

A Very Easily-Made

A.C. RADIOGRAM

Described Inside

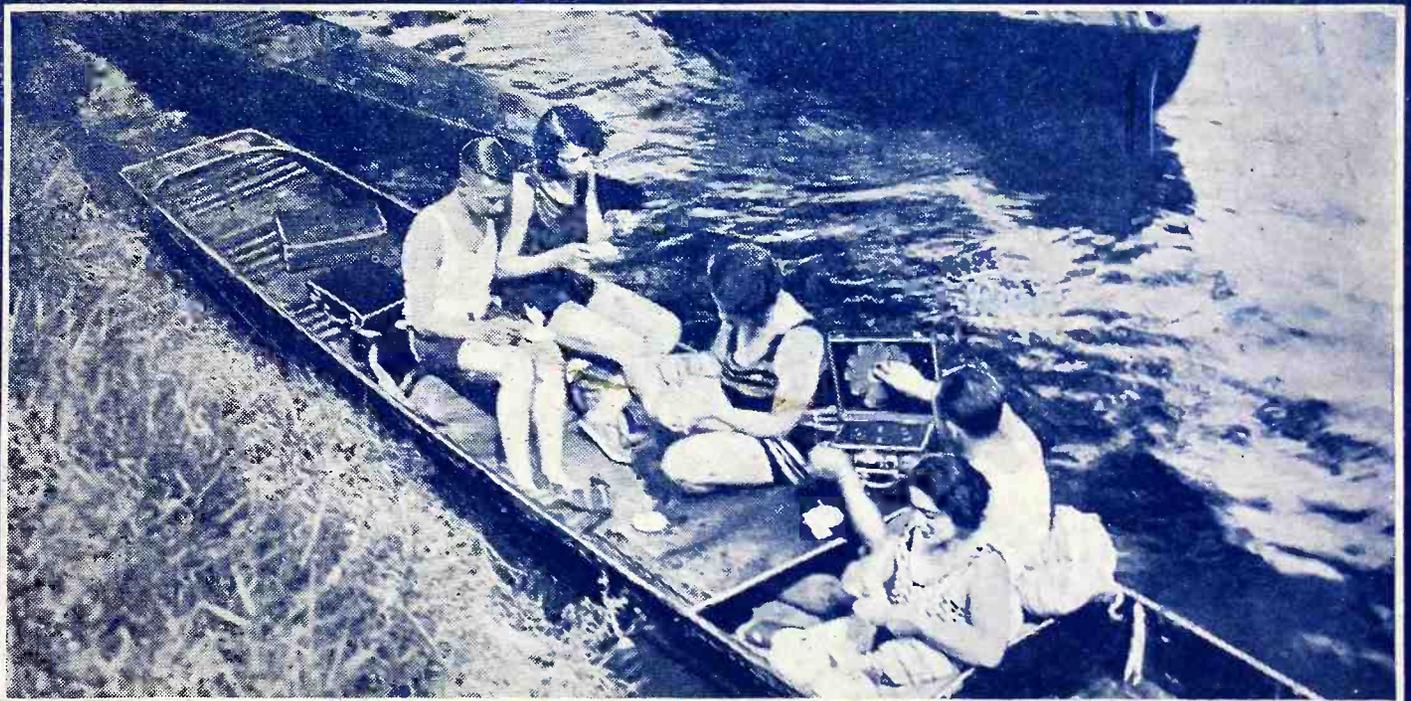
# Popular Wireless

Every Thursday  
PRICE  
3d.

No. 527. Vol. XXI.

INCORPORATING "WIRELESS"

(July 9th, 1932.)



**CAPTAIN ECKERSLEY**  
writes on  
**RADIO COMPONENTS**  
and  
**READERS' QUERIES**

*Also This Week:*  
**TOM CLARE ON RADIO HUMOUR**  
**STATIONS WORTH HEARING**  
**SHORT-WAVE NOTES**  
**WHAT HAPPENED AT MONTREUX**  
**LETTERS to a YOUNG "HAM"—By "ARIEL"**

**RADIO LUXEMBOURG**

□ □  
All about the new high-power station which will broadcast advertisements to Britain from the Continent.

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**KITS!**  
**COMPONENTS!**

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**READY RADIO**

# NEWS—VIEWS—AND INTERVIEWS (Continued)

and unemployed into contact? Why not a series entitled "Foundations of English Literature"?

### More Random Reflections.

WHAT is the B.B.C. doing to help the rising generation to become "air-minded"?

The life-blood of the country is trade. What is the B.B.C. doing to educate the youngsters for business?

What about a series of talks on "How to Invest Money"?

And why not a series on "Careers for Boys and Girls"? That comes very near to all families and fathers. Less about caterpillars and worms! More about domestic problems!

### The Bath and Crime.

CHUCKLING to myself over that bath of Sir John's at Broadcasting House, I am reminded of the unfortunate Leytonstone radio dealer who, whilst



ensconced in his bath, heard his plate-glass crash and, rushing downstairs (clothed in a blue print of our "Cosmic," I trust), saw three men lugging away one of his receivers.

On seeing this apparition the thieves dropped the set, but got away with most of the fragments. Moral: Don't sing in your bath unless the stock is dummy.

### Cheer From Channel Islands.

IT is refreshing to hear, as I do from E. James (Guernsey) of the excellent "service" given by the Blue Spot people; the Blue Spot is a bright spot, for not all the letters I receive are in praise of British radio traders. With regard to television, if Mr. James has followed my Notes he must know that "P.W." is still hoping that it will emerge from the laboratory stage of development.

However, if he wants to spend a lot of money on radio flickers, let him write to Messrs. Benn Bros., Bouverie House, Fleet Street, E.C.4. for back numbers of "Television," which magazine they have recently acquired.

### Radio Excelsior—Buenos Aires.

THE new high-power station, LR 5, which is to be erected in Buenos Aires by Marconi's for Radio Excelsior, is expected to begin operation early next



year on a wavelength of 361.4 metres. The energy of the transmitter is 20 kw. (unmodulated aerial carrier energy), and up to 100 per cent modulation is arranged for.

I am told that the apparatus will be the last word in radio science and beauty. The switchboard panels will be

finished in a deep blue-grey cellulose lacquer and framed in highly-polished aluminium borders. The Chief Engineer's bath will be enamelled—no! I was thinking of Broadcasting House, of course!

### A Waiting Market.

ONCE again, in response to a number of letters from patriotic Britons in Australia and New Zealand, I draw the attention to all whom it may concern that in those countries there is a ready market waiting, nay, calling, for radio sets which are not made in the U.S.A., Germany or Holland.

Apparently English-made sets have not any footing, especially in New Zealand, where the conditions and requirements are peculiar owing to geographical position.

## "SHORT WAVES"

### A TRIUMPH AT LAST.

"How do you like those two poems I submitted?" asked the young poet.

"Excellent!" replied the critic. "They are poems that Milton or Keats could not have written."

The poet breathed a sigh of relief. "Really!" he exclaimed, overjoyed. "It is very kind of you to say that!"

"Not at all!" returned the critic. "One is about the cinema, and the other is about wireless."—"Answers."

### OH, THOSE TALKS!

An increase of about a third of the nation's piano-playing is said to be due to broadcasting. It is only fair to admit that some people were against the radio from the very beginning.

Husband-to-be.—Yes, a crystal set would certainly be your best choice because when you get married you won't want another loud-speaker in the house. Besides, a crystal set might keep mother-in-law quiet for a minute or two.

### THINGS WE WANT TO KNOW.

Why do we tune in to foreign stations when we can't understand the porters on our own?

Non-stop variety is hailed as a new departure; but many wireless enthusiasts have been giving it to their neighbours for years!

### RADIO IN AMERICA.

We enjoy the music that is coming to us.

We are ready for an hour or more of it;

Then the announcer starts to blat

About the sponsor's this and that—

A listener's life is not a happy one!

### What is Wanted in New Zealand.

E. H. C. (Timaru, N.3), for example, says that battery sets are obsolete there and people want A.C. 250 volts, 60 cycles mains sets; 5 to 12 valves. The average set sold there is a nine-valver at about £35.

Only one firm in England, he says, has a chance of doing business there in ready-made sets (I cannot mention the name). The sets for N.Z. must cover 150-600 metres without coil-changing.

He gives a list of 112 stations which they expect to be able to select from, of which there are about 30 which they expect to get every night. Hence 3-valvers are hopeless there.

If there are valid reasons why home firms cannot cater for this market, and a manu-

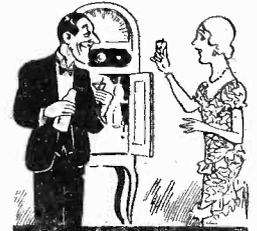
facturer cares to write and give them, I shall be only too glad to pass them on to our overseas readers.

### But Not a Bad Idea.

THESE ladies! They overhear a scrap of talk, and then go off at a tangent.

Only the other day my wife overheard me telling a friend that I was thinking of fitting a "pick-up" to my set. In she barged.

"What? Pick me up? Oh, how lovely! A combined radio and cocktail cabinet! That will just come in handy for our little garden-party. It will beat those Watkinses, with their silly Sundial Sundae idea," etc., ad lib.



### Changes in Norway?

THE Norwegian Government has submitted a Bill providing for the reorganisation of broadcasting as a Government service as from July 1st, 1933. The Government is to receive the equivalent of £10,000 per annum, the surplus revenue being used for improving the service and system.

Control over programmes is to be exercised by the Ministry of Education and Ecclesiastical Affairs through a special organisation which is to be set up, and which will enjoy a considerable measure of independence.

### Radio Law in Canada.

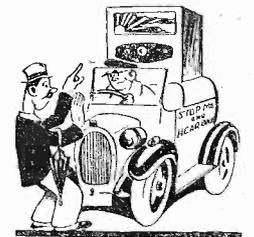
THE new radio law for the nationalisation of broadcasting in Canada received the Assent of the Acting Governor-General on May 26th. It authorises the appointment of a Commission of three members, the Chairman to receive \$10,000 yearly and the others \$8,000 each.

Nine assistant commissioners will represent the various provinces, and the Commission will have full control of broadcasting. Best of luck to all Canadian listeners, and may the change prove a blessing to them, as why should it not?

### Stop Me and Hear One.

AN enterprising Uxbridge radio firm has borrowed and adapted a famous slogan used by an ice-cream vendor. It has equipped a small motor-van with a portable receiver, and has inscribed on the van the magic legend, "Stop me and hear one."

If you stop him, you hear what chance and the B.B.C. may send, but you get a demonstration of the firm's apparatus. This seems very nice indeed, and all you require beforehand is a bromide powder to give you the nerve to stop him.



ARIEL.

# Radio Luxembourg



◆ This "sponsored programmes" business has recently assumed such tremendous proportions that a group of French capitalists have built a new high-power station near Luxembourg, solely for the purpose of radiating entertainment arranged by the advertisers of Europe. Some of the difficulties which will have to be overcome before these programmes acquire the necessary "international style" are told below

◆ By A. A. GULLILAND.

casting transmitter that intends deriving its total income from selling programme time.

Advertisers of all surrounding countries will now have a chance to show what European-sponsored programmes will look like, and listeners will sit in judgment. If the right style is found, who knows if other countries at present banning advertisements from their ether "pages" will not change their minds and increase their income to the general benefit of listeners, who would then be able to "buy their wireless entertainment" for a smaller annual subscription?

The transmitter proper is of French make, the power supply, the Diesel engines, etc., are from Germany, and a German architect has designed the interior decoration of the studio building, which will be situated in a wonderful park in Luxembourg.

### Medium-Wave As Well.

A very curious feature of this building will be an old medieval tower, as it would have been a pity to tear this down.

Luxembourg will have a low power station working on a medium wavelength,

**S**PONSORED programmes have been in the minds of many people ever since radio broadcasting began. We have been told a whole lot about the horrible consequences of permitting advertisers to use broadcasting stations as they do in the United States.

We know all about tooth-paste and its super-excellence, we also know that Americans have got used to hearing this in the intervals of a choir concert relayed from the Sistine Chapel in Rome. I am told that American sponsored programmes are broken up by about a minute to a minute and a half's publicity matter after every item.

And still I contend that that is no reason for being against sponsored programmes. We Europeans will probably not listen to sponsored programmes à la Americaine for very long.

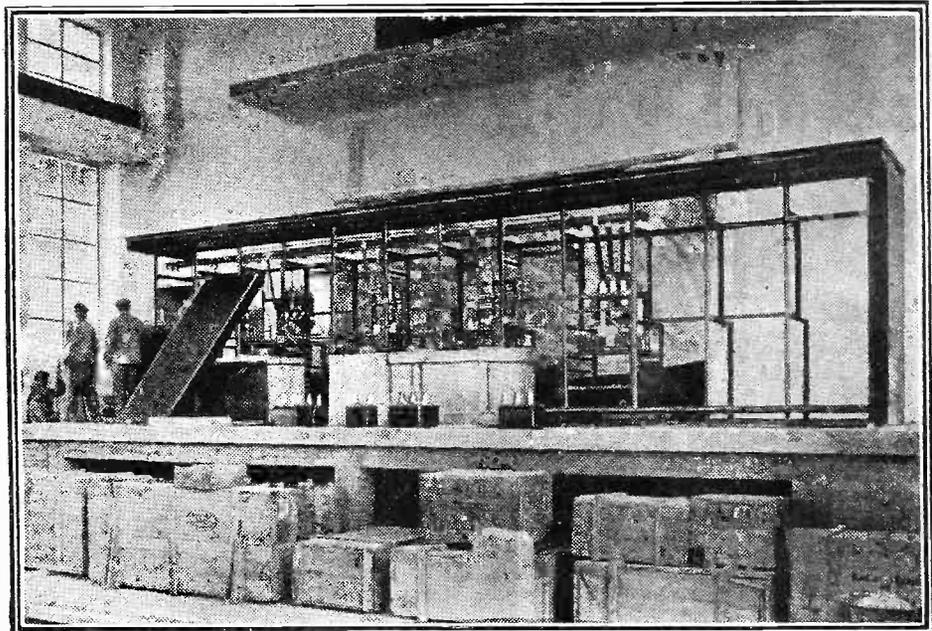
### Different Style Required.

Advertisers will therefore have to develop a new style, a European style for their programmes. They have, however, been given very little chance to do so as yet.

In Germany broadcast advertising has been relegated to the early morning hours, and in some cases to the noon-time programme. The time space allowed is very small, so advertisers give listeners practically undiluted advertisement and listeners are against sponsored programmes because they think that that would mean nothing but advertisement the whole day long.

A French group of capitalists, the same that are behind the Radio-Paris station, are at present building a new station, Radio Luxembourg. This high-power station is new in more senses of the word than just those that mean a new broadcasting station. The station is the first international broad-

## THE WHOLE BOX OF TRICKS!



This view shows the power switchboards of the new Luxembourg station in course of assembly. The work has been carried out in stages, and already test programmes have been radiated on 1,250 metres.

The concession for the new station has been granted by the Grand Duchy for a period of twenty-five years. Under this very liberal contract Luxembourg is to obtain a first-class broadcasting service for nothing. In fact, the Luxembourg post-office will obtain 30 per cent of the net profits of the station.

The transmitter is situated some 12 miles from the town at a place called Junglinster. The power in aerial will be 150 kw., according to the new rating, or 200 kw. under another formula.

somewhere around 200 metres, for district news and programmes of purely local interest. The high-power station will work on 1,250 metres.

Now this wave is not in the broadcast waveband, but under existing international agreements, a station can be operated outside the broadcast band providing no other existing commercial station is interfered with. Tests are at present being carried out with a low-power experimental outfit to find out if anybody complains.

(Continued on next page.)

