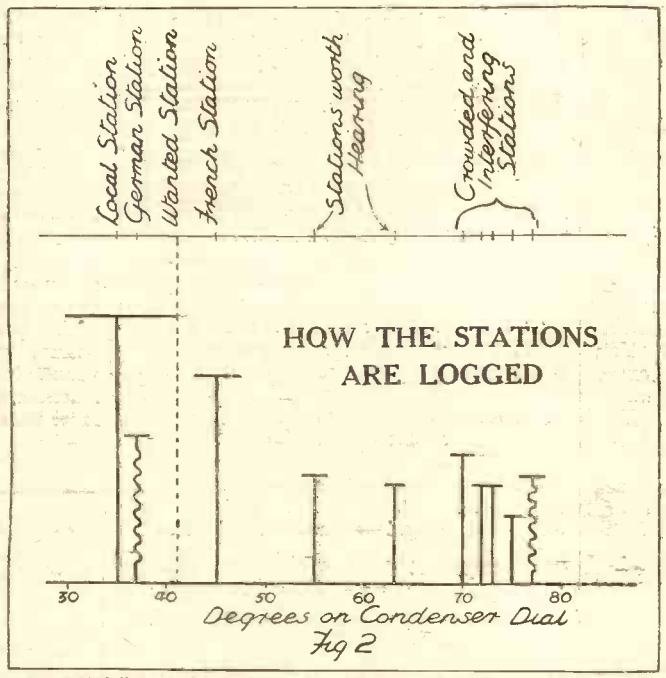


Fig 2

The dotted line represents the position of a wanted station. As it is right on the edge of the local station's spread, obviously it is not likely to be received very well.

The Scheme in Use.

However, the absorbing part of the "map" is not so much in forecasting reception as in the amazingly vivid impression one gets of the state of the ether as the picture reaches completion by the addition of more and more stations.

To show how the scheme works out in practice, a photograph of an actual chart drawn up for daylight reception on the long waves is reproduced. The set employed had two tuning dials, but the readings represent those of the aerial condenser, as the readings of the grid tuning condenser were liable to vary a little with the amount of reaction employed. In a number of cases the stations were identified only by their positions on the dial.

(When noting dial readings always choose the dial on which the readings can be varied the least by such settings as reaction condenser, selectivity controls, etc. As a matter of fact, these variable items should all be set to one value for the purposes of making the chart, as far as that is practicable.)

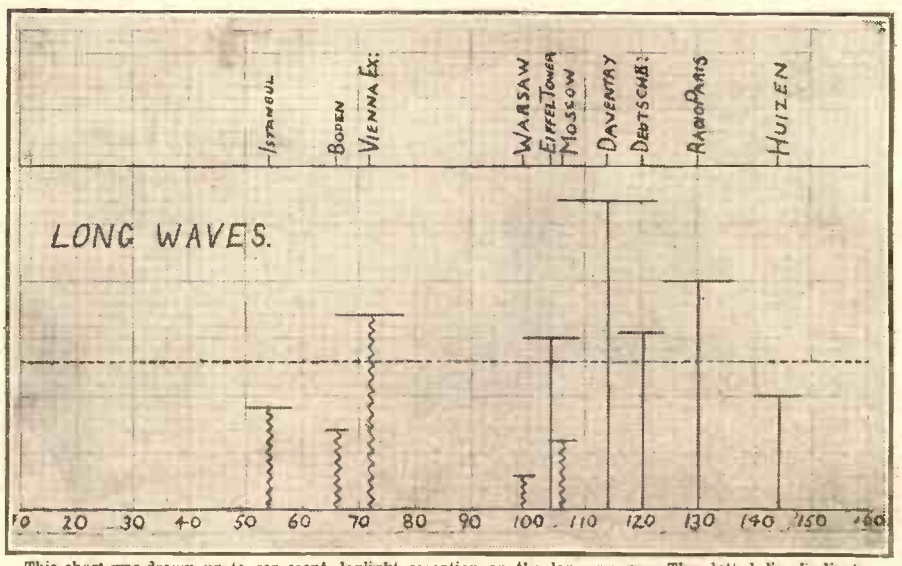
An Interesting Point.

The dotted line across the chart is an interesting point. It indicates the division between stations that need reaction and those that do not.

All power lines that stop below this dotted line are for stations that require reaction. And the farther they are below the line the more reaction that is necessary.

Quite likely readers may have ideas that would render the usefulness of such maps even greater, and the author would be pleased to hear about them and from anyone who cares to write about these maps.

A TYPICAL "MAP" SHOWING LONG-WAVE RECEPTION



This chart was drawn up to represent daylight reception on the long waves. The dotted line indicates the division between stations that need reaction and those which do not.

RADIO STEP-BY-STEP

OUR SPECIAL SUPPLEMENT for BEGINNERS

RADIO TERMS

A practical review for the enthusiastic beginner.

By G. V. DOWDING, Associate I.E.E.

BEATS

OSCILLATIONS or alternating currents produced by the superimposition of two dissimilar frequencies. The beat frequency will be the difference between the two original frequencies.

A familiar example is to be found in the so-called "heterodyning" which evinces itself as a squeal when two broadcasting stations whose wavelengths are only slightly different interfere. The wavelength of one might equal a frequency of 715,000 cycles. If the transmission frequency of the other station were 713,000 cycles or 717,000 cycles, a beat frequency of 2,000 cycles (the difference between 715,000 and either 713,000 or 717,000) would be set up.

BLASTING

A form of distortion. The term is generally applied to that type of distortion which results when either a microphone or valve is given an excessive input.

BOARD OF TRADE UNIT (B.O.T.U.)

The official buying and selling unit of electricity. It is equal to one kilowatt hour; i.e. if one kilowatt of power is taken from the mains for one hour, one B.O.T. unit has been consumed. A kilowatt is, of course, 1,000 watts. A 50-watt electric lamp can be burned for 20 hours before one B.O.T. unit is consumed, a 100-watt lamp for 10 hours, and so on pro rata.

BY-PASS CONDENSER

A condenser so placed in a circuit that it offers an easy alternative route to alternating currents of a certain frequency.

In high-frequency circuits it is desirable that a by-pass condenser should be of a non-inductive nature. Certain forms of condenser construction are apt to introduce inductance, and this would militate against the component's effectiveness as a by-pass.

CAPACITY

The capacity of an accumulator is rated in *ampere hours*.

The term is also applied as a measure of the charge of electricity a condenser or isolated body can hold. The unit of capacity is the farad. A condenser between whose plates there is a potential difference of 1 volt, and which holds a charge of 1 coulomb, has a capacity of 1 farad.

But the farad is too large to be of use as a practical unit, and so the microfarad (one-millionth of a farad) is generally employed.

CAPACITY COUPLING

The coupling of two circuits by means of a condenser.

CARRIER-WAVE

The high-frequency radiation of a broadcasting station, so called because of the analogy that it *carries* the speech and music frequencies from the transmitter to the receiver.

CASCADE

A form of series connection. The valve stages of a radio receiver are in *cascade* when, as is usual, the output of the first is joined to the input of the second, the output of the second to the input of the third, and so on.

CATHODE

The electrode of a valve from which electrons are emitted. In the battery type of valve the *filament* is the cathode.

CATSWHISKER

The wire contact of a crystal detector.

CHARACTERISTIC CURVE

A graph which shows the *characteristics* of a valve. The most usual form is that in which anode current is plotted against grid volts (Fig. 1). From such a curve can be calculated the grid bias to use for different high-tension voltages in the case of an L.F. amplifying valve.

CLASS B AMPLIFICATION

A method of L.F. amplification in which the high-tension current used is directly proportional to the output.