## RADIO LUXEMBOURG

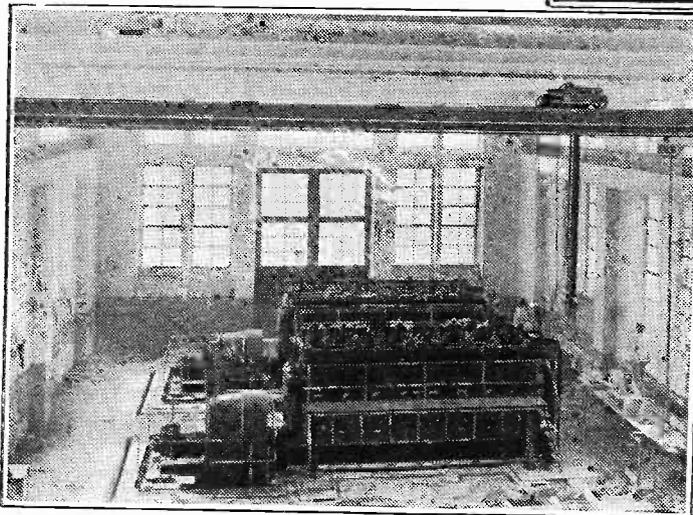
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But even should a country complain, it is quite probable that the broadcast waveband will be enlarged at Madrid, and then Luxembourg will have full right to work on this wave and will have priority claim against any other country wanting a long wave. After all, the station has been designed for a long wave and it seems unlikely that so many million francs would have been spent on a scheme which was hopeless from the outset.

### Special Licences Granted.

So as to be able to sell programme time in all surrounding countries, licences have been granted to various publicity companies in different countries. In France a company belonging to the Agence Havas group has obtained sole French rights; in Belgium a newspaper has sole rights; and in Germany a special company has been formed with sole rights for Germany.

## "MIGHTY MACHINES"



Here are some of the men who will direct the programmes when the new station comes on the air: M. Henri Etienne (director of programmes) is seen in conference with members of the German firm which controls the sole rights for central Europe.

On the left is the gigantic power plant which will provide the 200 kw. needed for adequate service. Radio Luxembourg, by the way, will work on 1,250 metres.

I have heard rumours that a King will speak, and that Mussolini may address Europe via Luxembourg. However that may be, I am sure of one fact; Luxembourg will give the listener what he wants and at the time he wants it, and not what some people think the listener ought to have.

And M. Henri Etienne, the founder of the oldest French radio journal, *L'Antenne*, and a journalist of many years' experience,

## "MASTER MINDS"



The writer used a simple one-valve plug-in coil detector circuit, fitted with an adaptor to facilitate easy connection to the existing receiver. The aerial was, however, aperiodically coupled to overcome the effect of one tuned circuit on the other. The circuit diagram makes the aerial connections clear, and also the wiring-up of the adaptor.

The required station is then tuned-in in the ordinary way on the main set. The detector valve is removed, and the adaptor substituted. This brings the new detector into circuit.

### Received From Two Stations.

It is then possible to tune-in a station relaying the one required. The programme is thus received from the two stations by the independent detectors. All that remains to be done is to replace the detector valve in the top of the adaptor and to alter the aerial connections as shown in the diagram.

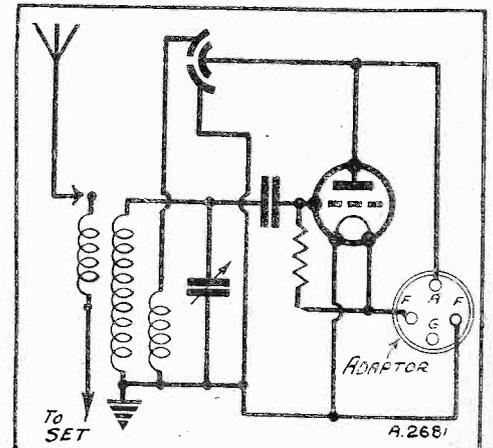
The low-frequency amplifying stages of the main set are now being fed with low-frequency impulses of the same character but from two separate sources; the output from the amplifier is, however, the same as either received separately. If the station chosen in the first case fades, it does so unnoticed since the other one is supplying the necessary signals.

The drawback to the scheme is that the present tendency is for the relay station to use a common wavelength. This, however, is offset by the fact that special items are invariably relayed by other stations.

### Short-Wave Possibilities.

Although the writer has not yet experimented on the short waves, the idea would appear to be quite useful in this field, provided the broadcast could be sufficiently well received via two stations. There also appears to be no objections to the using of medium frequency with one of high frequency.

## THE ADAPTOR CIRCUIT



Here is the very simple circuit diagram. Note especially the aerial tuning arrangements which are fully described above.

Below are some cases where use could be made of the scheme:

- The North Italian Group, i.e., Milan, Turin, Genoa, etc.
- Prague, Brno, etc.
- Stockholm, Göteborg, etc.
- Langenberg, Cologne.
- Breslau, Gleiwitz.
- Munich, Nurnburg.
- Rome 680 Kcs., Rome 11,810 Kcs.

listeners will tune in to 1,250 metres to get Europe's most impartial news and best programmes. I only hope that by the time this appears in print some enterprising person in Britain will have seen to it that Luxembourg listeners will be furnished with Reuter news and not only with Havas and Wolffbureau versions, and that Britain will have some influence on Luxembourg programmes and will not be left out in the cold.

## FAREWELL TO FADING

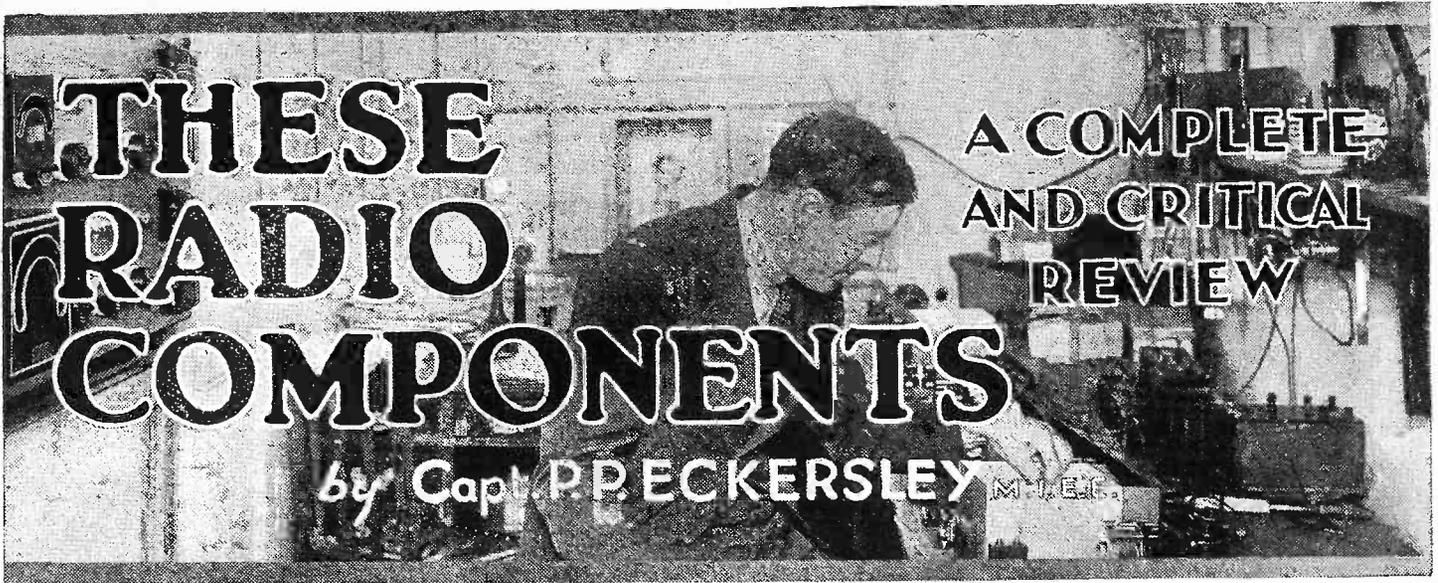
THE following novel idea goes a long way to a solution of fading, and is well worth trying. In brief, the broadcast is received via two stations and, of course, the chances of two stations fading simultaneously is considerably less than that of one.

This Internationaler Radiodienst was subscribed to by Wolff's Bureau, the semi-official German news agency (one third), by the German Reichspostreklame (one third), the official German post-office publicity office, and by European Tickers (one third). So that the same state of affairs prevails in Germany as it does in France; the people owning sole rights to sell the Luxembourg programme time are semi-official companies.

### Controlling the Programmes.

The idea being that as Luxembourg was going to work, anyhow, it was better to have a certain control over the programmes than letting a private body get hold of the sole rights.

I understand that as yet no arrangement has been arrived at for Britain, although Luxembourg with 200 kw. and a wavelength of 1,250 metres will be the highest power long-wave station in Europe, and will probably be used by the British advertiser in preference to Radio Paris as there is no nationality bias in Luxembourg. It will probably open officially in August.



# THESE RADIO COMPONENTS

A COMPLETE AND CRITICAL REVIEW

by Capt. P. P. ECKERSLEY M.I.E.E.

**T**HIS, my last article on components, will deal with all the etceteras which are so necessary for a set, and so profitable to the component manufacturer.

First, the grid-leak type of resistance. In my opinion the grid-leak type of resistance is pretty good for use as a grid leak, and pretty bad, in most cases, if you want to pass current of any useful amount through it.

I strongly advise the purchaser and user of grid leaks to find some means to check the value *before* purchase, and to have the same means available *after* purchase to see that the label still bears some relationship to the value of the resistance it purports to indicate.

## Carbon Dust!

Never pass more than .5 milliamp through the grid-leak type of resistance—it's apt to change the value of resistance. This is not, however, true of all types of "muckite" resistances (to distinguish them from wire-wound resistances). I know of one make (unfortunately not on the market in any quantity) which will stand up to quite startling power consumption.

I remember years ago in the Marconi Company we used a resistance (the invention of "Jock" Stewart) which was made by polishing the inside of an ebonite small-diameter tube with carbon dust, and this would carry, I think, 2 or 3 milliamps and hold its 10,000 to 50,000 ohms value.

To-day there is a tendency—and a welcome and perfectly correct tendency—to use wire-wound resistances. The spaghetti type is quite useful, but the marked values are too often wildly different from the true value.

## Cartridge Type for R.C.

For robust resistance-capacity technique I prefer the cartridge type of wire-wound resistance. Even they fail if big powers have to be dealt with—and oh! how I wish there was more factor of safety in modern design. I mean I wish people would afford to have a better factor of safety.

If, then, we do want 20 milliamps and 100,000 ohms (which you know is 40 watts), I advise the open cylinder wound over with fine wire. I have searched for this type of component in Britain, but have always failed to get anything approaching the

performance and low price of German or (particularly) Danish resistances.

I expect (because people continue to use too little power and too small a factor of safety and do so because of the economic question) that there is not much demand for *real* power resistances in Britain. It suffices to use the wire-wound cartridge type.

When decoupling high-frequency stages do not forget self-capacity. It is here that spaghetti resistances, properly mounted for minimum end-to-end capacity, are useful. I fear the cartridge type have too high a self-capacity for high-frequency work, ideal as they may be for low-frequency circuits.

I turn now to condensers. A box labelled .001 mfd. or 6 mfd. is a condenser in the general meaning of the term, but it may not be the condenser you ought to use for this or that purpose.

## HIGH RESISTANCES, FIXED CONDENSERS AND ALL THE ETCETERAS

This week our Chief Radio Consultant tells his readers about the faults and failings of some of the small, but none the less important, components in a radio receiver. He writes in his usual "breezy" style, dealing with all technicalities in really easy-to-understand terms.

Apart from capacity values, remember that a condenser may introduce severe resistance losses into the circuit in which it is included. For instance, an ordinary paper condenser may tell you it's got a capacity of 1 mfd. You want to decouple a high-frequency valve circuit; you want a very low impedance shunt to earth.

Why not use this 1-mfd. condenser? What's its impedance to 1,000 kc. frequency? Well, forgetting losses but remembering the formula, it's the reciprocal of six times a million times a millionth, or one-sixth of an ohm. Negligible compared with the series 5,000 ohms of spaghetti resistance you are using to decouple!

Is it? If that 1-mfd. condenser is made with cheap paper, and if the construction is to wind the foils and the insulation round and round and round each other, the effective capacity may be one-hundredth of a microfarad (making the impedance 100 times greater), but far more important, making the effective resistance of the

condenser to high-frequency perhaps 1,000 ohms.

This is because the high-frequency sets up strains in the dielectric and, the dielectric being poor, as we say, this creates an effective resistance to current flow. Mica condensers are more expensive, but they are best for high-frequency work. But in the generality of cases paper can be made to do, but it is best to ask the manufacturer for the product recommended for any and every class of work.

## Use Big Test Voltages.

It's important to use what are coming to be called non-inductive condensers for high-frequency work. It's important to ensure that the dielectric is sufficiently good. Mica is probably best, but usually unnecessarily expensive.

Now as to working and test voltage. Remember, the *test* voltage of a condenser should be at least twice the maximum peak voltage it's ever called upon to stand. For instance, in a resistance-capacity job the inter-stage condensers have a maximum peak *working* voltage which is safely called twice the value of the H.T.

So for 300 volts H.T. the inter-stage condenser requires a *test* voltage of 1,200.

And in resistance-capacity technique, if the inter-stage condenser has an insulation resistance of 100,000 ohms, and if the grid leak following is 100,000 ohms, and the H.T. is 200 volts to the valve anode, then a milliamp passes, and a milliamp through 100,000 ohms is 100 volts drop, and so you'll be putting 100 volts positive on the grid of the valve!

## Ask the Makers.

But, of course, 100,000 ohms insulation resistance is ridiculous. I only used the figures to show how careful one's got to be in resistance-capacity technique to have condensers which really do hold up and have a high insulation resistance. In commercial designs for the higher-powered kind of work I always use mica.

Again, ask the makers and remember to use a test voltage which is four times H.T. volts. Ten-megohms insulation resistance is none too high. You'll get 4 volts positive with a 200,000-ohm grid leak and a plate-voltage of 200 volts even with that. You want condensers for good R.C. technique right up in the 100-megohm class,

# WHAT HAPPENED AT MONTREUX

OUR SPECIAL CORRESPONDENT

urges the European Broadcasting Union to come into the open and to stop meeting in the manner of a "secret society."

IT has been my privilege to write articles with a similar title for the last year and a half. I described what happened at Budapest in the autumn of 1930, I told readers about the happenings at the U.I.R. conferences at Ouchy-Lausanne last summer and at Rome last autumn.

On these occasions I was writing from first-hand experience. But it was just this first-hand experience that prevented my going to Montreux this June. The news value of the meetings of the European Broadcasters' Union is very small indeed. Even for a radio paper and for a public of people vitally interested in radio there is nothing to write home about.

## A Repetition of Other Meetings.

At Budapest everything was new to me. At Ouchy the surroundings were different. But Rome was a repeat of Budapest, and I am sure that Montreux cannot have been very different from Ouchy-Lausanne last year.

The same people, the same talk, the same methods. I do not wish to criticise. The Union has done very good work in the past and is doing interesting and necessary work at the present.

I am quite sure that it is extremely useful, and perhaps even essential that the chief engineers of the European broadcasters should periodically meet and discuss latest developments. I am quite certain that it will improve our programmes if the delegates of the European programme directors come together and discuss ways and means of rendering international programme exchange more perfect and more attractive as they did in Montreux.

But I contend that the Union has never sought the understanding of the general radio public.

I say the Union as a whole. Both its Secretary-General (Mr. Arthur Burrows) and many individual members have always been most kind in answering my questions, but their hands are tied. Mr. Burrows' more than others.