In Class A amplification (ordinary power and pentode valves) the high-tension current is set at an average value by the application of negative grid bias and the L.F. impulses occur as equal increases and decreases above and below this average. Thus the H.T. current is the same whatever the volume.

A Class B valve is two high-magnification valves built into one glass bulb and having a common filament. Each valve handles successive negative and positive impulses. The negative impulses have little or no effect, but the positive impulses cause varying increases of H.T. current in accordance with the strength of the input.

The quiescent H.T. current flow (i.e. when there is no input) may be only two or three milliamperes, but this may rise to as much as 30 milliamperes or more on full volume.

For this reason the smaller H.T. batteries are seldom satisfactory for Class B work. Also an H.T. mains unit, owing to the widely differing load imposed on it if used for Class B, should be properly designed, preferably with a stabilising device such as a neon valve, to provide against these variations.

In some cases no grid bias at all is used for the Class B valves, but in others small grid biases are applied.

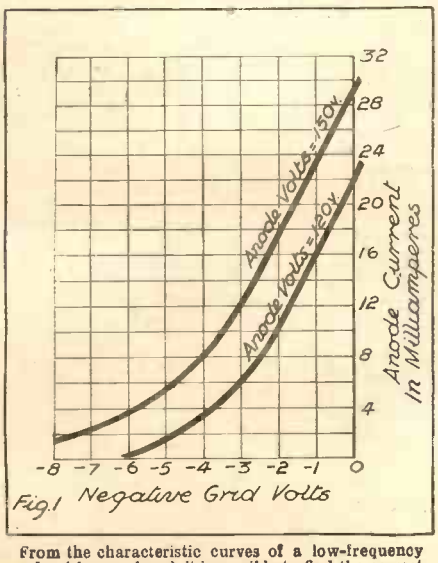
Special coupling requirements are needed for Class B valves, and many modern loudspeakers are now made with centre-tapped transformers having ratios suitable for the purpose.

It should be appreciated that adding a stage of Class B to a set does not necessarily decrease the overall H.T. current consumption. But it will enable a much greater volume to be obtained with but a comparatively slight additional H.T. current.

Owing to its pentode-like characteristics, a Class B valve tends to emphasise the high notes, and suitable tone correction is often advisable.

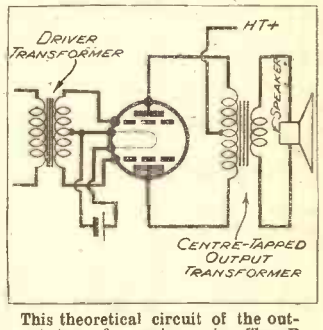
Also it should be noted that a Class B valve is a power-operated amplifier and is not voltage operated and must, therefore, be preceded by a "driver," i.e. a small power valve.

TO FIND CORRECT BIAS



From the characteristic curves of a low-frequency valve (shown above), it is possible to find the correct grid-bias voltages for different high-tension values.

IN ACTUAL USE



This theoretical circuit of the output stage of a receiver using Class B shows the centre-tapped driver and Class B output transformers and the Class B valve with its two anodes and two grids.

What is a CONDENSER?

THE condenser is probably the most widely used component in radio. In every wireless receiver there are condensers of various types, either variable or fixed.

A condenser relies for its functioning on an electrical property called *Capacity*, and in fact may be said to consist simply of concentrated capacity

Barrier to D.C.

Therefore, before we consider the condenser in its many applications, we must discuss this important property, capacity.

CIRCUIT SIGNS

Symbols used to show various forms of condenser in a theoretical circuit. F is a simple fixed condenser. V shows a variable type such as is used for tuning. S V is a semi-variable condenser, also known as a preset.

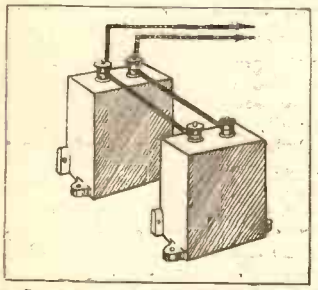
Capacity exists in all electrical circuits, and any two objects which are at different electrical pressures possess this property. Capacity tends to resist any change in the voltage between two conductors. It permits the passage of alternating current effects, but acts as a barrier to direct currents.

A Simple Case.

If two conducting wires are run side by side, separated by some form of insulator such as air or rubber, a definite capacity will exist between the two conductors. The two wires are equivalent to a condenser.

In other words, the conventional condenser is simply two or more metal plates separated by a non-conducting material. The capacity of a condenser depends upon the size of the conducting plates, the nature of the material separating the conductors and the distance apart of the plates. The non-conductor between the plates is called the *dielectric*, and every material has a *dielectric constant*.

ADDED TOGETHER



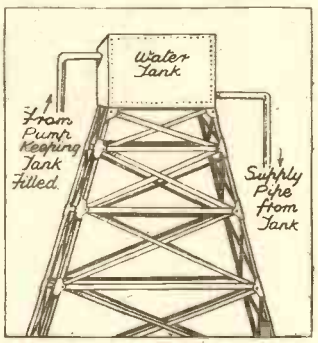
Connecting two condensers in parallel gives a total capacity value equal to the sum of the two individual capacities.

In previous articles in this series we have already shown that the quantity of electricity flowing along a wire is measured in coulombs. The quantity of electricity in a condenser is also stated in coulombs and may be expressed as the capacity multiplied by the voltage. In symbols we have Q (coulombs) = C (capacity) × E (voltage).

The unit of capacity is the Farad, but it is a unit which is too big for practical radio work; hence we speak of a radio condenser as having a capacity of so many microfarads, or millionths of a farad. A microfarad in its abbreviated form is written mfd. Thus ·01 mfd. is a capacity of one-hundredth of a microfarad.

One of the most important features of a condenser is its ability to act as a reservoir, and in this respect it can be likened to a water tower used for supplying a constant water pressure irrespective of the fact that the inflow to the tank takes the form of spurts.

STORAGE TANK



This simple illustration from everyday life explains how a condenser acts as a reservoir, giving a constant pressure at the outlet, irrespective of any irregularities in the inlet.

Steady Stream.

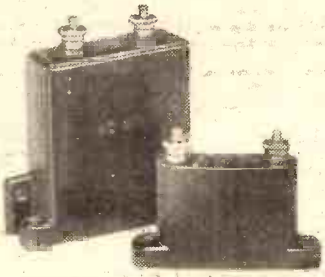
The pumps feeding the tank maintain the water level by supplying quantities of water in "gulches," but the outflow from the tank is at a constant pressure.

Similarly, a condenser can be used for smoothing a fluctuating supply in an electrical circuit. The condenser acts as a reservoir and serves to maintain a constant pressure, regardless of the pulsating currents flowing in the circuit.

When a condenser is charged (or filled) with electricity it will retain its charge even when removed from the circuit. If the condenser terminals (assuming the capacity to be in the neighbourhood of 1 or 2 mfds.) are then joined by a wire a discharge will occur which can be seen as a spark just before the wire touches the terminals.

This is because the two sets of plates are, when the condenser is charged, at widely different potentials. Directly the wire is allowed to join across the terminals (this is the same as joining the two sets of plates) the plates revert to a state of equilibrium and both sets are at the same potential. The condenser is then discharged, and no E.M.F. exists between the terminals.

In radio we use fixed and variable condensers. A fixed condenser consists of two or more conductors (plates) separated by a dielectric. In a practical fixed condenser the dielectric is rarely air. Generally it is mica, waxed or bakelised paper.



Typical examples of commercial fixed condensers.

Plate Area.

We can increase or decrease the capacity by varying the total area of the plates, the thickness or material of the dielectric.

If we double the thickness of the dielectric and keep the effective plate area the same we shall halve the capacity. Similarly, doubling or halving the effective area of the plates will double or halve the capacity.

Obviously, a commercial condenser cannot consist simply of two plates separated by a single thickness of dielectric, except in cases where the capacity is very small indeed.

But by joining a number of plates together, as in the sketch on this page, it is possible to increase the capacity to any desired extent without making the condenser unwieldy.

The capacity of a fixed condenser can be worked out from the expression: $C = \cdot 0885 \frac{KA}{d}$

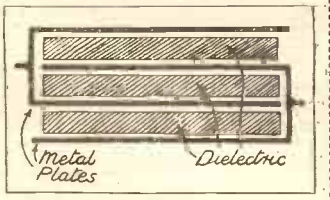
where C = capacity in microfarads; K = the dielectric constant; A = the effective area of the plates in square centimetres; and *d* the dielectric thickness in centimetres.

Variable Condensers.

In this expression it is assumed that the plates are flat, the effective area being that portion of the plates which actually overlap.

The dielectric constant varies according to the material used. Air is unity, or 1. Mica may be anything from three to eight, depending upon the particular grade employed. Rubber is about two, and bakelite from four to eight.

HOW IT IS MADE



This practical illustration shows how the metal plates are separated by a dielectric, usually mica, paper or ebonite, in a fixed condenser.

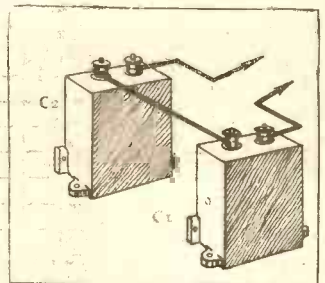
In a variable condensers one set of plates or vanes is arranged so that they can be interleaved with a second set of vanes to any desired degree.

The moving vanes are mounted on a common spindle and are rotated either directly by means of a knob or indirectly through gearing. Thus the moving vanes can be rotated into any position in relation to the fixed vanes.

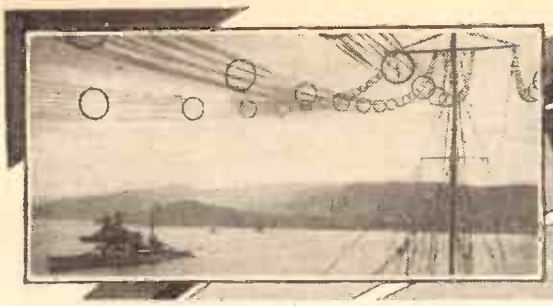
Usually the dielectric is air, but in some instances, e.g. where compactness is essential, a solid dielectric is employed.

There are also semi-variable or preset condensers. These components are virtually fixed condensers, having a screw adjustment giving variations in capacity value between certain limits.

THE FORMULA



When condensers are joined in series the resultant value is given by the formula $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$ where C is the total capacity.



INTERFERENCE OLD and NEW

Mutual interference between stations is one of the biggest problems that radio engineers have to solve. It has been with us ever since wireless became a popular means of communication, and below is a review of the subject from before the Great War until the present day.

By G. H. DALY.

ALL the world knows about the chaos in the ether nowadays, and there is much wailing and gnashing of teeth over the interference to one's favourite programme.

Interference, or jamming as it is called in the wireless vernacular, is as old as wireless itself. It began in the very early days when engineers found that if a number of wireless transmitters were radiating at the same time they completely jammed each other.

Sir Oliver Lodge solved the difficulty, to a certain extent, by inventing the principle of tuning: he discovered that if the electrical circuits in the wireless transmitters were tuned to different wavelengths or frequencies they did not interfere with each other to the same degree as otherwise.

One Noisy Buzz.

In the first decade of the twentieth century, when wireless stations and wireless-equipped ships were few and far between, jamming was not a serious proposition. Following the disaster to the Titanic in 1911, however, wireless became very popular, many more ships were fitted and land stations erected. The English Channel was soon one noisy buzz, each ship trying to forestall the other in attempting to get its messages through to the Post Office land stations.

The Post Office, which had taken over the control of British wireless communications following the Telegraphy Act of 1906, tightened up the regulations and, following an international convention, the present system regarding the ordering and conduct of messages was brought into force.

Early Incidents.

The famous S O S, or, as it had been previously, C Q D, was given, of course, priority over all other messages. Thus a certain amount of order was obtained, and the wireless traffic, which had hitherto been in very much the same state as the present wireless situation in Europe, was properly regulated.

The first and perhaps most famous jamming incident in history occurred at the outbreak of the war. Two German warships, the Goeben and Breslau, were cruising in the Mediterranean when war was declared. The Mediterranean Fleet naturally attempted to capture these two German warships—a naval victory at this moment would have been invaluable to the Allies. Unfortunately, owing to delay and confusion in orders, particularly wireless orders, both ships escaped.

German Wireless More Efficient.

Right up to the last moment they were followed by H.M.S. Gloucester, and the latter ship actually engaged the Goeben, while all the time the wireless operator on the Goeben was "sitting on his keys," i.e. radiating unnecessary signals in order to jam the wireless messages from H.M.S. Gloucester to the admiral at Malta, and thus prevent helpful information being obtained.

In those days the German wireless was more efficient, in some respects, than the British system, because the Telefunken system radiated a higher-pitched note than the British system. A higher note is much easier to hear through jamming and atmospherics than a low note.

All through the war a regular system of jamming was used by either side, and as in naval warfare instructions and signals from the commander-in-chief are particularly vital, effective jamming by ourselves and the enemy played quite an appreciable part in many engagements

Not Sufficient Separation.

Perhaps the biggest jam of all occurred in the battle of Jutland, for in this case a large number of ships engaged one another in close proximity.

It will be seen, then, that the problem of jamming is really nothing very new; and just as the question has been settled in the commercial and marine wireless service, so in the same way will the present muddle be cleared up.

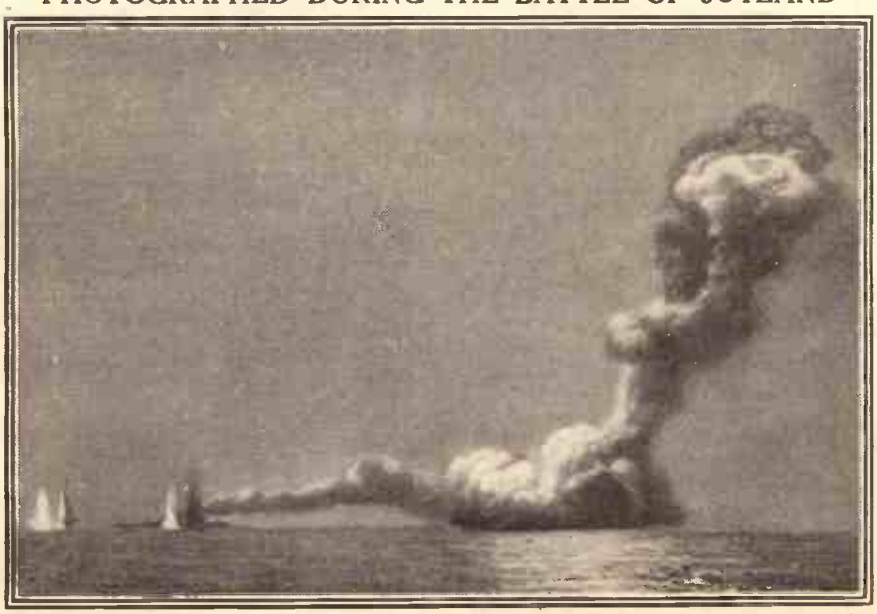
The main trouble to-day is that the various broadcasting stations, particularly on the medium waves, have not sufficient frequency separation between them. The various heterodyne whistles which you hear emanating from your loudspeaker are the result of two stations beating together, thus producing the whistle which you hear.