Everything is a great secret at the Union's meetings.

## Excluding the Press.

The Union issued a communiqué to the Press after its meeting. Even at Rome there was still talk of a daily communiqué after each day's work. But at Rome the Fascist government did not allow this, and since then there has been no talk about it again.

On the other hand, I quite understand and fully realise the fact that the Union's meetings as a source of news are worth nil.

The Union is a club. A very important club, a very useful club, but the public is not asked to listen to the private affairs of members. I suppose that it is right so.

Perhaps it isn't. Then let's organise an International Union of Listeners. But that is hopeless from the outset, because no two listeners ever do agree!

Let us forget the Union. Its machinery is well oiled, thanks to Mr. Burrows. It does its job efficiently, smoothly and, I am sure, economically.

The broadcasters are content. We all know that the international club and meeting place is necessary, its advisory powers are looked upon with respect by the postal administrations of the European countries, but the time is past when it would have had a popular appeal.

I am afraid it has gone behind scenes. It would be a pity if it were to stay there. Ten European administrations were present at Montreux, and sixteen broadcasting companies had sent delegates. Thus twenty-six European countries were represented.

Estonia became a new member. The two American companies, N.B.C. and Columbia, had sent observers, so had the Russians.

## Representatives for Madrid.

The League of Nations and the International Office of the World Telegraph Union had sent representatives.

The technical committee worked out the manner in which the Union was going to be represented at the great World conference in Madrid, which will start on September 3rd and last till December at least. They decided to install at Brussels apparatus developed by B.B.C. engineers to measure

the modulation of broadcasting stations at a distance.

The engineers spoke about aeriels for improving the range of the ground wave of broadcasting stations. They, and everybody else, hope that at Madrid broadcasting will get a few more wavelengths between 550 and 2,000 metres.

The relay committee united the delegates of European programme directors to discuss international relays. They also spoke about the different methods used in different countries of broadcasting the spoken word in an interesting-to-the-listener form.

The council met and approved and decided that the next meeting should be as soon after the close of the Madrid conference as possible, that will be some time early next spring. The meeting will take place in Geneva.

Well, and that's about all.

## Too Many Secrets.

Nothing happened at Montreux. Things were never at breaking point. There were no discontented members who said that the Union was costing too much for their pockets. I positively know that nobody said this in public. I am no thought reader.

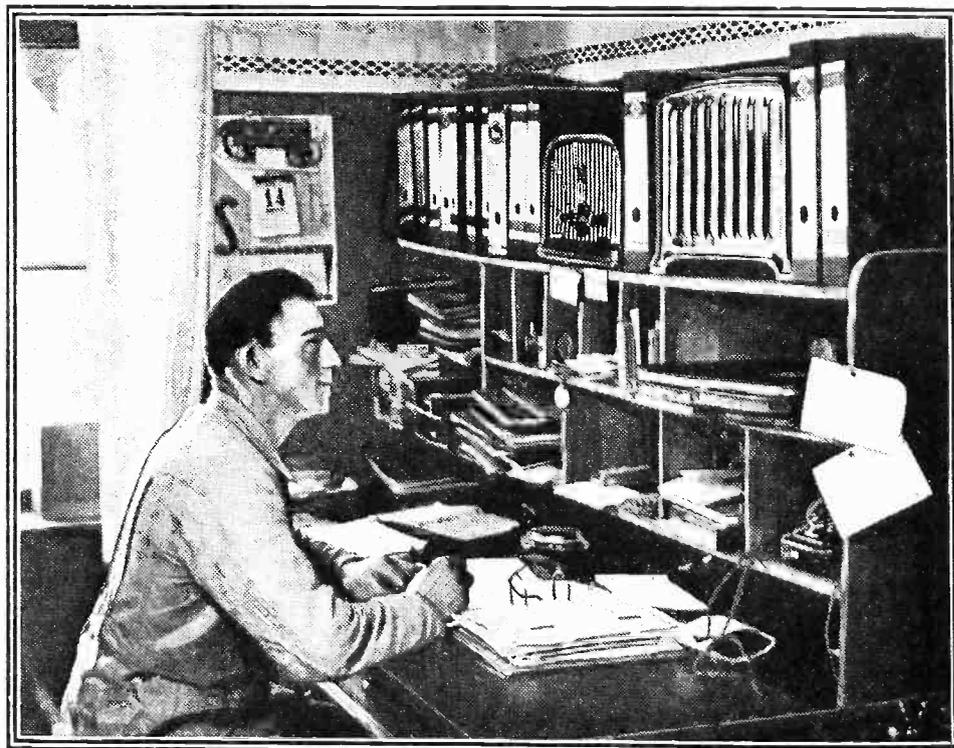
As a journalist I ask the Union one thing: Why not come out into the open and let those people specialising in gathering radio news into some of your secrets?

We would treat them with respect, but we would also write more about your doings, would be able to write more about them, would have actual facts and not rather vague communiqués.

We could stiffen the back of the Union when it wants to make a stand against the administrations, we would help to make the Union popular again.

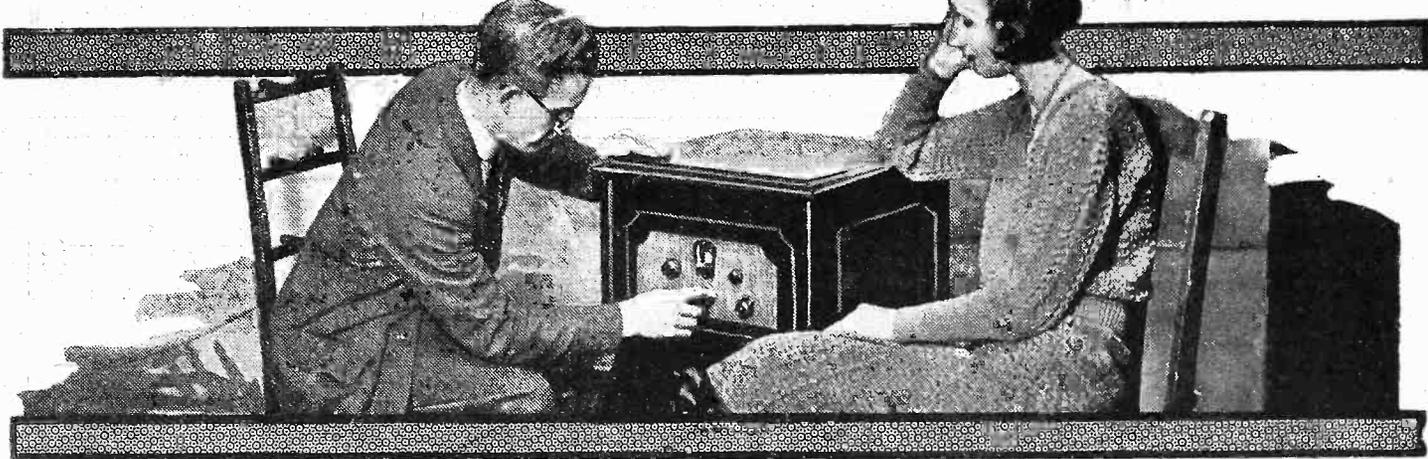
Or are we to forget it and know of it only as an international club where secrets are discussed diplomatically?

## "FURTHER OUTLOOK—UNSETTLED!"



The necessity for regular weather forecasts is one of those things on which the broadcasting authorities of every country are agreed. Here is an up-to-date German farmer whose scientific methods depend upon the frequent and accurate forecasts which he receives from Königswusterhausen.

# The "P.W.A.C." RADIOGRAM



A magnificent all-mains instrument which you can build at home with only pliers and screwdriver at very low cost. It will provide you with high quality radio and record programmes, and is in every way a first-class proposition.

Designed and Described by the "P.W." RESEARCH & CONSTRUCTION DEPARTMENT.

THIS is the receiver which thousands of our readers have been waiting for; and that is a plain statement of fact. The phrase "and when are you going to describe a radiogram for all-mains working?" has occurred in literally hundreds of letters during the past month or two.

But nearly all the writers wanted a moving-coil speaker, plenty of stations and other such things at an all-in figure "of about the price of a sideboard," as one correspondent naively put it.

Well, you can pay anything from five to fifty pounds for a sideboard, but there is

no doubt at all to which end of this range he was referring!

However, it is absolutely impossible to build any kind of all-mains radiogram for £5, and we can claim with full justification that our "P.W." design is the most  
(Continued on next page.)

## YOUR GUIDE TO THE COMPONENTS AND ACCESSORIES

- 1 Wood Panel, 14 in. × 7 in..
- 1 Coil (Colvern, K.G.R.).
- 1 Coil (Colvern, K.G.O.), with switch rod, 8-in. long.
- 1 Twin-gang Condenser, .0005 mfd. with disc drive (Lotus).
- 1 Screen-grid 5-pin valve holder (Lissen, Telsen, W.B.).
- 2 5-pin valve holders (Lissen, Telsen, W.B., Lotus, Graham Farish, Wearite, Igranic).
- 2 1-mfd. condensers (Lissen, Telsen, T.C.C., Dubilier, Igranic, Graham Farish).
- 2 1-mfd. condensers (T.C.C., etc.).
- 1 2-mfd. condenser (Telsen, etc.).
- 1 2-mfd. condenser (Lissen, etc.).
- 1 Terminal Block with two Terminals (Belling & Lee).
- 1 H.F. choke (small type Lissen, Lewcos, Telsen).
- 1 L.F. transformer (Lissen Hypernik, R.I. Hypermite, Varley Nichoke, Lotus, Graham Farish Snap).
- 1 .0001-mfd. condenser (Dubilier type 670, T.C.C. type M).
- 1 .0001-mfd. condenser (Lissen, Dubilier, Telsen, T.C.C., Ferranti, Graham Farish, Sovereign).
- 1 1/2-meg. volume control (Igranic).
- 1 Radiogram on-off switch (Bulgin).

- 2 1/2-meg. grid leaks, with wire ends (Lissen, Dubilier).
- 1 .0003-mfd. differential condenser (Ready Radio, Telsen, Lotus, J.B.).
- 1 350-ohm resistance (Dubilier 1-watt type, Graham Farish, Lissen).
- 1 500-ohm resistance (Dubilier 1-watt, etc.).
- 1 250-ohm resistance (Dubilier 1-watt, etc.).
- 1 1,000-ohm resistance (Graham Farish Ohmite, etc.).
- 1 30,000-ohm resistance (Graham Farish Ohmite, etc.).
- 1 60,000-ohm resistance (Graham Farish Ohmite, etc.).
- 1 40,000-ohm resistance (Graham Farish Ohmite, etc.).

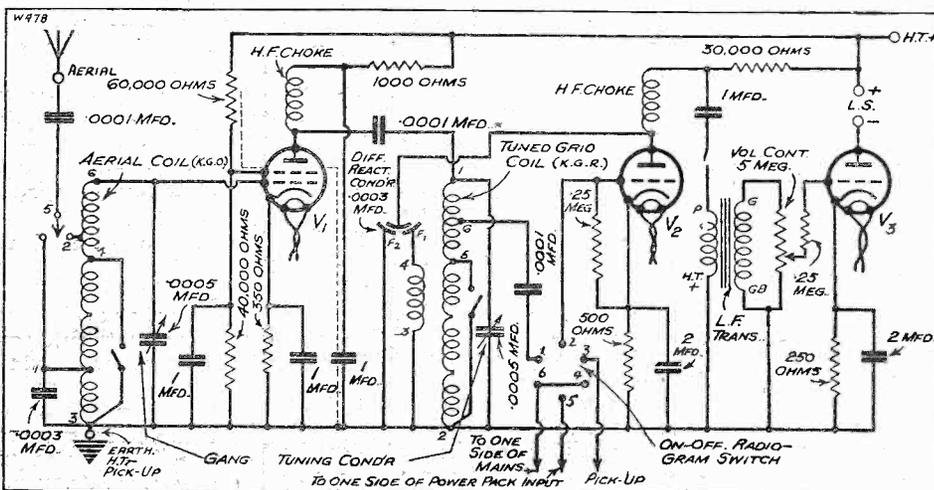
- 1 .0003-mfd. condenser (Lissen, Dubilier, T.C.C., Graham Farish, Sovereign, Telsen).
- 1 H.F. choke (Peto-Scott, Ready Radio, Wearite, Lewcos Type II).
- Aluminium screen, 5 1/2 in. × 4 1/2 in. (Peto-Scott).
- Copper foil, 10 in. × 9 1/2 in.
- Baseboard, 14 in. × 10 in. × 3/8 in. (Peto-Scott).
- Cabinet (Peto-Scott).
- Power pack (Heayberd "Popular").
- Loudspeaker (R & A "Challenger," Epoch, etc.).
- Gramophone motor (Simpson Synchronous).
- Pick-up (Zonophone).

- 2 needle cups (Bulgin).
- Power plug (Bulgin P.12).
- 18-Gauge tinned wire and sleeving (Wearite).
- Flex, screws, etc.

**VALVES.** — S.G.: Mullard S.4V.B., Mazda A.C./S.G., Cossor M.S.G.L.A., Six-Sixty 4Y.S.G.A.C., Marconi and Osram M.S.4.

Detector: Cossor 41M.H.L., Mazda A.C./H.L., Mullard 354V., Six-Sixty 4G.P.A.C., Marconi and Osram M.H.L.4.  
Power: Cossor 41M.P.

## A POWERFUL MAINS-VALVE COMBINATION



Much greater power is provided than with an equivalent arrangement of normal battery valves, and the moving-coil speaker is operated to full effect on both radio and records.

## THE "P.W." A.C. RADIOGRAM

(Continued from previous page.)

inexpensive instrument of its kind that has ever been designed.

It costs about seventeen pounds and embodies features not always encountered in an outfit selling complete at twice that amount.

For instance, there is a silent, induction type gramophone turntable motor (not a clockwork one) and a good moving-coil loud-speaker. Then there is single-dial tuning accomplished by using ganged tuning condensers.

### Exceedingly Sensitive.

A screened-grid valve figures in the circuit, and although there are only three valves in all you must not consider the set in relation to a 3-valve battery design of which you might have knowledge. Mains valves give much greater amplification and have superior power-handling capabilities than the ordinary battery valves.

It is probably no exaggeration to say that the "P.W." A.C. Radiogram is equal to a high-class battery-driven four.

And in that it is completely free from batteries of any kind it is the perfect "household" outfit, for it will give many, many months of hard service (including accidental all-night runs should someone forget to switch it off now and then!) without needing any maintenance whatever.

Moreover, its running costs are positively negligible—merely a few shillings a year for "juice"!

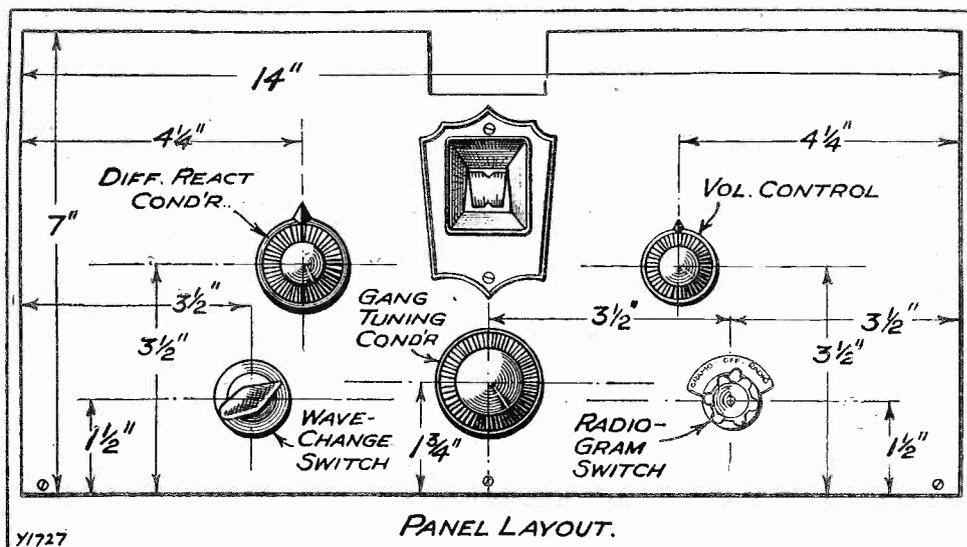
And providing it is built in accordance with our specification there need not be the slightest fear that it will provide electric shocks for those who inexpertly manipulate its controls.

On the radio side the set has excellent selectivity and is capable of bringing in

facility—nothing is more certain than that.

First-class record reproduction is given, and we feel certain you will want to play all your old records through again and again in order to hear them under the really high-grade conditions made possible by this set.

## STRAIGHTFORWARD SINGLE-DIAL TUNING



The controls have been reduced to the barest minimum without any sacrifice of sensitivity.

thirty or more stations on medium and long waves almost anywhere in the country so long as a moderately good outdoor aerial or a fairly efficient indoor one is used.

Naturally we cannot guarantee a definite number of stations, but many constructors will tune in two or three more with great

Now we won't be able to give the full constructional details this week, and these will have "to be concluded in our next," but as many of you will be waiting to get to work we will mention two or three vitally important points.

1. If you select and use a metallised S.G. valve the bulb of this should be covered with thin rubber or stout brown paper which has been oiled or shellaced, or two or three layers of waxed paper such as is used by grocers and, as an improvisation, two or three layers of ordinary white paper. This is to prevent the metallised bulb of the valve from coming into contact with the screen and so short-circuiting the H.F. grid-bias resistance.

### Special Radiogram Switch.

2. The radiogram switch must be of such construction that it can handle mains current. An ordinary battery type is not at all likely to prove capable of doing this.

However, it should be noted that the particular make of switch which appears in our original model happens to be catalogued as a battery switch. But it is perfectly safe and satisfactory when used for our radiogram. Nevertheless, it is doubtful whether there are many, if any, other battery switches which would prove entirely suitable.

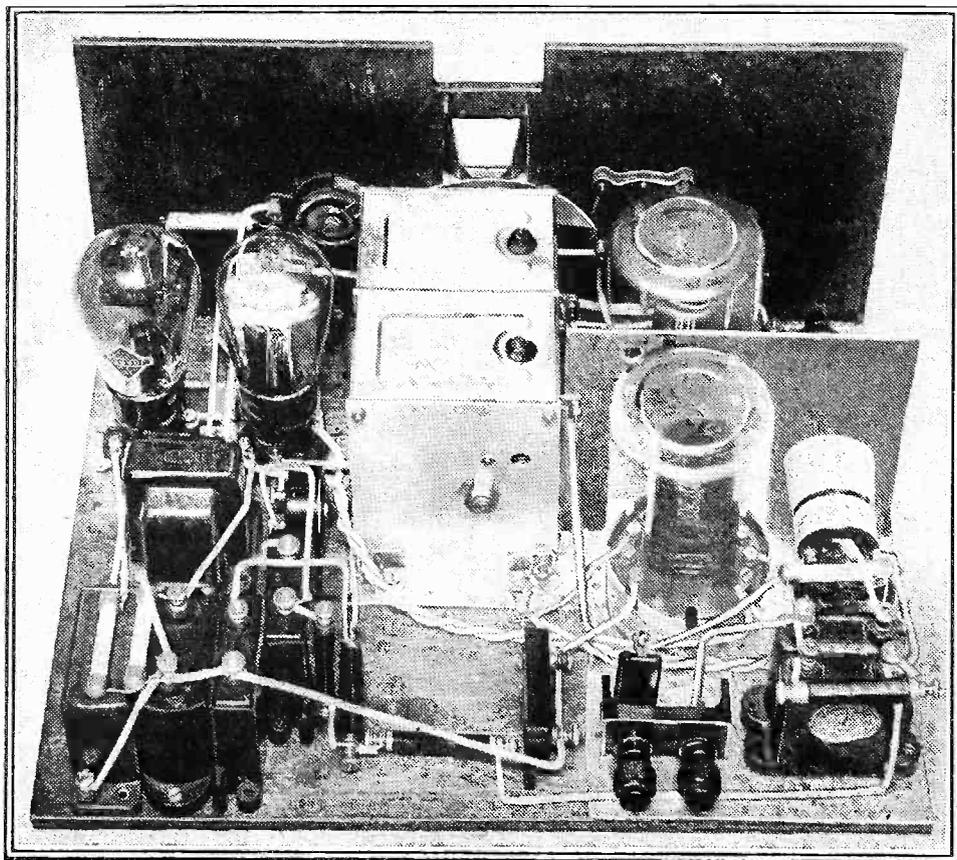
3. Do not conduct any tests or experiments with the mains current on before the set is finally completed. And even then do not make any circuit alterations and internal adjustments until you are certain the mains current is switched right off.

There are no snags in this set, but we would advise you to wait for our next article before you proceed with much more than the preliminary selection and collection of components.

There are in this set a few components and accessories for which fewer alternative makes appear to be quoted than is our

(Continued on next page.)

## FULL AMPLIFICATION UNDER COMPLETE CONTROL



The use of screened components and one simple shield results in complete stability being maintained when the set is "all out." One of the coil shields is shown in "ghost form" for illustrative purposes.

THE "P.W." A.C. RADIOGRAM.

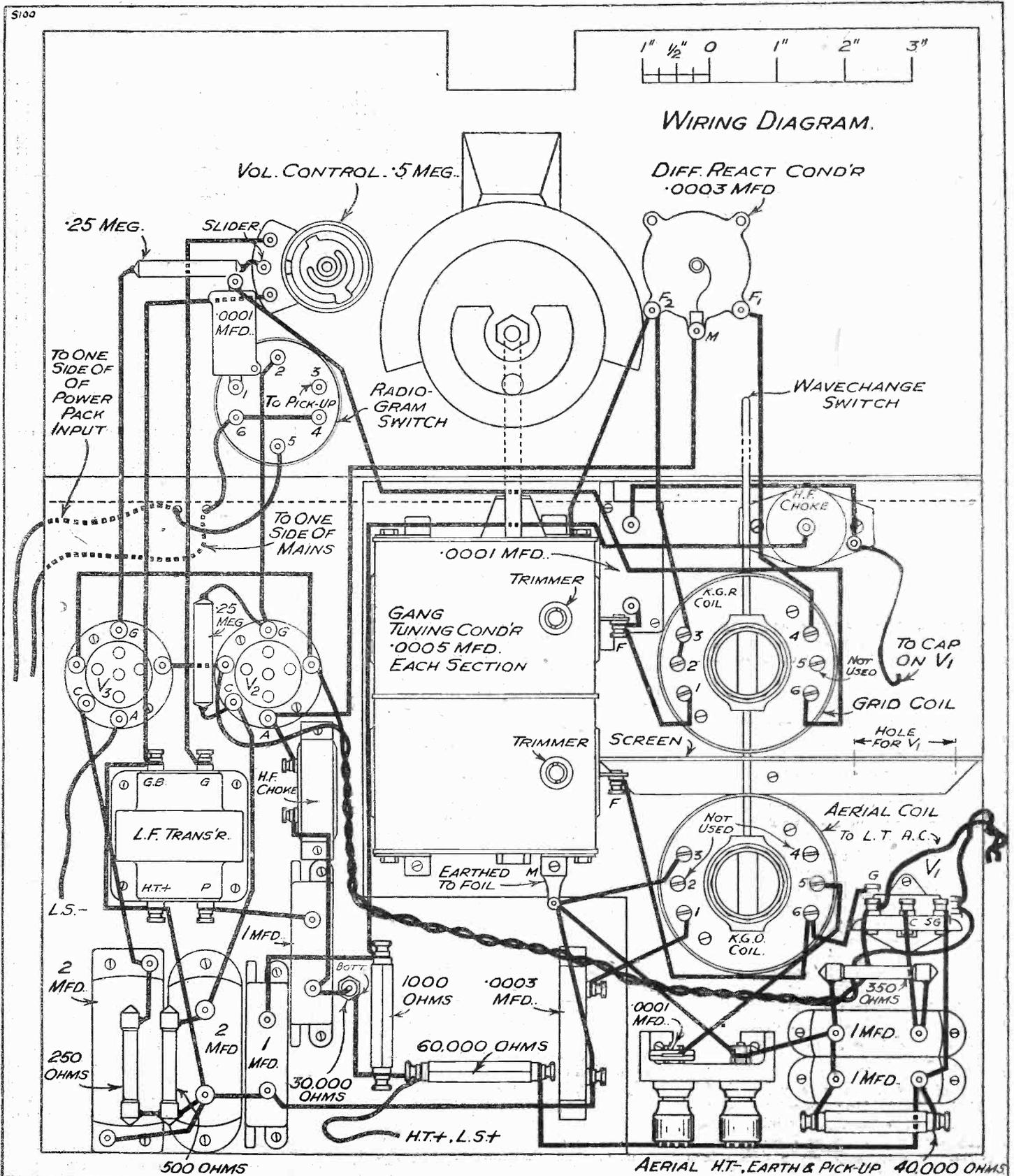
(Continued from previous page.)

usual practice. The reason for this is two-fold.

In the first place, the instrument, by virtue of its specialised nature embodies parts which do not in the ordinary way figure in "P.W." sets. Secondly, we have made very special efforts indeed to keep

the cost down. And by a painstakingly systematic survey of all the available suitable components and accessories on the market we have managed to reduce the cost to a very low level without in any way impairing the performance of the outfit.

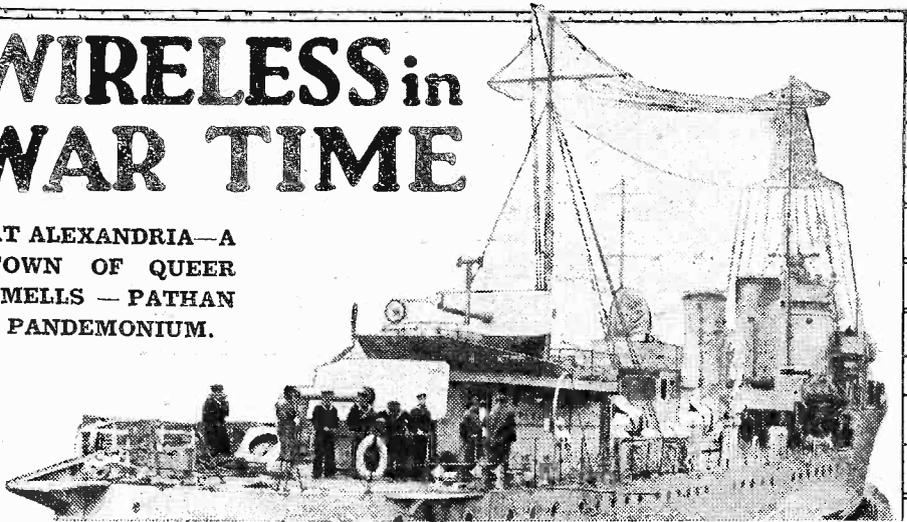
INEXPENSIVE—EASY TO BUILD—RIGHT UP TO DATE



The "P.W." A.C. Radiogram is unique in that it combines extraordinary inexpensiveness and ease of assembly with all that is best in modern all-mains radiogram technique.

# WIRELESS in WAR TIME

AT ALEXANDRIA—A  
TOWN OF QUEER  
SMELLS — PATHAN  
PANDEMONIUM.



## Extracts from the Diary of a Wireless Operator at Sea, 1916-1918

OCTOBER 28TH, 1917.—We arrived in Alexandria this morning. We are supposed to be off again in four days, so I am afraid my proposed visit to Cairo will have to be postponed.

Part of our cargo consists of long pipes, which are transferred from the hold to the quay by means of a crane.

Gathered on the wharf as I write these words, a number of natives in a lazy, yawning mass are waiting to untie the pipes as they are swung over the ship's side and dumped on the quay.

It's rather amusing to watch some of these natives trying to carry a single pipe to the store sheds. As a matter of fact, two men can carry a pipe with the greatest of ease, but with these Arabs, or Egyptians, or whatever they are on the job, at least twelve lift one pipe!

Of course, they're as lazy as you make 'em, and if they can bring off a spot of malingering they'll certainly do so whenever the opportunity arises.

### In the Native Quarter.

To the visitor first landing in Alexandria, the native shops must come as a bit of a shock. Amidst indescribable filth and confusion can be made out a conglomeration of fly-infested fruit, or some species of fish the smell of which would make the average waiter in a third-class Soho restaurant turn green with disgust.

Looking about Alexandria again for the second time I could not fail to remark on the strange odours of the place in general. I think another name for this port might be "the city of a million smells." Sometimes I would pause before a turning and peer half-fearfully down some narrow alley, at the corner of which would be a single oil lamp throwing a patch of light about the entrance, but ahead, a stygian blackness, stabbed here and there by fitful gleams of light from hovels that lined the path.

### An Eerie Atmosphere.

Out of the darkness, a voice singing in that nerve-racking monotone of the East, and, of course, the stink peculiar to the quarter. Then, as I peered down the narrow way, suddenly a dusky face would emerge from the gloom, and a native, silent as a ghost and grinning at my surprise, would pass by. Then back to find a carriage.

"You savvy Number 18 Dock gate?"  
"Yes, sar. Me savvy. Ten piastres."  
"No, no, you son of Ishmail. Five."  
"Oh, oh, sar. Ten piastres!"

But it is no good arguing with an Arab when he's got Jewish blood in his veins.

### Not a Popular Place.

To some people on this ship the place is something unmentionable. They cannot appreciate the charm of the quaint houses, the shops and the people. All they care about—in fact, all they really care about in any port—may be summed up as follows: (1) At least half a dozen pubs, with plenty of beer. (2) Lots of amusement. (3) Plenty of "long-haired pals."

a walk. The actual town of Suez—if it can be dignified by such a name—lies about five miles inland, and the little port at which we anchored along the canal is named Port Tewfik.

At Suez, V— and I hired a couple of white donkeys, really fine beasts that required but little encouragement from the whip, as the poor devils thought they were going home to the stable. We simply raced along the desert road and thoroughly enjoyed the breath of fresh air.

### Trouble at Ashar.

After some much-needed refreshment, we started back along the sandy road to the ship. But we had more trouble with the donkeys than with a twenty-four-year-old Ford. They seemed to resent the idea of travelling another five miles—away from their stables.

DECEMBER 11TH.—Ashar.

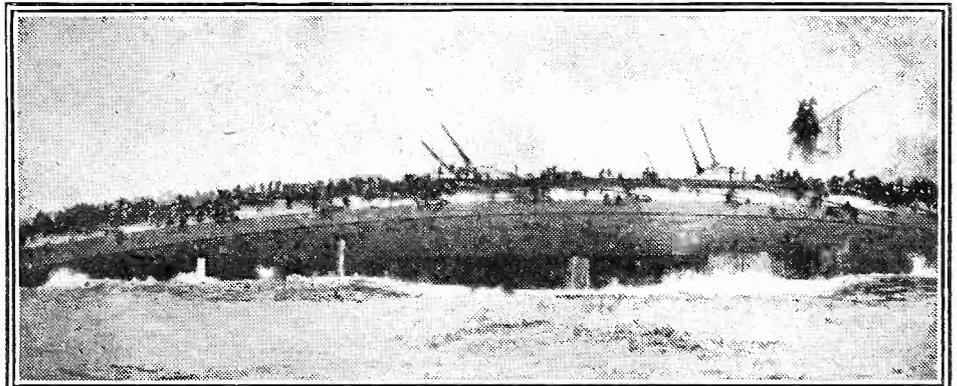
DECEMBER 12TH.—The most dramatic thing that happened during our stay at Ashar was a little affair in which some Pathans (natives from the Indian hills, on duty here) played a leading part.