For instance, if two transmitters are separated by, say, 5 kc. (5,000 cycles), you will hear a beat note having a frequency of 5,000. So it is obvious that if interference-free reception is desired the various broadcasting stations should be separated by at least 10 to 15 kc., the beat note produced being well above audibility.

The Solution.

The solution is, of course, for the various national committees which forgather from time to time to have the backing of their respective governments behind them. Once this is done, the trouble will be stopped and wireless over Europe will become as orderly and efficient as that which obtains in marine communication, where all the nations of the world work in complete harmony—and jamming is the exception, never the rule.

PHOTOGRAPHED DURING THE BATTLE OF JUTLAND



In the Navy radio plays a very important part as a means of communication and it was, of course, used extensively during the Great War. Above you see an actual photograph taken from H.M.S. Lydiard during the battle of Jutland, showing H.M.S. Queen Mary blowing up.

THE "AVOMINOR"

IF every constructor possessed a range of good meters our queries would probably fall away by fifty per cent. But good meters are expensive instruments, and in these hard times many cannot afford to buy them.

But there is an alternative to a range of separate meters, and that is a combination instrument. These, however, are not always as good as they might be, although there are exceptions. Especially, in my opinion, the AvoMinor which has recently been introduced.

It is almost enough to say that this is a junior version of the very famous Avometer which is to be found in practically every radio factory in the land.

And the AvoMinor, despite its pedigree and its efficiency and precision, costs only 40s. in a nice case, and with leads having interchangeable crocodile clips and testing prods.

It is a high-class moving-coil instrument suitable for both mains and battery measurements.

There are no external shunts, it is completely self-contained, yet it provides no less than 10 separate ranges. These are 0–6, 0–120 and 0–300 volts for H.T., L.T., G.B.; mains and mains apparatus measurements, 0–6 0–30 and 0–120 milliamperes for testing all radio valves, etc.; and 0–10,000, 0–60,000, 0–1,200,000 and 3,000,000 ohms for all radio-resistance measurements.

Ten separate ranges of readings are possible without external shunts on the "AvoMinor."

Such versatility is extraordinary in view of the compactness and price of the instrument.

It is very easy to handle and sufficiently robust to stand the "heavy-handed" treatment such a device might receive. The scale is wide and clear and the needle alert and dead-beat in action. Its accuracy, too, is just what we should expect of an "Avometer."

I have no hesitation in recommending it to "P.W." readers as excellent value for money.

At the same time as the Automatic Coil Winder and Electrical Equipment Co., Ltd., sent me a sample of their attractive AvoMinor they also sent one of their new Universal Avometers, which is an improvement on their original Universal Avometer.

This is a "senior" measuring instrument especially suitable for service men and test engineers, and is such a fine proposition that I propose to reserve a separate write-up for it in a future issue.

A USEFUL COMBINATION CONTROL

In quite a number of cases reaction controls are marked "Volume" on commercial sets. This practice was at one time regarded as most improper, and such words as "masquerading" and "misleading" have been applied to it.

But *autres temps, autres mœurs*, which is French for "some of the things which we do would have made our grandfathers have fits" (free translation!).

The change that time has brought about in this case is the muzzling of reaction. Practically every set has at least one S.G. or H.F. pentode these days, and this acts as a barrier against radiation.

However much the operator swishes about with his detector-reaction adjustment, he is the only one who suffers: the squeals do not with any appreciable strength reach the ether.

So if a knob marked "Volume" causes distortion and squeaks if it isn't used gently—well, it's a temperamental control, that is all, and not a disturber of public amenities.

And it does control volume within wide limits, so there can be no ethical arguments against so labelling it. All providing, of course, that the set really is a non-radiating set.

This is the R. & A. "Alpha" speaker which was dropped by the Technical Editor several times in the course of his tests. It was none the worse for this deliberate ill-treatment.

If, in addition to a reaction control, the set has a variable-mu H.F. sensitivity control, there are two "volume" adjustments which can quite well be linked together, for reaction is not needed—should not, in fact, be used until the receiver is "all out" in regard to its normal H.F. amplification.

Clearly a combination control is the logical development, and this we have in the Utility Combined Volume Control and Reaction Condenser.

This comprises a potentiometer ganged to a special ·0003-mfd. reaction condenser, which can be of either the plain or differential type, as desired.

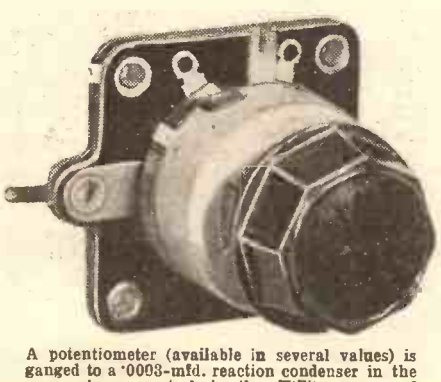
Both are, of course, operated by the same knob, but not simultaneously. The first 180 degrees of movement varies the potentiometer and a remaining 90 degrees the reaction condenser. A very excellent scheme most satisfactorily applied.

The movement is perfectly smooth, and is, in fact, as good as that of any single component of the kind.

The gadget can be obtained with any one of three different potentiometer resistance values, and these are 5,000 ohms, 10,000 ohms and 25,000 ohms.

But it should be noted that only soldering tags are fitted. Perhaps Messrs. Wilkins and Wright will let us have a terminal model in due course. I hope so, because otherwise so many constructors will not take advantage of this latest aid to better and simpler radio.

Soldering is an easy enough process to carry out, but the fact remains that tens of thousands of constructors will do almost anything to avoid it. Not that, on the whole, they lose much, because *nearly* every component has its "terminalised" models nowadays.



A potentiometer (available in several values) is ganged to a ·0003-mfd. reaction condenser in the new volume control in the Utility range of components.

A NEW R. & A. REPRODUCER

I am now going to tell you about a new loudspeaker which will, I am sure, command the immediate interest of every constructor. Indeed, its practical features are such that it must surely have been designed by some super-constructor or, more probably, a bunch of very clever engineers with vision.

It is a moving-coil instrument so made that the entire diaphragm and special coil can easily be removed for inspection and cleaning, should this ever become necessary. With one magnificent gesture R. & A. have thus killed one of the most popular themes of "P.W." Radio Wrinkle writers! No longer will they need to exercise their imagination and ingenuity in devising countless schemes for dealing with the delicate operation of removing and replacing speech coils—at least, in so far as this R. & A. reproducer is concerned.

Further, this R. & A. "Alpha," as it is called, with its special diaphragm-supporting system, can stand up against all kinds of mechanical shocks which would ruin many others.

I don't think it is too much to say that it has the delicacy of response equal, if not superior, to any other speaker within crowns of its price, plus an almost revolutionary robustness.

You mustn't drop a speaker on the floor if you can possibly avoid it as a matter of principle, but I deliberately dropped this "Alpha" *several times*, yet it still took anything from a two-valver output up to some 8 watts without any signs of this terrible ill-treatment!

And it costs 52s.6d., with either a 6-ratio transformer for all kinds of power and pentodes, or a universal transformer for Class B, which seems to me to be very reasonable indeed.

As a speaker pure and simple, and ignoring its special design features, it is first class, and "P.W." readers should make a point of trying to hear it at their local dealers.

Weekly jottings of interest to buyers.

I WONDER how many battery users are still using a straightforward output valve when they might be enjoying all the advantages of the Class B method of amplification. Perhaps not nearly so many as I imagine; and yet I wonder!

With Class B, as with practically everything else in radio, one is apt to regard it at first as just another nine-days' wonder, and, however firmly the scheme may ultimately be established, there is a tendency for that first impression to linger on.

I don't want to be dogmatic about it, but I for one am convinced not only that Class B is here to stay, but that it is likely to occupy the attention of technical designers in the future even more than it has in the past. Isn't there ample proof in the entirely new combined driver and Class B valve that has just been produced by Hivac, and which was introduced exclusively to "P.W." readers in the last issue?

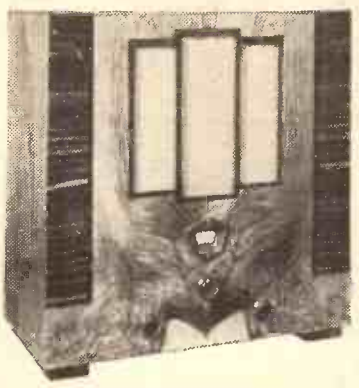
An Excellent Valve.

From what I hear with my ear to the Research Department keyhole, I gather that our technical people are very enthusiastic about this newcomer, and, in my humble opinion, not without reason.

Why not try it yourself? It will cost you 15s. 6d. for the valve, and if you buy one to

(*Continued on page* 778.)

RECEIVERS of RENOWN



THE BRITISH RADIOPHONE "MATCHED PERFECTION" SEVEN BATTERY SUPERHET.

GIVE a dog a bad name and hang him. Talk to the home constructor about a seven-valve battery set and he'll show you the door, perhaps not too politely. Somehow it is difficult to associate seven valves with a dry battery—more especially seven valves in a superhet. Then why is everyone talking so enthusiastically about the new British Radiophone "Matched Perfection" Seven?

The reason is not far to seek. Take a glance inside the cabinet of this receiver—the one we have here, all ready for test. Anything odd about it? Yes, you're quite right. Only five valve holders, and they call it a "seven-valve superhet." Strange, isn't it?

And yet not so strange on closer investigation. You haven't forgotten the Westector, or "cold" valve, surely? Well, that is the secret of this new British Radiophone success—that and the fact that a unique design is supported by one of the most up-to-date and best-equipped radio factories in the country.

"Your Satisfaction and Pride."

The "Matched Perfection" Seven is a receiver which you can build yourself. To call it a "kit of parts" would be to minimise its importance. It is a first-class commercial receiver design. But instead of paying a mechanic to assemble and wire it for you in a factory, you do all that for yourself. There is much fun to be had from a few odd components and straggling wires in a home-designed experimental set. But that fun is as nothing compared with your satisfaction and pride at having built for yourself a receiver which will not only compare with but often surpass the dearly bought instruments of your friends.

But the chief point about the whole thing is that you have no need to know anything about superhets. You may never have seen a superhet in your life, let alone built one, but the construction of the "Matched Perfection" Seven holds no terrors for you. The incorporation in the circuit of a British Radiophone Superheterodyne Radiopak (a component to which readers of POPULAR WIRELESS need no introduction) has simplified the construction to such an extent that there is no need to worry about coils or condensers or anything like that.

Europe is Yours to Command.

On the Radiopak there are a dozen or so terminals. Connect them to the few, the very few, other components which comprise the circuit—and all Europe is yours to command.

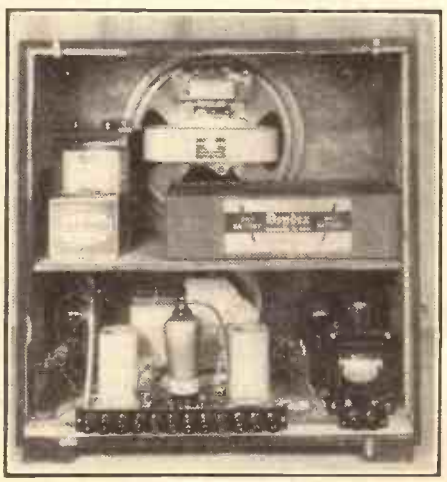
Without any exaggeration, the construction of the seven-valve superhet is easier and quicker than building many a "straight-three" set of the cheaper kind.

There are no less than ten tuned circuits it is stated: ten tuned circuits with single-knob control! That of itself is an achievement which nothing can belittle, for it combines the stringent efficiency of modern tuning demands with the prevailing tendency for "a set which the family can work." But the "Matched Perfection" Seven has still more to commend it.

It uses three screen-grid valves, two of them of the most recent multi-mu type. It has a pentode in its output stage which gives an undistorted output of over 1 watt, much more than adequate for all domestic requirements. And it has its two Westectors.

This is a seven-valve superheterodyne receiver which uses "Westectors" in two of its stages for economy of operation, thereby ensuring the advantages of superhet operation with the use of dry batteries.

HOME-MADE PERFECTION



The tidy and "commercial" appearance of the completed receiver makes it hard to believe that it is entirely "home made." The results, too, are far above those which one usually expects from a receiver built up from selected parts.

One of these "cold" valves acts as the second detector, thus saving the current which an ordinary valve would take in this position. The other carries out the important duty of automatic volume control—and carries it out to perfection. This A.V.C. really *is* automatic and really *does* prevent the "blasting" effect of a strong local station and also reduces the fading of weak distant transmissions.

Were these two Westectors in the circuit simply and solely to carry out their respective pieces of work, their use would be justified. As it is, they make all the difference between impossibility and practicability in the use of a battery for this receiver.

No "Concentric Trimmers."

There are three controls only on the "Matched Perfection" Seven. And three controls only mean that there are no additional "gadgets" hidden away at the back or sides which need attention. Control number one, on the left, switches the receiver on and proceeds to increase the volume the further it is turned to the right. Number two, in the centre, is the one-knob tuning which allows you to pick out station after station immediately and without any adjustments of concentric trimmers and such like. On the right is the wave-change and gramophone switch, for this set, like all modern designs, has its pick-up terminals at the back.

That is all there is to it. Three knobs—and all the stations of Europe at your command. Which brings us, when we have very little space left, to the actual tests of the receiver under working conditions.

The range and selectivity are amazing to anyone who is not used to superhets. But what struck us particularly was the quality of the reproduction. Tonal balance in the reproduction of both speech and music is most pleasing, and the bass response is entirely free from boom. That, to our mind, is one of the most important points of this important receiver.

Calibrated in Wavelengths.

The tuning of the receiver is, literally, child's play. Any child can turn a knob (most children would enthusiastically acclaim the opportunity to do so!) and that is all that is involved to bring the programmes tumbling in not "one on top of the other" but, rather, one after the other.

The calibration in wavelengths on both the long and medium bands is sufficiently accurate to offer more than an approximate guide to the positions of the principal broadcasters, so that a list of stations and their wavelengths is sufficient data for finding the more powerful European stations.

There is much more we could say about the "Matched Perfection" Seven, but we must refer you for that to the manufacturers, whose constructional chart (with a complete list of the parts needed and their prices) is a masterpiece of efficient simplicity.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos.

Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work, carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

TONE CONTROL ON THE "P.W." APEX.

H. P. (Southampton).—"I have built a 'P.W.' Apex, and, although the results were quite good, I decided to add a tone control.

"When this is wired up I find that with the control knob in the central position the reproduction is hopelessly blurred.

"On either side of the centre the volume is reduced by more than half. Can you suggest a reason?

"The set is built of specified parts with the exception of the S.G. H.F. choke, which is a Lissen Astatic. Is it possible that this is causing the trouble?"

You do not give us enough details to enable us to diagnose the trouble definitely, but it looks as though you have "slipped up" rather badly somewhere.

The proper method of tone-controlling the Apex was described in an article in "P.W." dated October 22nd, 1932. It called for two new components, viz. a tone-control base for the Hypernik transformer and a 50,000-ohms potentiometer.

When these are used as described in the article there should be no difficulty, and although other methods of controlling tone are possible this is the one we recommend.

The astatic choke named is perfectly satisfactory for the circuit, so we do not think its use has anything to do with the results you are experiencing.

A SOLDERING S.O.S.