One of their number had been ordered ten strokes with the "cat" for some misdemeanour. He was strung on to a triangle to receive his punishment, and was stripped of everything but his loin cloth.

At least, he was ordered to be stripped in this fashion, and I believe the military courts-martial made it clear that the man's loin cloth was not to be removed, because it was known that this causes a Pathan to lose caste. Unfortunately, the sergeant in charge of the punishment party forgot this instruction, and whipped away the cloth.

Instantly, several other Pathans who

## EVERY MAN FOR HIMSELF!



Probably the most remarkable photograph taken during the war, this picture shows the German battle cruiser "Blucher" in the act of rolling over before taking her final plunge. The crew can be seen clambering over the slippery side before jumping into the sea, where British warships are standing by to rescue them.

As regards the last item, the veil, or yashmak, of the native woman has a curious fascination. If there is any trouble ashore, it is generally a case of "*Cherchez la femme*."

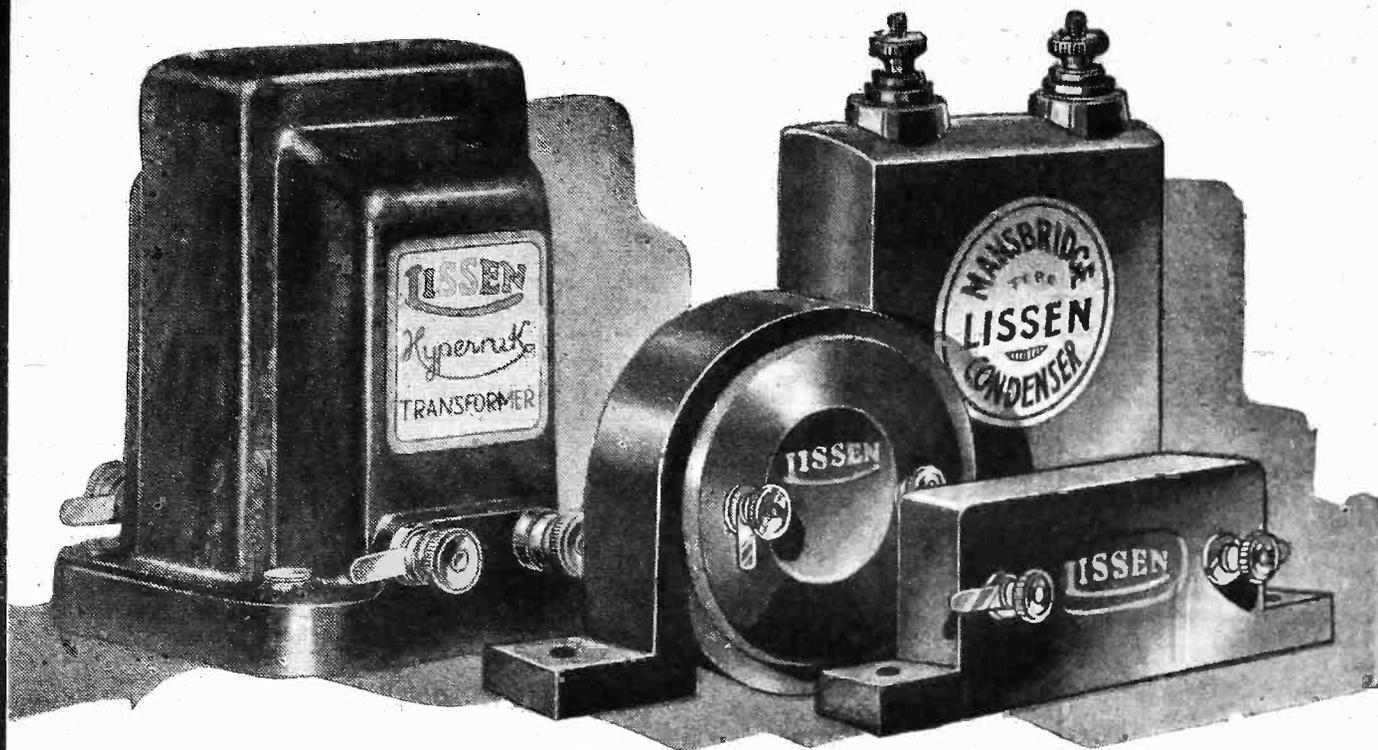
NOVEMBER 13TH.—We left Suez to-day, having unloaded an extra five hundred tons of stores for the troops. I forgot to mention that while in Port Said we experienced a lively air raid from a couple of Turkish 'planes. The first alarm was given about midnight, and the anti-aircraft guns soon got busy, but with what result I don't know, for about that time we had just commenced our journey through the Suez Canal.

We arrived at Suez on the 11th, and in the evening V— and I went ashore for

were standing by assumed that this was a deliberate insult against the Pathan caste. Probably some religious question was also involved. Anyway, one of them whipped out a knife and stabbed the soldier who was administering the punishment four times in the back.

Pandemonium, of course, reigned supreme. The Pathans seemed to have gone quite mad; they were rushing about like a lot of drunken Red Indians. Eventually the Pathan with the knife was floored by a well-aimed coconut! It caught him a beautiful crack on the side of his head and laid him out for about ten minutes.

(Continued next week.)



# “First Class Reproduction” says P.W. and specifies largely LISSEN

The designers of the P.W. “A.C. Radiogram” claim that they have produced a circuit which gives first-class reproduction at really moderate cost. *Naturally they have used the Lissen Hypernik Transformer*—the transformer which all the set designers are using now because it is impossible to get such a fine response curve from any other transformer at anything like this price. Look at the specification—*use LISSEN where it says LISSEN!*

## LISSEN

### HYPERNIK L.F. TRANSFORMER

You must not depart from the specification—you must use this Lissen Hypernik Transformer—if you want to get the same results as the designer of this P.W. Radiogram.

With a primary inductance of fully 100 henries, it yet operates perfectly when passing currents up to 5 m/A or more. Its step-up ratio is 4 to 1, and a stage amplification of more than 100 is obtained.

PRICE **12/6**

## LISSEN

### DISC-TYPE H.F. CHOKE

A disc-type H.F. Choke of outstanding merit in very compact form. Will operate perfectly in any capacity reaction circuit wherever an H.F. Choke is specified. Suitable for both long and medium wavelengths. Will give perfect results in receivers employing Dual Wave Coils.

PRICE **2/6**

## LISSEN

### FIXED CONDENSERS

#### Mansbridge Type

The designers of this P.W. Radiogram have specified Lissen Mansbridge Type Condensers. Keep closely to this specification because upon the reliability of the condensers you use depends the performance, the safety and reliability of your set.

2 mfd. PRICE **3/6**

#### Mica

These Lissen Mica Fixed Condensers are leak-proof. They never vary. They deliver all their stored-up energy. Guaranteed accurate within 5% of marked capacity. Can be mounted upright or flat. Grid-leak clips included free with each condenser.

·0001 to ·001 PRICE **1/6**  
·002 to ·006, 1/6.

# LISSEN—the SPECIFIED Parts!

LISSEN LIMITED, WORPLE ROAD, ISLEWORTH, MIDDLESEX

THE MIRROR OF THE B.B.C.

By O.H.M.

## SIR KINGSLEY WOOD'S PREDICAMENT

NEW TELEVISION TRANSMISSIONS—CURTAILMENT OF REGIONS?—  
MR. BERTRAM FRYER—NEW THOUGHTS ON INDUSTRY.

HAVING been, while in Opposition, one of the most determined and dangerous enemies of the Opera Subsidy, Sir Kingsley Wood now finds himself, as Postmaster-General, perforce its upholder.

The P.M.G. makes no secret of his continued dislike of the arrangement, and I would not be surprised if the B.B.C. receives a fairly pointed instruction to give the required three months' notice of the termination of the agreement with the Covent Garden Syndicate—this to be given on September 30th next.

All the goings and comings of the various interests do not seem to have attained any solution of the problem. I believe the fatal mistake was in ignoring Lady Snowden. If she had been consulted, there might have been results by now.

But I doubt if the general body of listeners cares much about opera, anyway.

### New Television Transmissions.

The B.B.C. will start its own television transmissions between the 15th and 20th of this month for four nights a week at about 11 p.m., on waves not being used for ordinary programmes at that time. The Baird method will be used at first, but it is understood that Mr. Hutchinson, formerly Managing Director of the Baird Company, is about to launch a new kind of television which he thinks will be so far ahead of his first love as to drive it from the air forthwith.

I must admit it is entertaining to hear of approaching "war" between Mr. Baird and Mr. Hutchinson.

### Curtailment of Regions?

In a recent address to a study circle interested in the evolution of broadcasting, Mr. Charles Siepmann, the new Talks Director of the B.B.C., announced that he had decided on certain important reforms chiefly affecting the provinces.

He said, *inter alia*, that he was taking over the talks in the provinces from the Regional Directors, who would have more time to act as outside contact men. He added also that he had accepted the talks from abroad as part of his general scheme.

If correctly reported, Mr. Siepmann has made a very important declaration of B.B.C. policy and one which, it seems to me, deals another blow at the already staggering Regional Scheme.

I hardly like the sound of all this concentration on London. Is the whole business of broadcasting to be done from Portland Place? If this is the idea, and if it is established by 1935, I would not care to be the B.B.C. defender before the next Parlia-

mentary Committee of Inquiry which is likely to be appointed in that year.

### The Children's Hour.

An interesting point has been raised by listeners to the North Regional.

It concerns the suitability of the time at which the Children's Hour programmes have always been broadcast. In one letter the father of a family takes the view that

5.15 is much too early, and suggests that as children definitely sit up later than did the kiddies of years ago (a fact which is even more strongly emphasised in the summer when the clocks are put forward), the Hour should not begin until 7.30. Many listeners will think his argument to be worthy of serious consideration by the "Children's Hour" authorities.

### Mr. Bertram Fryer.

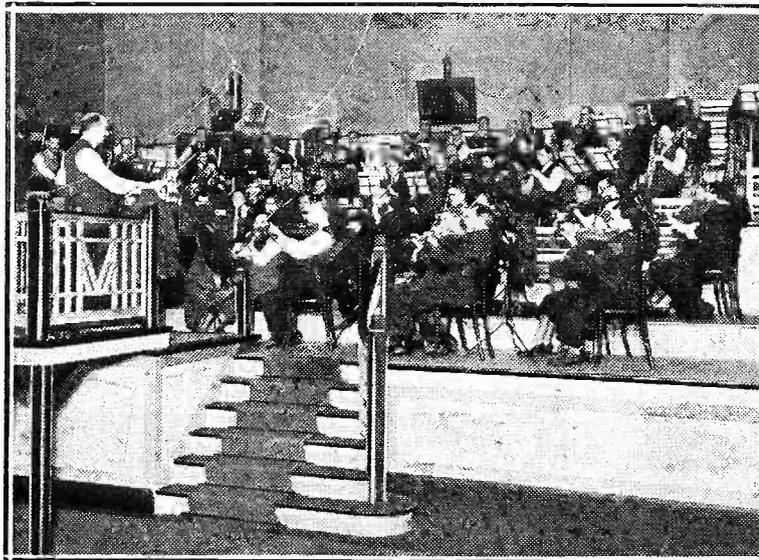
I confess to some surprise at the sudden exit from Broadcasting House of Mr. Bertram Fryer, the father of radio vaudeville. Mr. Fryer was one of the earliest and ablest and most widely experienced of the B.B.C. entertainment staff. He was a great success as Station Director at Bournemouth, and a still bigger success in charge of B.B.C. vaudeville for the last five years or so. What actually caused him to leave remains a mystery.

### New Thoughts on Industry.

Mr. E. Raymond Streat, who opened the important series of talks on "New Problems in Northern Industry and Trade," returns to the microphone on Tuesday, July 12th, to give the fourth talk in the same series. Mr. Streat, who is secretary of the Manchester Chamber of Commerce, will have returned from the Ottawa Conference, so that his remarks upon the general problem of attracting new industries will be of outstanding interest.

A friend from the North told me recently that some of the hard-hit towns realise that signs of old age and decadence in staple industries require handling on modern lines, and that in the attraction of new industries lies their best hope.

## THE B.B.C. ORCHESTRA RECORDING



This photograph of members of the B.B.C. Orchestra was taken at the recording studios of H.M.V. They recently made some records there under the direction of Adrian Boult, the Director of Music of the B.B.C., who is shown conducting.

## THE LISTENER'S NOTEBOOK

A rapid review of some of the recent radio programmes.

### Some Good Outside Broadcasts.

OF recent outside broadcasts, the one that pleased me most was the departure of the new White Star M.V. "Georgie" on her maiden voyage from Liverpool to New York. This was perhaps because the event was such a unique one, and because it lent itself so admirably to broadcasting.

The commentator was obviously the right man for the job, and he succeeded in drawing a scenic mind picture which listeners will long remember. There was a multiplicity of events too extensive to enumerate *in toto*.

Those which appealed particularly were the general air of excitement outside the purser's office and the very intriguing conversations we overheard there, the music from the ship's orchestra, intended, we were told, to make passengers forget they are at sea, the loud murmur of the machinery in the engine-room, the Lord

Mayor of Liverpool's greetings and farewell message, the commander's reply, and finally, countless ships' sirens in chorus as the "Georgie" made her way down stream. Here was realism indeed.

### Not Very Exciting.

"Postman's Knock" was about as exciting for adults as the game of that ilk. Isn't there anyone capable of writing better stuff than this? As far as I could see, there were about a dozen jokes (most of which ought to be enjoying the eventide of their life in undisturbed retirement), around which a story was written.

How artistes can wax enthusiastic over such material baffles me. Claude Hulbert and Gene Gerrard seemed to revel in it. The part of "Hilda" was not a very happy one for Helen Breen to make her first microphone appearance in.

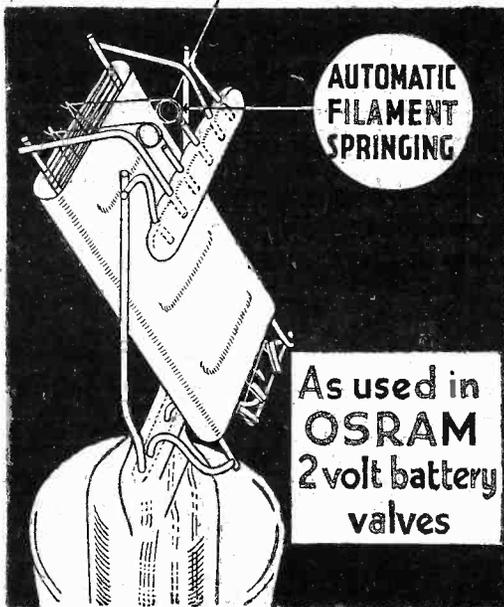
(Continued on page 541.)

EVERYTHING **The G.E.C.** ELECTRICAL  
your guarantee

**OSRAM**  
new automatic cushion  
filament springing  
ensures  
**ABSOLUTE CONSISTENCY**



# CONSISTENCY IN OPERATION



is as vital in a radio valve as in a ship's compass.

To ensure consistency, the position of the electrodes in any valve must not vary. Now, OSRAM, by momentous advance in valve design, remove all dangers resulting from filament expansion due to heat. More, the effects of internal and external vibration are eliminated. OSRAM filament-springing means consistent performance always—an end to microphonics, a dead silent background, longer and more useful valve life.

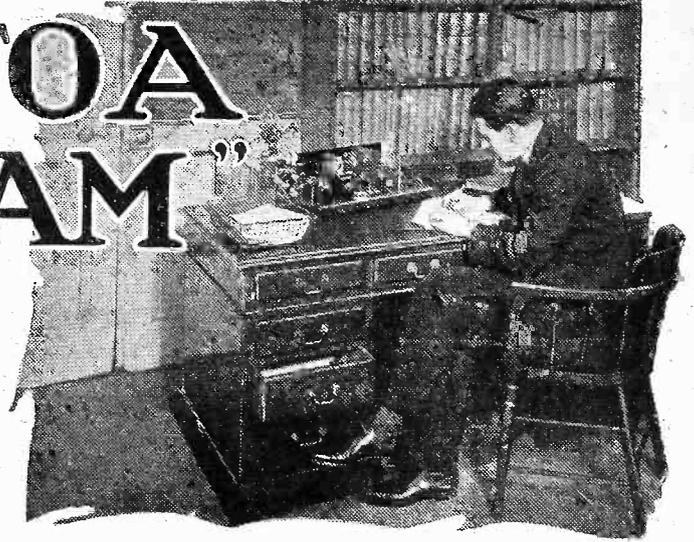
**Osram**  
2 VOLT BATTERY  
**Valves**  
MADE IN ENGLAND  
SOLD BY ALL WIRELESS DEALERS

**WITH THE WEMBLEY FILAMENT**

Advt. of The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2

# LETTERS TO A YOUNG "HAM"

by ARIEL



Although "Uncle Ariel's" letters are written in a light and entertaining manner, there is always plenty of sound commonsense underneath. Everyone will agree with the advice given this week—"Don't turn up your nose at wireless principles—but don't be afraid to experiment."

My Dear Fellow,—That was a fairly good bit of work you did with my old two-valver, though I've done better myself with it. I expect you mucked up the reaction adjustment—I always *meant* to wind those coils less drunkenly, too! Not at all smooth—no!

I used to stick my cigarette case between the coils to get rid of that nasty, sudden, pop over the "threshold." I ought to have told you.

#### Good Advice.

Now that I am certain that you realise that there *are* things in this world which count, besides motor-bicycles and aircraft, I will let you into another potent secret.

*Let everything be done according to principle, unless by experiment you find a better method.*

A great number of the principles of

perspiration, with the dread suspicion, "I've not put heavy enough insulation on that wire!"

#### Auntie Responsible.

That's the general idea, Horace, though you will not go to such lengths, I know. But I used to have radio under my skin. Your Auntie talked a lot of it out.

Insulation, proportion, precision—the three master words.

Time was when I could grab a beer bottle and wind upon it, by hand, a coil within ten turns of the microhenries required.

But *they* were pioneering days, when we fooled and frolicked with apparatus which would arouse your scorn. Very well, now that we have reached the golden age of precision, mind and be precise. Do not say "30 metres" if you mean

What do you mean by trying to swing the lead at the only intelligent uncle you have?

Cultivate powers of accurate observation and do not let your mind be influenced by your desires. Record what you really hear, not what you hope to have heard.

I've taken the trouble to look up some of the call-letters in your log, and according to one entry you heard H.M.S. "Queen Elizabeth" holding a conversation with an amateur station located in Pumpville, Oregon, U.S.A. and owned by an American citizen named Heinie Zecker Bloombaumer!

Oh, Horace—I think not! I ask you—what would Jellicoe say?

#### Keep Your Log for Facts.

Nor can I believe that you really heard a German lightship talking in French to a Japanese submarine which was scrapped in 1929.

You must learn to keep the log for facts; reserve the fiction for the family.

I think that a three months' course of head-telephone reception would do you a world of good; you will never be a *pukka* radio man until you have developed corns on your ears, you know.

Besides, you can hear much more that way.

I'll send you along my pet pair, heavy as lead but as sensitive as a boil on the neck. They'll teach you to appreciate loudspeakers and to keep your paws off the reaction.

By the way, old boy, I noticed the other evening that you are becoming rather fluffy round the chops. What about a nice little dry shave?

#### Taking the Test.

If you can turn up here on Sunday with a smooth map I'll introduce you to Major Brown, the first English amateur to get Melbourne on a one-valver. When I told him that you hankered after nine valves he smiled sympathetically and then said: "Is he deaf—or what?"

When I come over to your home next week I am going to do several things to your set. It will then refuse to function. You will tell me what is wrong with the set within half an hour—I hope—and while you are finding out I shall smoke my pipe and see how you go about it.

Then I shall know about how much *you* know. So snap into it, old son.

Your affectionate Uncle,

ARIEL.

## IT DOES WHAT IT IS TOLD!



This is a little Comper Swift monoplane, believed to be the smallest machine to carry wireless. It has been seen lately at several air displays, where spectators have directed its flying movements by giving instructions into a microphone on the ground.

electrical practice have stood the test of time, so don't turn up your nose at them, and think that you can hook up circuits without proper regard to them. Conserve all energy till you have caused it to give you its utmost. "punch."

Remember that a dozen small leaks may be pretty nearly as disastrous as one big hole. Don't be afraid to try new ideas, though.

I used to wake up at night, all in a

"30·13 metres." Talking of precision, it wouldn't be a bad plan to import more of it into your log-book.

Parts of the log which you entered up last Thursday would make a cat laugh. You've let desire outrun discretion. You've guessed at the half and then multiplied by two.

I expect that these remarks will give you pain in the neck, but you've got to swallow them—and no back answers.

# CAPT. ECKERSLEY'S QUERY CORNER



Don't address your letters direct to Capt. Eckersley; a selection of those received by the Query Department in the ordinary way will be answered by him.

Under the above title, week by week, our Chief Radio Consultant comments upon radio queries submitted by "P.W." readers.

## HETERODYNE WHISTLE—MAINS UNITS—OUTPUT CONDENSERS—LOUDSPEAKERS.

### A Carrier-Wave Problem.

B. L. (Dulwich).—"I am puzzled as to the precise meaning of heterodyne whistle. Is this note caused by the beating of two carrier-waves, or by the mutual interference of the two sets of sidebands? How is it that a heterodyne note often varies in volume in spite of the fact that the two interfering stations apparently maintain a constant volume?"

The steady heterodyne note is due to the beating together of two carrier-waves, a beating audible after detection only, of course.

The heterodyning of sidebands also takes place, but this does not set up a steady note, rather it is a sizz spizzling noise well described as "monkey chatter."

The variation in volume is due to fading, and the fact that the modulation volume appears constant is probably due to the fact that you are listening to one station which keeps constant while the other varies. You don't say so, however, so I suggest that small changes in relative intensities of carriers make a more pronounced effect than small changes in modulation volume.

At any rate, I can assure you it's due to fading; one station goes up the other down, and that's a double effect. Of course they sometimes work together, but then there would be no change.

### Field Current from H.T. Unit.

M. O. (Cambridge).—"Is there any reason why the field current for a moving-coil loudspeaker should not be obtained from the same A.C. H.T. unit which feeds the receiving valves, assuming, of course, that the H.T. unit is easily capable of supplying the necessary current?"

There is no reason whatsoever why this should not be done—it frequently is done. Sometimes the field winding of the speaker is used as the smoothing choke for the eliminator but, of course, this presupposes a fixed design where the ampere turns on the speaker magnet are calculated on the basis of a constant H.T. feed.

In any case, provided, as you say, the eliminator will stand it, it can perfectly well be employed to give the necessary milliamps. (or even amps.) to magnetise the coil.

### Is it Necessary?

L. C. (Dover).—"I notice that the value of the condenser used in output filter circuits is always large; say, about 2 mfd. Is it necessary to employ such a high value, bearing in mind that the average coupling condenser used in an R.C. stage is usually about .01 mfd."

Let's work it out; it's quite simple. Fig. 1 is equivalent to Fig. 2, which is equivalent to Fig. 3.

A constant voltage generator, E, Fig. 3, has to pass energy to the loudspeaker, which is a combination of resistance R and inductance L. It is our object to see that at no frequency in the audible gamut will the impedance of C be comparable with the combined impedance of R and L.

In other words, C must not impede the current going into the loudspeaker. Now, L has a minimum and C a maximum impedance at a low frequency.

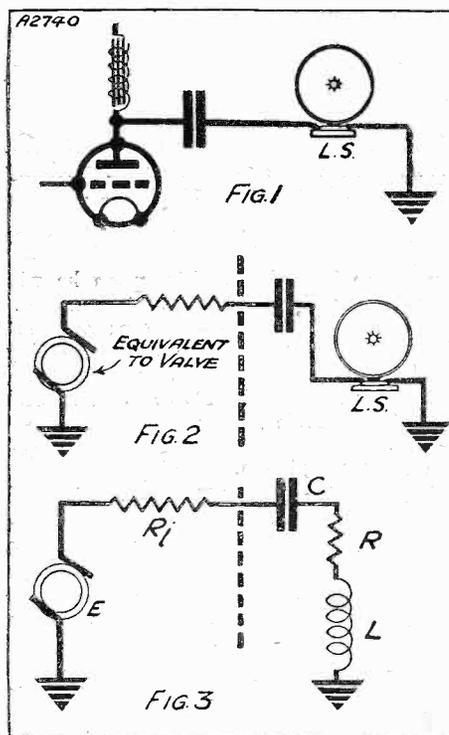
So we must consider for practical purposes a frequency of, say, 50 cycles/sec. Now R is about 1,000 ohms, and L about 1 henry (as a minimum).

So the combined impedance of R and L is the square root of the sum of their squared impedances or root, 1,000 squared plus  $6 \times 50 \times 1$  squared, or 300 squared. This is about 1,000; the inductance makes little difference. Therefore the impedance

of C should be a good deal less than 1,000; say it should be 200 ohms. Well, this means it should be 15 microfarads. So 2 is far short of the right value, but it doesn't matter, because loudspeakers if really given a constant voltage are bass heavy.

The 2-mfd. impedance must be also added to  $R_1$  the internal impedance of the valve. There is therefore a lot of bass cut, but the tuned circuits and the quality of the speaker adjust against this. Of course, the value of the inter-stage coupling condenser can be much higher, because the grid leak is of the order of 200,000 ohms, which is equivalent to saying that R in my diagram is 200,000, and not 1,000 ohms.

### "BOILING IT DOWN"



The top figure shows the usual circuit arrangement for an output filter, while the other two sketches illustrate the equivalent theoretical circuits in varying stages of analysis.

### Not Through the Windings.

J. K. (Hounslow).—"The power valve used in my receiver is one of the new types, taking about 6 milliamps anode current. Would it be permissible to pass this current through the windings of my cone speaker, or would there be a risk of damage to the speaker?"

Not knowing the design of your speaker I cannot say definitely whether you should pass your H.T. through it or not. But, whatever the design, I should strongly advise NOT to pass the current through the windings.

First because the speaker was probably not designed to have the magnet field increased by a substantial amount and, if you were to connect the windings the wrong way round, it wouldn't work if the field was decreased by a substantial amount.

I may be wrong, but I know of some moving-iron speakers where this is true.

Secondly, one does not want to bring the H.T. to the speaker terminals which children and others may easily touch when trying perhaps to adjust the speaker.

**A** S GOOD a way as any of giving the reader an idea of what reception conditions are like at the present time is to shut my eyes and dab with a pencil at the date headings on the page of my log for the past fortnight.

This done, I will tell exactly what happens on the particular day selected by fate for description.

Eyes shut. Dab! The day chosen is a recent Thursday.

#### A Well-Known Set.

First of all let me say that the set used on that day was a well-known four-valver containing two screen-grid high-frequency stages, a grid-leak-and-condenser detector and a power output valve, transformer-coupled.

All reception was done on the loud-speaker, and the period during which it took place was between 4 p.m. and 10 p.m.

Beginning with the long waves, Huizen was heard with fine quality and strength. Radio-Paris was not transmitting at the time, but Zeesen and Warsaw were both first-rate.

I see, too, that Motala received full marks, though this was actually the only occasion on which he gained them for a week or more.

Working upwards, as one usually does when searching, from the bottom of the

# STATIONS WORTH HEARING

Some practical distant-programme notes compiled by a special contributor who nightly searches the ether in order to obtain really up-to-the-minute information for "P.W." readers.

medium waveband, I find that Nürnberg was so badly heterodyned that he was not worth listening to.

Trieste was very good, Toulouse P T T barely at loudspeaker strength, and both Leipzig and Turin excellent. Heilsberg, Bratislava, Hilversum and Genoa all showed good volume and quality, but Bordeaux was not heard.

Göteborg, the Poste Parisien and Brussels No. 2 were excellent, though Breslau, who on other evenings provided fine reception, was not recorded on the night in question. Milan also was an absentee.

#### The Top End Best.

The band between about 340 and 380 metres does not seem to have been good, for there are no entries for Brno, Strasbourg, Barcelona, Hamburg or Lwow, all of them stations whose record is usually good. Toulouse, Frankfurt and Sottens were all very well heard.

The best part of the medium waveband was between 440 and 510 metres; Rome, Beromünster, Langenberg, Prague

and Brussels No. 1 all furnishing fine reception. The only station not up to the mark in this region of the waveband was Florence, who is entered as weak.

There was hardly anything to hear above the wavelength of Brussels No. 1, the only entry in the log being concerned with very faint reception of Budapest.

The actual number of Continental stations providing satisfactory volume and strength on the day in question was five on the long waves and eighteen on the medium waveband; twenty-three in all.

#### Rather Below The Average.

A comparison with others in the log shows that the day was quite a representative one, though, if anything, rather below the average for the number of "V.G.'s" is generally twenty-five or twenty-six.

The list given above shows that summertime reception this year has been almost as productive as was that of winter a year or two ago.

Now that the longest day is well behind us, long-distance reception should show steady though possibly rather slow improvement from week to week.

We are likely, I believe, to find stations in the upper part of the medium waveband returning to form before long. The most important of these are Vienna and Budapest. R. W. H.

**I** AM writing these notes on the "morning after the night before," having just "come to" after another of my sittings "all through the night."

As a result of much intensive listening I am beginning to think that conditions are quite good, but not at the times when ordinary mortals choose to listen.

At 10.30 or 11 p.m. there was very little to be heard, apart from the usual crop of "hams" on the 20- and 40-metre bands. At 2.30 a.m., however, the state of affairs was very different.

#### "The Roaring Forties."

The first point that one notices in the small hours is that the American amateurs on the 40-metre band are tremendously strong. There were times when I was almost reminded of the good old days, with real R 8 signals coming over.

The 49-metre band has three "high spots" to show at that hour of the morning, W 8 X A L, W 3 X A L and W 8 X K all being terrific in strength, even on one valve.

W 3 X I, a little lower down, would doubtless have been excellent had he been on the air at the time. He closes down nowadays between midnight and 4 a.m. on Sunday mornings.

W 3 X A L, by the way, recently announced a programme change, as a result of which he will be working on 16.9 metres

## SHORT-WAVE NOTES



News and views regarding an exciting and fascinating wave-band.

By W. L. S.

except on Saturday nights, when he will resume his present setting of 49.18 metres.

Although I was principally on the hunt for "hams," I found several broadcasting stations between 2 a.m. and 4 a.m., notably V E 9 G W, Y V 11 B M O (Venezuela) and H K A (Colombia).

#### A Disappointing Patch.

W 2 X A F and W 1 X A Z were the only "signals" to be heard in the region of 32 metres, and both were disappointingly weak. "X A D," of course, usually disappears by midnight, and sometimes does not last out till then. The fade-out on the 20-metre amateur band seems to occur nowadays at about 2.15 a.m.

The only other discovery of note was one

solitary New Zealander, Z L 4 A O, on the 40-metre band at 5 a.m., which is quite an unusual time to hear the Antipodes on that band.

"J. B. M." (Glasgow) comes into the limelight once more with a report of receiving "Radio Pernambuco" on 31.5 metres just after midnight, strength R 7.