G. W. (Maidenhead).—"Barring 'Pacifists' and chewing-gum there is nothing under the sun that I hate so heartily as soldering! Dirty, smelly, fizzly business—oh! how I admired "P.W.'s" pluck in chucking it overboard and announcing that well-screwed-down joints were perfectly satisfactory!

"They *are*, as I have proved again and again. But what can you do when you recommend a set to a young friend, who is another solder-hater, and he finds that on one of the components there are *no terminals* or other means of connecting *except rotten little soldering tags?*

"Shall I advise him to use a fairly fine wire for connections, and clean this carefully, afterwards wrapping it round and round the tag as tightly as possible? Or what?

"(And please don't suggest that soldering is not too difficult after all, because it would spoil all his pleasure to come down to using a soldering iron. And, anyhow, he hasn't got one!)"

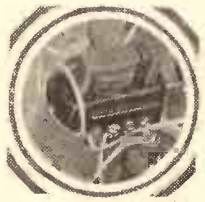
This is a point that is not often raised, G. W., but undoubtedly there are other readers who have wondered what is the best thing to do in a case of that kind.

We do *not* recommend the "twisting-wire-round-it" stunt. It may be quite satisfactory for a time, but there is always a liability to crackles creeping in through bad contact. And even soldering is not more annoying than a persistent crackle!

An easier way, and one which is infinitely better, is to put the component in question, and leads of ample length, in your pocket one day when you are going past a garage or a tinsmith's. If you call in and explain the difficulty to a mechanic he will do the job properly in a jiffy, and will think so little of it that the financial side will be nothing to worry about.

When the component is placed in position in the set the leads can be clipped to the right length, and you will have the satisfaction of knowing that the contact at those points is perfect.

For whatever grouches there may be against soldering there is nobody who denies that, properly done, it results in a good joint.



FOR BETTER RADIO

THE ADVANTAGES OF IRON-CORED COILS.

One of the most striking of the recent advances in radio reception is the introduction of iron-cored tuning coils.

* * *

Iron cores have long been used for low-frequency apparatus—chokes, transformers, etc.—but many difficulties stood in the way of their use in high-frequency circuits. These have now been overcome, and a core of fine iron "dust" is employed, embedded in insulation.

* * *

High inductive values are thus obtainable in a very small space. Shielding is simplified because of the compactness achieved, and the H.F. efficiency is very high indeed.

THOSE TRICKY TAGS.

The following letter from an Exmouth reader is well worth noting, as it affords excellent proof of the lots of trouble that a little soldering tag can cause when it is left where it can make unwanted contact with an adjacent conductor.

"With reference to previous correspondence re my "S.T.500," I have found out what is wrong, and the joke is against me!

"I had left one of the tags on the output terminals of the choke, and it was shorting to one of the other terminals, throwing everything out of balance.

"I now join the larger company of satisfied constructors of the 'S.T.500.'"

SHOULD CLASS B AMPLIFICATION GREATLY INCREASE THE VOLUME?

M. J. (Great Yarmouth).—"I quite expected to find a big increase in the volume of the 'S.T.500,' which uses Class B, as compared with the 'S.T.400,' which had no Class B valve.

"As a matter of fact, I find that now I can hardly get any increase in the volume as against the '400's,' though I am quite certain that the new set is perfectly in order as regards wiring, components used, etc.

"How do you account for this? Quality and so on are perfect, and the only thing I am disappointed in is the lack of extra volume."

It would appear that you are not correctly comparing the merits of the "S.T.500" with those of the "S.T.400."

Although the "S.T.500" is a four-valve set, it has only three stages of voltage amplification, as the Class B stage is primarily a power generator. In other words, the Class B stage is a special output stage, which enables large output volume to be obtained without distortion. The Class B stage only affords comparatively low amplification.

It is not generally realised that if the power output (A.C. watts) given by a set is doubled, there is only a barely audible increase in volume. The "S.T.500" gives 1·5 watts undistorted output with an H.T. voltage of 120, while an ordinary super-power valve gives about ·3 watt undistorted output.

The greater power output of the "S.T.500" may not be very obvious except on the local station so far as the actual volume is concerned, but it ensures much better quality of reproduction.

The ordinary super-power valve usually causes distortion, due to overloading on loud volume "peaks," but with the Class B output this is avoided.

We trust that the foregoing explanation will clear up your difficulty.

WHEN YOUR NEIGHBOUR'S SET IS OSCILLATING.

W. H. F. (Strood, Kent).—"We, like other people with wireless, get our share of oscillation.

"Can you tell me, when other people oscillate and we receive it through our speaker, does it go down their earth or to their aerial after leaving their set? If so, does this proclaim that a receiving set has the ability to *transmit?*"

When a receiving set oscillates in its aerial it sets up an ether disturbance like that of a transmitting station, but, of course, on a smaller scale.

If the set in question employs an S.G. valve in such a way that the oscillations do not affect its aerial-earth system there may be little or no radiation from it.

If, however, the oscillations are allowed to affect the aerial-earth circuit they may be radiated and cause interference for quite long distances—whole districts may be affected and other sets located several streets away may have their reception ruined.

(Such interference has been heard several miles away from the oscillating set, but generally it is a matter of less than a mile.)

The "transmission" comes, as in the case of a broadcasting station, from the currents flowing in the aerial and earth attached to the oscillating set. And, therefore, if your aerial is very close to that of an oscillating set, or if you use the same earthing point, you are bound to get interference.

It will thus be seen that such a set *is* a transmitter on a small scale. And the owner is violating the terms of his licence when he allows the interfering oscillations to take place.

Complaints of interference of this kind will be dealt with by the Post Office, who will do all in their power to stop the nuisance.

"P.W." PANELS, NO. 150.—RADIO SUISSE ROMANDE.

Familiarly known as Sottens (where it is situated), this station is now working on 403 metres. On Jan. 15th, 1934, it will change wavelength to 443·1 metres.

* * *

The power employed is 25 kilowatts, and the station is often well received in this country. Distance from London, 465 miles.

* * *

The programmes originate at Lausanne and Geneva, so these names are often given by the announcers (Geneva also has a low-powered relay on 760 metres).

The announcements from Radio Suisse Romande are in the French language.

GRID-BIAS CONNECTIONS FOR THE CLASS B VALVE OF THE "S.T.500."

Although clear instructions were given re the above, some readers who are using other than the type of Class B valve used in the original set appear to be in difficulties with grid-bias connections.

There should be no difficulty at all. Mr.

(*Continued on next page.*)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from previous page.*)

Scott-Taggart mentions in his articles on the "S.T.500" that the B.21 is the *only* Class B valve requiring grid bias.

Therefore if any other Class B valve is used the G.B.—2 lead (No. 23) should *not* be taken to —4½ volts on the grid-bias battery, but connected instead to the L.T.—, H.T.— or G.B.+ terminal.

THE COILS FOR THE "P.W." "DOUBLE X" THREE.

W. B. (Chatham).—"I am writing to you asking for your assistance over two points of your 'Double X' Three.

"I am only a novice at the game. I bought a two-valve set last April, and, like a good many more people, it pays to look before you leap!

"No doubt the two-valver is a very fine model and gets good results, but what an expense for running it! Of course, all connections are soldered.

"The first H.T. battery supplied with set ran for 9 weeks (120 H.T. and bias combined in one); since then 6 or 7 weeks is the limit, and a friend of mine (he is rather smart on wireless, being a crystal-set owner who has built many sets since) tells me that I cannot alter it owing to the circuit. So I am scrapping it and going to try your 'Double X' Three.

"In your list of parts in 'P.W.,' Dec. 2nd, you gave no H.F. transformer, only L.F. being quoted. And can you give me points in H.T. battery for No. 2+ and wander-fuse?"

The H.F. transformer is exactly like the aerial-coil unit, (also an H.F. transformer), and it is these two that are the first items in the list of components, viz. "1 pair matched screened iron-cored coils."

One is called "H.F. transformer" and the other "aerial coil," because that is how they are used in the set. But actually they are exactly alike.

H.T.+2 goes to the maximum voltage socket on your H.T. battery and the wander-fuse goes in the H.T.— socket.

THE MIRROR OF THE B.B.C.

(*Continued from page 762.*)

These will include eight of Gilbert's Bab Ballads. The Midland Studio Chorus will also sing two of Mr. Beecham's part-songs, "I Loved a Lass," and the "Dialogue in Praise of the Owl and the Cuckoo."

"Non-Stop" Music.

The pot-pourri, or non-stop hour of music, is a form of entertainment which various conductors have popularised from various continental broadcasting stations. On Thursday and Friday, January 4th and 5th, respectively, Dr. Julius Burger, of Vienna, will conduct the B.B.C. Theatre Orchestra for Regional and National listeners.

The programme, which will consist of an elaborate score of one of his most successful pot-pourris, is entitled "Vienna." Mainly it will be the music of Johann Strauss and Joseph Lanner.

"Four Bells."

If you listened to the play called "Four Bells," by H. J. Berry, which was broadcast about five years ago in a programme called "Down to the Sea in Ships," you may remember how this mystery of the sea worked out.

On the other hand, if you did not hear it, or have forgotten it, you will be able to enjoy its revival on the North Regional wavelength on Friday, January 5th.

A Blackpool Night.

Blackpool Nights are, of course, the great events of the summer for all who can wend their way to the famous Lancashire coast resort. But Blackpool wants you to know that its "Nights" go on all the year round, and that the holiday spirit by no means departs with the swallows.

On Wednesday, January 3rd, North Regional listeners are to be taken on a tour of the various places of amusement which Blackpool offers—places where there is dance music, organ solos and vaudeville entertainment. It should be an enjoyable tour.

THE LISTENER'S NOTEBOOK

(*Continued from page 762.*)

One has also noticed during the year the B.B.C.'s fondness for those musical medleys reviving songs of bygone days, Victorian, Edwardian, pre-war and so on. Here, again, it trod on sure ground. Similarly, with songs now associated with particular music-halls, the B.B.C. anticipated certain success.

* * *

The Brighter Sunday Movement is one of the outstanding innovations of the year, and one that met with instant approval. A certain moderation, however, has characterised this. The Shakespeare broadcasts have been exceptionally brilliant, which should encourage the B.B.C. to give us more of them.

The most recent play, "Julius Cæsar," wasn't by any means the best, though I was glad to see so many fresh names among the cast. It's greatest fault was the excessive speed at which it moved along. Robert Donat as Brutus, and to some extent Ralph Richardson as Mark Antony, delivered their speeches at a rate that made listening a trial. Following from a book, I noticed several mistakes in the lines, and interrogative sentences were often converted into affirmative ones. The intonation wasn't always correct, either.

* * *

In these plays the B.B.C. seems to be overcoming the crowd difficulties. After all, much—in fact, all—can be done by suggestion. The crowd scenes in "Julius Cæsar," for instance, while they revealed little more than a crowd of four citizens, were perfectly adequate. But the length question doesn't seem to

(*Continued on next page.*)

THE LISTENER'S NOTEBOOK

(Continued from previous page.)

be so easily settled. In spite of excessive cuts, a Shakespeare play is a long affair. Personally, I wouldn't have it shorter, but I do deplore the obvious efforts of the cast to get through with it before listeners begin (as the cast appears to think they do) to grow weary. If we are to have Shakespeare, as I'm sure we ought, let us have it unspoilt by an attempt to crowd it into prescribed limits which are impossible.

* * *

The political talks, too, were something new this year—probably the beginning of yet greater things to come.

* * *

Saturday evening items, while we appreciate their popular flavour, fell far short of similar fare of former years. In the "Escape" and "Hazard" series we undoubtedly had the good wine first, and it will be a rare vintage indeed that eclipses them. Yet we live in hopes.

* * *

Lastly, we notice with regret that the B.B.C. is still without a good-story teller. In fact, it hasn't a story-teller at all now. What better entertainment is there than a good story? Truly, I am amazed at this state of affairs.

THE LINK BETWEEN

(Continued from page 774.)

use in the set that was described in our last issue you will be eligible to compete for a nice crisp five-pound note! No, I'm not joking. The High Vacuum Valve Co., Ltd., who are, of course, the makers of this new valve, are offering a prize of £5 for the best 80-word postcard report of the set, and it might just as likely come your way as not.

Make a special note of the closing date. All postcard reports must be in by January 23rd, 1934. Kindly note, too, that all entries must be addressed direct to the High Vacuum Valve Co., Ltd., at 113–117, Farringdon Street, London, E.C.1. Build the set, win the £5, and then, out of the kindness of my heart, I will agree to come and help you spend it! And if there is anything else you would like to know about the competition, just drop a line to Hivac's. They will be pleased to give you what I believe is known in the States as the "lowdown."

Mr. W. O. TWELLS.

It is with deepest regret that we have to record the death at the age of 45 of Mr. W. O. Twells, of H.M.V., after an illness of only one week.

Mr. Twells, who for five years was in charge of the Radio Advertising Department of Columbia, joined the staff of H.M.V. in May of this year. His likeable personality and his unbounded zeal for whatever he undertook were characteristics which earned for him the admiration and respect of all who came into contact with him, and his loss to the Industry will be keenly felt.

THE HOME RADIO DOCTOR

"RADIO UPKEEP AND REPAIRS FOR AMATEURS," by Alfred T. Witts (Pitman, 5s. net). It is the complete home radio doctor. In 152 pages it has 104 illustrations, 88 of which are reproductions of photographs; and it has a really satisfying index.

The author is not only an amateur, but a professional radio man—a perfect combination for a book of this kind—and therefore he has something to teach the non-technical listener, the beginner, and the experienced constructor. It is specially valuable to anyone who is thinking of trying to make a connection as a radio "doctor." Get a copy and give it to yourself for a New Year gift.

E. B.

MORE READERS PRAISE "THE MANUAL OF MODERN RADIO."

"THANK YOU" FOR PROMPT DELIVERY.

(*From E. Laurence, 21, Wickham Lane, Plumstead, S.E.18.*)

"Thank you very much for sending 'The Manual of Modern Radio' so promptly.

"It is a book that no beginner or amateur should be without. Wishing POPULAR WIRELESS every success in the future."

"A WONDERFUL BOOK."

(*From W. Newton, 4, Barnett Street, Macclesfield, Cheshire.*)

"What a wonderful book it is! I am more than delighted with it. I am also very much taken up with POPULAR WIRELESS, which comes out every week."

"MOST COMPREHENSIVE WORK."

(*From W. Reeder, Kings Road, Fakenham.*)

"It is a most comprehensive work, and has surpassed all my expectations. It's a book all should own."

"AN IDEAL TEXT-BOOK."

(*From C. D. Davies, 11, Wyndham Street, Ton Pentre, Rhondda.*)

"It is the most comprehensive treatise on present-day wireless practice I have yet seen, and you are to be commended upon such a production.

"It is an ideal text-book or book of reference, and one which every 'P.W.' reader should be proud to possess."

CAN YOU WRITE A RADIO PLAY?

Here are the simple rules of "P.W.'s" £50 prize offer. No entrance forms are needed. Just write your play and send it in.