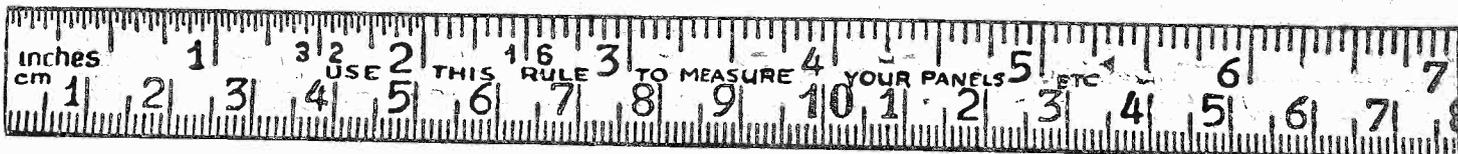
He also mentions a New Jersey transmitter which I can only assume to be W 3 X A L testing in the region of 20 metres. Possibly they are testing out various settings before going over definitely to the 16.9-metre wave already mentioned.

#### Have You Heard Him?

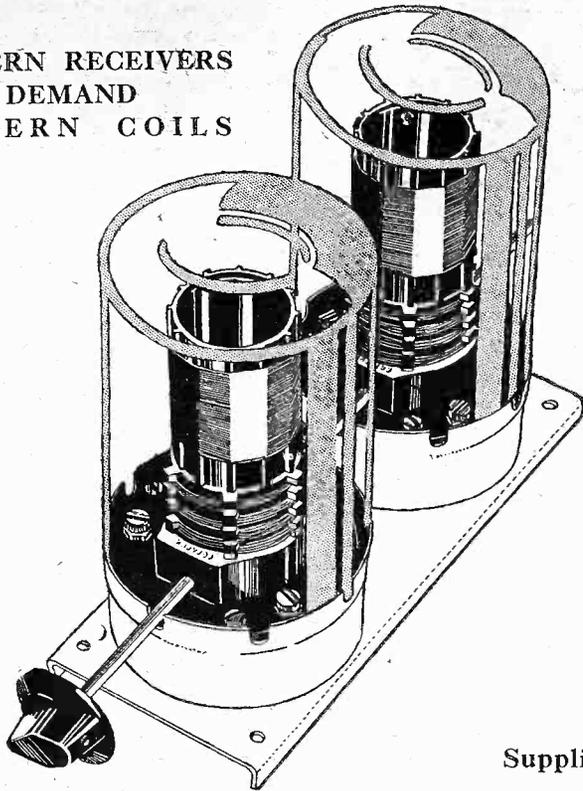
Another station to watch for is C T 3 A Q (Funchal, Madeira). I am informed by "V. C." (Northfleet) that this station is on the air on 24 and 31 metres alternately on Tuesdays and Thursdays from 9.30 to 11.30 p.m., and on Sundays from 3.30 p.m. to 5 p.m., with an input of 50 watts.

G 5 Y A (Hurstmonceux) tells me that he is using my "S.G." Four in conjunction with his transmitting gear and likes using a loudspeaker when atmospheric conditions are bad enough to make headphone work a trial.

He adds that his "family circle" have had W 2 X A D for five consecutive nights with sufficient programme value to follow perfectly a serial play that has been broadcast.



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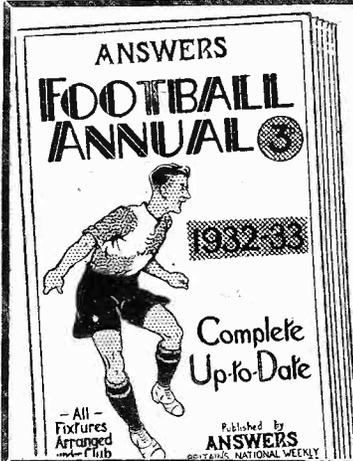
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## FROM THE TECHNICAL EDITOR'S NOTE BOOK.

# Tested and Found—?



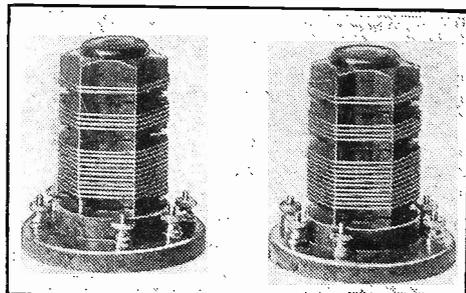
## SHORT-WAVE RANGES.

I RECENTLY noticed a statement (not in "P.W.") in which it was said that the wavebands covered on short-waves are necessarily rather narrow because of the small capacity of the usual short-wave tuning condenser.

But this is only a half-truth. Certainly the wavebands are narrow, but their station-accommodating powers are enormous.

Let us consider the new Lissen Triple-Range Short-Wave coil from this point of view. It comprises three sections and one or two of these can be shorted out of circuit

## NEW LISSSEN COMPONENT



Two of the Lissen Triple-Range Short-Wave Coils.

at will. (In due course we believe Messrs. Lissen are to market a special switch to do this work, in the meantime it can be done quite successfully with two simple on-off types.)

Now, on test, I find that this coil effectively covers a range of from 13 to nearly 80 metres. At first sight that might not seem a very wide waveband as compared with, say, the 200-500 metres of medium waves which can be covered fairly easily with one coil having no tappings.

But each metre covers a greater and greater range of frequencies as you go down towards the short waves, and station separation is arranged in accordance with a frequency, not wavelength standard. The present arbitrary frequency allotment for each station is 9 kilocycles—that is the width of the "channel" in the ether it is allowed.

There are one hundred such channels in the 200-500-metres waveband, but there are about two thousand three hundred in the 13-80-metres range. So you see the Lissen Triple-Range Short-Wave Coil, despite the smaller capacity tuning condenser which one would use with it, could deal with more than twenty times the

number of stations than an ordinary medium-waver, given the standard frequency separation!

I must mention, too, that the reaction is wound in sections on this Triple Ranger, and that a smooth reaction effect is given over the whole of the range covered.

It is a most compact coil and is actually smaller than many ordinary dual-wavers which, in view of its indisputable efficiency points to careful design and the employment of high-grade materials.

And yet it costs only 4s. 6d.

It is certainly an attractive component.

In conclusion, it should be noted that a .0002-mfd. tuning condenser (as recommended) was used during our tests and that there were no gaps between the three ranges—indeed, there was ample overlap.

## THE BULGIN "TRANSCOUPLER."

To quote the words of the maker's leaflet, the Bulgin Transcoupler is "a parallel-connected resistance-fed high-primary-inductance nickel-core L.F. Transformer. It incorporates a coupling condenser and a tapped wire-wound anode resistance."

You might think from all this that it is a large and somewhat fearsome-looking component. But it is nothing of the sort and is, indeed, rather smaller than the average L.F. transformer. Also it has only six terminals, so that it introduces an economy in wiring as well as space as compared with the usual parallel-fed transformer and its associated components.

The Bulgin Transcoupler can replace such an arrangement, or an ordinary transformer, in any circuit, and the resistance tappings allow it to be matched efficiently to a preceding valve of any kind, with a consequent improvement in amplification and quality.

The advantages of resistance feeding are quite well-known these days. And to my mind the most important is that a high primary inductance can be maintained without resort to a large quantity of iron. Needless to say, the elimination of the D.C. component of the current from the primary winding is a considerable benefit.

With the Bulgin Transcoupler you can run up to seven or eight milliamperes in the anode circuit of the preceding valve and still maintain from 80 to 100 henries of inductance, and that is a most attractive feature.

Indeed, the transformer which will, with a direct H.T. connection, handle successfully anything like this is in the nature of a rarity. And in any case it means a heavy load of iron.

We have tested the Bulgin Transcoupler very carefully and find that it is perfectly efficient, and when used in the recommended manner it gives first-class results and an even amplification of good order

extending from the base right into the higher frequencies.

The component is built into a fine bakelite case and its terminals are widely spaced on the base for easy and tidy wiring. The price is 11s. 6d., and we predict that it will tend to set a new pace in L.F. component design and that the system involved will achieve great popularity.

## PLEASE NOTE

Manufacturers and traders are invited to submit radio apparatus of any kind for review purposes. All examinations and tests are carried out in the "P.W." Technical Department with the strictest of impartiality, under the personal supervision of the Technical Editor.

We should like to point out that we prefer to receive production samples picked from stock, and that we cannot in any circumstances undertake to return them, as it is our practice thoroughly to dissect much of the gear in the course of our investigations!

And readers should note that the subsequent reports appearing on this page are intended as guides to buyers, and are, therefore, framed up in a readily readable manner, free from technicalities unnecessary for that immediate purpose.

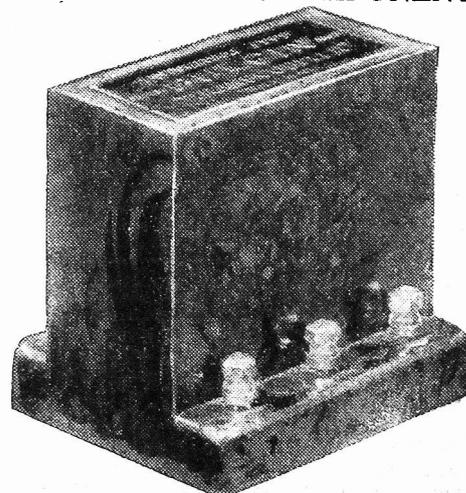
You see it enables a de-luxe performance to be achieved at a low cost, and there is not a great difference in the amplification obtainable. A further advantage is, of course, that it is easier to avoid stray coupling effects with this parallel-feed scheme and that means greater stability and also better quality.

## FERRANTI'S RETAIL DISTRIBUTORS.

Ferranti are to adopt a new trading policy. They are going to take the Wireless Retailers' Association list of members as the nucleus of their accepted retail distributors, and add to this only the names of non-members who are able to qualify as good dealers. Various other measures are also to be adopted to ensure that both the trade and the public are treated fairly. We believe Mr. C. P. Beardsall, Ferranti's radio chief, is himself responsible for the scheme which, we learn, has been most favourably received by all concerned.

(Continued on page 540.)

## A COMBINATION COMPONENT



The Bulgin "Transcoupler" embodies all the essential elements for parallel-fed L.F. transformer coupling.



# TOM CLARE TALKS ABOUT RADIO HUMOUR

"A humorist must be loyal to his own public," is the motto which Tom Clare has kept before him throughout his long and successful career. To-day, this "G.O.M." of piano humorists tells of the ways in which a "funny man" can achieve radio fame—and gives several good reasons for his strong dislike of a "studio audience"!

**A**LTHOUGH broadcasting is some eight or nine years old, a lot yet remains to be learnt about its technique, especially where humour is concerned. Radio humour is different from any other kind and a comparison with the stage is quite off the mark.

A humorist, whether he knows it or not, appeals mainly to a section only of the public. These people comprise what is known as his "public," and if he satisfies them he is doing all he can expect.

They must be his especial care and live in his imagination all the time he is broadcasting and preparing his material. If his imagination is not strong enough to enable him to see them at their fresides and to talk to them in the way they would want him to, then he will never be a "top-liner."

Personally, I regard imagination as the most important part of a broadcasting humorist's mental make-up. I even place it above his ability to be funny, because if he cannot visualise the people he is trying to entertain, then his efforts at funniness will miss their mark.

### The Audience Question.

Some broadcasters feel that an audience in the studio helps them in this way, but, personally, I do not share this feeling. To me broadcasting means entertaining an unseen audience, one which exists only in my imagination.

The people in front of me have nothing to do with those I am talking to. I would much prefer them out of the way, for their presence has an effect upon me which I find it almost impossible to resist: they hinder my imagination and tend to put me out of my stride.

Their applause, too, is upsetting. It rarely coincides with what I am expecting, and with what I am sure is taking place in the homes where my particular "public" is listening. Sometimes they laugh at a remark which cannot possibly be funny outside the studio, which must be very annoying to the listeners. If they catch me by surprise their noise drowns what I am saying.

Perhaps I have expressed myself rather strongly on this point, but, after all, I can only say what I think. Others, I know, have different opinions, but this is mine for what it is worth.

### Helping the Listener.

Just as the humorist needs to employ his imagination, so he must see to it that he helps the listener to use his successfully. When he is describing funny incidents it is more than essential that he supplies all the details which go to make up the mental picture. Stage comedians especially should bear this in mind when they are broadcasting, because they are so accustomed to

Whichever way I look at the question I find myself against studio audiences.

having scenery and gesture to implement description.

Another point is the time a listener requires to make a mental picture of what has been said. Any broadcaster, or would-be broadcaster, would do well to become a listener on certain occasions just to test this out for himself. I think he would afterwards agree that detail is the secret of success, and that it must be built up step by step with the utmost dramatic emphasis.

Once the picture is complete and the listener is able to imagine the setting, the incident can be unfolded, but not an instant before.

When he reaches his climax he must remember above all else to allow time for the laughter to subside: not to do this is fatal. I am sure there is nothing more likely to spoil a programme than the thought that some jolly good fun is being missed because oneself or someone else is laughing.

### DO YOU REMEMBER HIM ?



The "Reminiscences of Piano Humour" series which Tom Clare gave recently was one of the most successful of light broadcasts. Those who heard him sing "The Tin Gee-Gee," for instance, could not fail to appreciate his genius.

### Imagination a Great Asset.

This is another way in which the imagination has to play its part. No artiste can hear the laughter. In fact, he has no guarantee it is there at all, apart from what his instinct tells him.

But, if he knows the people he is talking to, and if he really is talking to them, then the laughs will be there all right, and he will find himself judging his pauses well enough to let the noise die away before resuming.

In my recent appearances "on the air," I have dealt with the history of entertainment at the piano, as some listeners will recall perhaps. My Broadcasts were like instalments of a newspaper serial story, because I felt that some kind of continuity was a good thing.

Those who did not like the first instalment knew what was coming when they saw my name in the programme the second time! On the other hand, those who did like it had something to look forward to, and did not afterwards experience the disappointment of discovering that I was talking about something altogether different.

Other Broadcasters have tried this method, too, and found it advantageous.

It is undoubtedly a good thing for them to build up a wireless personality for themselves, as some of them have done, so that listeners know more or less what to expect

(Continued on page 540.)



# RADIOTORIAL

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

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor 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 inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lilie, 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 ACTUAL AMPLIFICATION OF A VALVE.

P. V. S. (Smethwick).—"What is the formula for calculating the amplification obtained from a valve, as distinct from its theoretical amplification factor?"

"I have seen this given as a simple equation, with the impedance and anode resistance as part of the formula, but all I remember about it is that it comes out considerably lower in most cases than the amplification factor given by the valve makers.

### 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) The (approximate) number of broadcasting licences in force in this country at the beginning of the year?
- (2) Why Brussels has two equal-powered broadcasting stations covering the same service area?
- (3) Where and what is Skamlebaek?
- (4) How to calculate the voltage drop across an A.C. mains set's biasing resistance?
- (5) The wavelength of the B.B.C.'s short-wave station?

"Can you give me an example to make it quite clear?"

The formula is:

$$\text{Actual amplification} = \frac{R \times \mu}{R + \text{Impedance}}$$

where R = the anode resistance,  $\mu$  = the amplification factor.

Suppose, for example, that we have a valve with an amplification factor (or "mu") of 40, and an impedance of 60,000 ohms, and its external load is 100,000 ohms.