1. **POPULAR WIRELESS will give a prize of £50 for the best original radio play—comedy or drama—written by a "P.W." reader.**
2. **The B.B.C. will undertake to produce and broadcast the winning play.**
3. **The plays submitted will be judged by a member of the B.B.C.'s Production Department, the Programme Critic of THE WIRELESS CONSTRUCTOR and the Editor of POPULAR WIRELESS. The decision of the Judges must be accepted as final.**
4. **The latest date for submitting a play has been fixed as March 31st, 1934.**
5. **Plays should be addressed to The Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4. Envelopes should be marked "Radio Play."**
6. **While every care will be taken of MSS. submitted, the Judges cannot guarantee return of MSS. Plays submitted must be accompanied by stamped, addressed envelopes.**

"THE GOODS."

(*From E. Dunkin, 36A, Morgan Road, Bromley, Kent.*)

"Have just received your marvellous book. It is the goods in every respect, a book which I, as an amateur, have been wanting for a long time."

AN "INSTRUCTIVE VOLUME."

(*From F. W. Smith, 11, Newborough Avenue Sefton Park, Liverpool.*)

"Very many thanks for 'The Manual of Modern Radio.' I am very pleased with same, and think it a very useful and instructive volume to everybody interested in wireless, either amateur or professional. It will have an honoured position on my bookshelf."

"DELIGHTED WITH IT."

(*From C. I. Joyce, 18 Annesley Road, Newport, Mon.*)

"'Manual of Modern Radio' just to hand. I feel delighted with it. I am looking forward to many happy hours of interesting and instructive reading. This gift-book definitely puts you on top among the many other wireless publications."

"A VERY LUCID STYLE."

(*From O. H. Hughes, 102, Dumfries Street, Treorchy.*)

"Many thanks for 'The Manual of Modern Radio.' I must say that Mr. Scott-Taggart has a very lucid and fascinating style of writing, and he has the gift of making a difficult subject as clear as the sun on a summer morning, as well as interesting. I shall certainly recommend it to my radio friends."

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Making Your Own Records.

During the past three or four festive seasons several different types of home-recording apparatus have been put on the market, and some of these have met with quite large sales, showing that there is undoubtedly a demand amongst listeners and experimenters for some means of making their own records at home. This is not surprising, because, if it were not for the technical drawbacks which have so far been met with, making records at home, amongst a party of friends, is very entertaining and amusing.

A Question of Reproduction.

The difficulties up to the present seem to have been, first of all, that it was quite a hazardous business making these records at all, and secondly that the record, when made, could not be properly played with an ordinary needle and, in any case, did not last long. In addition to all this, the reproduction from these home-made records was usually pretty dreadful!

When you consider that the method which has been used is to record on a disc of aluminium (or such-like medium-soft metal) and then to reproduce straight from the untreated surface, you will see that at the best it must be but a poor compromise, and anything in the nature of really good results can hardly be expected.

Many people have felt that satisfactory results could never be obtained until we had some method of making the record soft *whilst it was being recorded* and then *hardening it up*—that is, definitely changing its character prior to the reproduction. A number of attempts of this sort have been made on the Continent, and lately a British firm has brought out something on these lines which appears to meet the case quite well.

I should explain that, although I have heard the records made by this new process, I have not actually made them myself; the reproduction that I have heard was very good indeed, and I have no reason to doubt that the making of the record, according to the instructions, is quite satisfactory and within the scope of the ordinary user.

The Process Adopted.

These records are made on a thin aluminium disc as before, but this disc is covered with a kind of plastic varnish. It is, therefore, a simple matter to record the disc in the first instance. After it has been recorded it is baked for two hours in a specially provided electric oven (not unlike a sort of muffin dish).

After baking, the surface becomes quite hard, very similar to the surface of an ordinary commercial shellac record, and the record can then be played in the usual way with a steel needle. It is claimed, in fact, not only that it will operate just like a commercial record, but that it has the further advantage of being very thin and light and so saving in bulk and weight.

I have not the space to go into this matter any further at the moment, but those of you who are interested should get in touch with the manufacturers, Messrs. Musikon Limited, Lisle Street, W.C.2.

Class B and H.T. Consumption.

Now that Class B amplification has become so popular I often notice that people imagine that the use of this system gives you a power gain with, as it were, no outlay—I use the word "outlay" in the *power* sense, not, of course, with reference to outlay of money. It is often stated, for example, that the economy in high-tension current is such that a cheap high-tension battery of small cells is able to stand up to the work.

Remember the Driver.

Well, this impression is really quite wrong, because you have to bear in mind that current is needed for the Class B valve and the driver. For instance, with a conventional set employing a screen-grid high-frequency amplifier and power output, with a Class B valve in addition, the high-tension current will be increased.

Or perhaps I should say that, although you can run the circuit on a fairly low current, this may lead to distortion, and, by the time you have got things up to the proper degree of quality, you will find that your power consumption is not so small as you imagined.

For this reason it is a mistake to use a high-tension battery of too small a *capacity*—or, incidentally, of too small a *voltage* either.

Importance of Bias.

With the driver valve, as in other cases, the high-tension current depends upon the bias, and, since the impedance of the driver will be relatively low, it is important that the proper bias should be used, if only from the point of view of the H.T. consumption.

Loudness and Watts.

Talking about the output from a set, by the way, most people think of this as being "moderately loud," "quiet," "very loud" and so on, and I have met very few people

(*Continued on next page.*)

TECHNICAL NOTES

(*Continued from previous page.*)

who can think of loudness in the more correct terms of wattage output. Of course, there is no definite connection between the watts output of the set and the loudness, since the conversion of the electrical output from the receiver into sound energy depends very largely on the efficiency of the loudspeaker.

Nevertheless, modern loudspeakers reach a sufficiently uniform level of efficiency for us to assume *some* kind of general relationship between the watts output and the loudness. Anyhow, be that as it may, the fact remains that engineers talk in terms of watts output, and therefore it is useful to have some working idea of the sort of loudness to expect from an output of, say, half a watt, and so on.

Headphones and Loudspeaker.

As a general guide it would be reasonable to say that, with headphones, an output of 5 to 10 milliwatts should give you good volume. You know that the headphone requires much less energy input than a loudspeaker, since it is placed practically in contact with the ear, whilst the loudspeaker may be many feet away.

With a loudspeaker you generally want something like a couple of hundred milliwatts to give volume enough for an ordinary-sized room, whilst when it comes to a moving-coil speaker you can take it that one watt, or even a couple of watts, is desirable. I know that many sensitive moving-coil speakers operate on no more than half a watt, but, as I say, better results are obtained with a little more power. When I say "better results" I mean better *quality* and all-round performance.

Can You "Visualise" Loudness?

For public-address systems and outdoor work one sometimes hears of enormously greater outputs, 25 watts and more, but these are out of the question so far as radio reproduction in the home is concerned.

I think the foregoing will give you a general working notion of the relationship between volume and watts, which is often useful when you hear a thing specified in terms of watts and want to "visualise" what it will give you in terms of loudness.

Sensitivity.

Now that amplification is so easily available, both in the high-frequency and low-frequency parts of the set, people do not seem to worry so much as they used to do about the sensitivity of the loudspeaker itself. In the old days, the sensitivity of one speaker as against another was a very important matter.

But I think it should be treated just as seriously to-day, because, if the speaker is relatively insensitive, clearly it means that you have to make up for this with extra amplification *somewhere*, and this again nearly always brings you up against the question of quality. All this is quite apart from the question of running costs.

After all, when you have passed the signal energy into the H.F. end of the circuit, and amplified this through the various stages, until you get your final output from the set, the "last word" still remains with the speaker.

The Last Word.

Now, it seems rather illogical, after giving so much care and attention to every stage of the electrical part of the arrangement, to be indifferent about what happens at the final step, simply because this happens to be of a somewhat different character. If you have the choice of two loudspeakers, which are identical in all respects except sensitivity, one being twice as sensitive as the other, it means that the inferior one has to have twice the output energy supplied to it to give the same results.

When you think of it that way you see that the question of loudspeaker sensitivity is quite as important as the question of stage gain, or signal strength.