To find the actual amplification we apply our formula:

$$\text{Actual amplification} = \frac{R \times \mu}{R + \text{Impedance}}$$

which becomes:

$$\begin{aligned} \text{Actual amplification} &= \frac{100,000 \times 40}{100,000 + 60,000} \\ &= \frac{4,000,000}{160,000} \\ &= 25. \end{aligned}$$

If a much higher anode resistance were used—say, 250,000 ohms—the result would be less disappointing:

$$\begin{aligned} \text{Actual amplification} &= \frac{250,000 \times 40}{250,000 + 60,000} \\ &= 32 \text{ (approx.)} \end{aligned}$$

This more nearly approaches the "amplification factor," but, as is well known, there are unsurmountable obstacles to using very high anode resistances. So, in practice, the valve always gives a lower amplification than its amplification factor would suggest.

### LONG-WAVE TROUBLE.

P. L. W. (Worcester).—"When the 'Eckersley Tuner' was first described in the 'P.W.' I was very much drawn to it, but I did not get a chance to make it up in a set until last March, and then I realised what a lot I had been missing up till then.

"It has given me the greatest satisfaction, and several times I have been going to write; but I little thought that, instead of congratulations, I should have to pen an S.O.S. However, such is the case, because, for some unknown reason, the tuner now refuses to work on either the long or ordinary waves.

"At first I thought it was the set, but after two wasted evenings I found nothing wrong with it. And then I thought of joining the aerial straight to the grid condenser, instead of to the aerial side of the tuner.

"The effect of this is that the set comes back to life, but there is a noticeable fall off in sharpness of tuning on the second condenser, and the first condenser is useless.

"When I change back to put the aerial on

### "P.W." PANEL No. 79. CONNECTING APPARATUS "IN PARALLEL."

When dry cells, resistances, condensers, or other electrical components are wired "in parallel" the object is that current flowing across that part of the circuit shall have alternative pathways where it can divide, some of the current going through one piece of the apparatus and some through its neighbour.

Thus if two batteries are to be charged in parallel, one of the charging circuit wires goes to the positive on one cell and also to the positive on the neighbouring cell; the other charging wire goes to the respective negative terminals. And at this part of the circuit the charging current will divide, some going through one cell and some through the other.

Any coils, resistances, etc., thus affording alternative pathways are said to be connected "in parallel."

the other side of the screen, either to the coil itself or to the selectivity condenser (either side), the set goes dead.

"I have examined the tuner and all wiring, etc., with the utmost care, expecting to find a break somewhere. But nothing is wrong there—of that I am certain.

"Can you tell me how to put it right, and what is the quickest way to test where the fault lies?"

It looks as though the whole trouble is due to a dud coupling resistance. It is most unusual for this component to give trouble, because it is carrying only minute currents which should not affect it in the slightest, even after years of use.

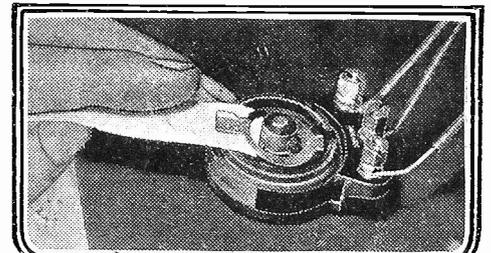
But apparently your "coupling" is simply a broken circuit at the moment, and your best plan is to join up a fairly high resistance across it. That is to say, connect the new resistance to the same points as the old one.

You need not trouble to remove the original resistance, even: simply try the new one in addition to it. A resistance of 100,000 ohms is correct, but almost anything in the resistance line will do just for testing purposes.

In all probability your tuner will "come to life" immediately, proving that the present resistance is a dud. Should you fail to get good results, however, it will be due to a break (somewhere in the first coil or its connections) which has escaped your notice. It is surprising how difficult it is to be sure that the circuit is O.K. merely from inspection of it.

To test it you need to apply the 'phone and dry cell method of checking continuity, which has frequently been described in "P.W."

### WHAT'S WRONG?



### KEEPING VOLUME CONTROL CLEAN.

It sometimes happens that the adjustment of the volume control produces loud clicks and bangs because dust or dirt has been allowed to fall on it and so produce poor contact.

In some cases a clean-up with a strip of cardboard rotated under the slider as shown will cure the trouble. In others it is generally necessary only to tighten the spring contact a little to remove the fault.

### WATCH YOUR L.T. BATTERY.

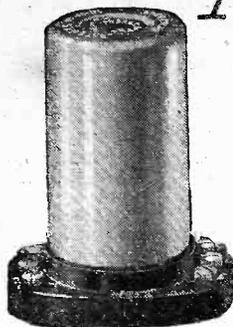
M. G. (Alpertou).—"It has been pointed out to me that the liquid in my accumulator is about a quarter of an inch below the line marked on the case. Being charged at home, it is never moved, and could not have been spilled. Is it doing any harm?"

Yes. Partly because of the warm weather, and possibly partly due to gassing on charging, etc., some of the liquid is bound to get lost. It should be replenished before the level falls below the tops of the plates.

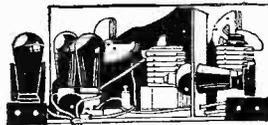
The plates must always be completely covered with liquid, in other words. If you are doing your own charging you should use a hydrometer, and had you been doing this you would have appreciated the fact

(Continued on page 538.)

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(Described in this issue.)

**35'-**

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Read this  
extract from  
a recent  
"WIRELESS  
WORLD"  
Test Report :

"The performance of this unit is such that it merits discussion from an absolute standpoint and without regard to the very reasonable price asked . . . Overall sensitivity slightly better than the average . . . reproduction of bass below 100 cycles quite definitely above the average . . . as a result of the well-maintained output down to 50 cycles a full-bodied bass is obtained without 'boom.' Reproduction of speech is natural and unforced, and the balance in music is exceptionally good."

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P.M. MOVING COIL REPRODUCER

REPRODUCERS & AMPLIFIERS LTD.

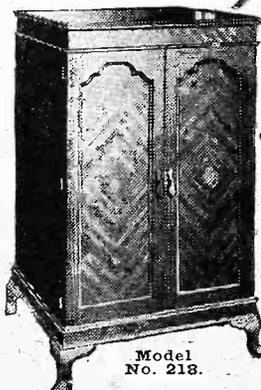
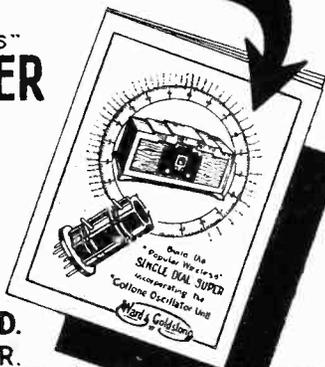
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CHAS. A. OSBORN  
(Dept. P.W.).

## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 536.)

that the cells needed refilling because it would have been difficult to draw off the acid when the level fell.

Unless the gassing has been excessive, probably you only need to replace the loss of liquid by distilled water. You can get this at any chemist's for a few pence, and the level of each cell can be brought up to the indicating mark with the distilled water if voltage appears to be O.K.

Keep constant watch with voltmeter and hydrometer if you want to get good service. Observe the maker's instructions carefully, avoid high temperatures, see that the plugs and connectors are tight and that the vent holes are open. If either voltage, or specific gravity as indicated by the hydrometer, is low, and is not restored by a rather longer-than-usual charge, get an expert at a service station to look at your accumulator for you.

### THE MILLIAMMETER AS AN AID TO DIAL READINGS.

E. W. C. (Horseferry).—"Recently when checking on a milliammeter in the plate lead

of the detector valve, joined between H.F. choke and primary of the low-frequency transformer, I was surprised to notice that the milliamps flowing showed a sharp drop when the set was accurately tuned in. Even some of the foreign stations showed a slight decrease in anode current, but on the stronger British it was really quite marked. I am wondering if this is usual, or anything wrong?"

With a grid-leak detector it is quite usual to have a marked decrease when a strong station is tuned in. In fact, this method of inserting a milliammeter in the plate lead is sometimes taken advantage of when very sharp readings are required, because the visual indication is so much clearer than the alteration in sound values, as the tuning condenser is moved.

### A TUNING TIP.

J. L. (Ashford, Kent).—"I am very interested in the method of spreading out the dial readings which was introduced by W. L. S. in Short Wave Notes. I mean the method of using a condenser of small capacity connected in parallel with the other condenser, and tuning over a certain part of the wave-range with this.

"Could the method be applied to an ordinary broadcast receiver, so the dial readings for a given part of the tuning range would spread from 0 to 100 degrees on, say, a .0001-mfd. ? If so, what would be the best way of doing this?"

The method is quite applicable to ordinary wavelengths, as well as to short waves, and there is really no difference in the procedure for such a change. All you have to do is to clip a pair of short flexible leads to the moving and fixed vanes of your tuning condenser, and join them to the (rigidly mounted) extra condenser, of smaller capacity.

Then to explore that part of the dial say between London National and London Regional you would set your new tuning dial to 0 and adjust the main tuning dial so that London National was sharply tuned in there. Then proceed to tune not on the main dial, but on the new dial, which even at the full-scale reading will take you up only to somewhere in the vicinity of the Regional station.

You will thus get the advantage of "spread out" dial readings over this portion of the scale, but of course, there is always the difficulty that the slightest

variation in the setting of the main condenser will throw out your reading on the smaller condenser, so that they cannot easily be repeated from a prepared calibration chart.

### AN EXTRA CIRCUIT FOR SELECTIVITY.

P. L. (Falkirk).—"I have been told that the simplest way to get better selectivity is to add an extra tuned circuit to the present set, without altering the internal wiring of it.

"Then take the aerial connection to the new circuit instead of to the set as before. What does an extra circuit of this kind consist of?"

The extra tuned circuit consists in the ordinary way of a coil and variable condenser, the latter being of, say .0005 microfarad and the coil being of the size appropriate for the particular waveband which you desire to cover.

One side of this circuit may be connected to  
(Continued on page 540.)

### HOW ARE YOUR RESULTS NOW?

Perhaps your switching doesn't work properly? Or some mysterious noise has appeared and is spoiling your radio reception? Or one of the batteries seems to run down much faster than formerly?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers its unrivalled service.

Full details, including scales of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an Application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form, you will know exactly what information we require to have before us in order to solve your problems.

**LONDON READERS, PLEASE NOTE:** Inquiries should NOT be made by phone or in person at The Fleetway House or Tallis House.

### THE ANSWERS

TO THE QUESTIONS ASKED ON PAGE 536 ARE GIVEN BELOW.

- (1) Between 4½ and 4¼ millions. The exact figure on January 1st was 4,930,785.
- (2) Because about half the population do not speak Flemish, and the others do not speak French, so a station is provided for each of these commonly used languages.
- (3) In Denmark. It is the site of Copenhagen's short-wave relay station. Wavelength 31.51 metres.
- (4) Multiply the number of milliamps passing by the number of thousands of ohms in the resistance. Examples: 20 milliamps through a 500-ohm resistance = 20 × .5 = 10 volts.
- (5) 25.53 metres. The station is situated at Chelmsford. Call-sign is G 5 S W.

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We paid a customer £4 0s. 0d. for an Osram Music Magnet Three.

And helped him to buy an Ekco M23 All-mains Console (£17 17s. 0d.).

We paid a customer 13/6 for three 2-volt S.G. (B.V.A.) valves.

And helped him to buy a Pifco Radiometer (£2 2s. 0d.).

We paid a customer 10/- for a Ferranti L.F. transformer A F 3.

And helped him to buy a B.T.H. Pick-up (£2 5s. 0d.).

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**I AM THINKING OF BUYING:—**

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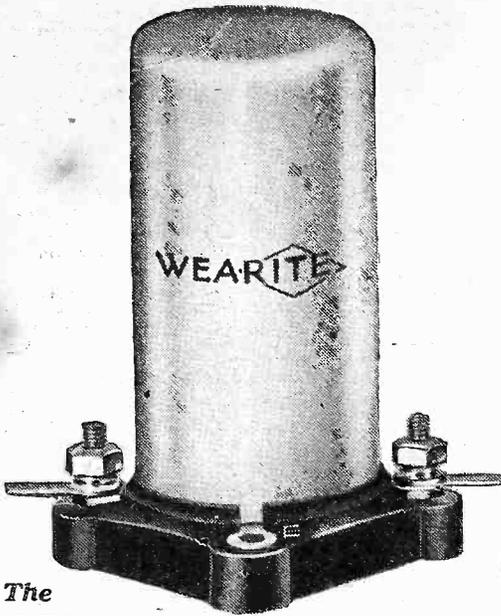
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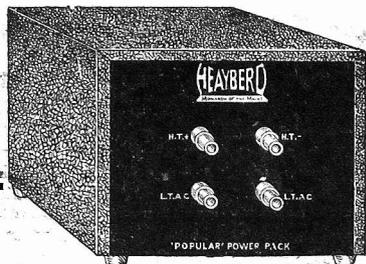
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P.W.37.

## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 538.)



### Selected for "P.W." A.C. Radiogram

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L.T. A.C. 4v. 4 amps.  
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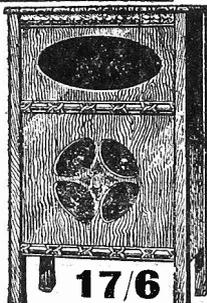
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earth and also to the earth terminal of the receiver. The other side—that is, the other junction between coil and condenser—takes the aerial connection, and also that between the extra circuit and the set itself. This does not go direct, but via a coupling condenser between the new circuit and the aerial terminal of the set.

This coupling condenser should preferably be of quite small capacity, and you will find in general that as the capacity of the coupling is reduced the tuning will become sharper.

It is important that there should be no magnetic coupling between the coil in this extra circuit and the coil in the receiver. To avoid it the outside coil should be placed at right angles to that in the receiver and as far away as convenient.

(In order to test whether there is any magnetic coupling between the two coils you might try disconnecting the coupling condenser altogether, and noticing whether anything is picked up between the coils.) For the coupling condenser you will probably find it convenient to use one of the neutralising type, and the capacity needed is so small that often a satisfactory "condenser" can be made by an inch or so of twisted insulated wire. Two of the ends of the twist are left quite free, and the other two ends are connected to the circuit in place of condenser plates. The shorter and looser the "twist" the less the capacity.

### A NEW TYPE MAINS SET.

"CURIOUS" (London, W.C.2).—"With reference to the interesting article on the new high-voltage indirectly-heated valves, appearing in 'P.W.' of June 18th, should not the 50,000-ohm potentiometer which has one side joined to the mains fuse, be joined on its other side to the other mains fuse?"

Yes. This lead was omitted from the theoretical circuit diagram in error.

### TESTED AND FOUND

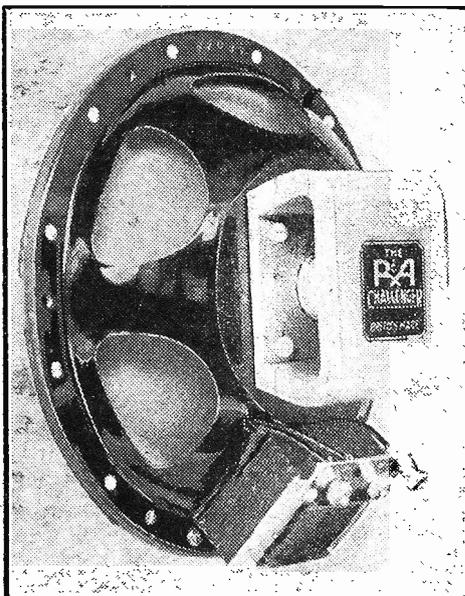
(Continued from page 534.)

#### AN R & A LOUDSPEAKER.

One of the most interesting small moving-coil speaker units that we have tested recently is the Challenger, made by Reproducers and Amplifiers, Ltd., of Birmingham.

It is of the permanent-magnet type, and is listed at 35s. The characteristics of the speaker are quite good, and it will handle two watts of A.C. energy without distress. Thus it can be used with large mains output valves of the super-power or pentode type if desired.

As regards its response, the model we have had under test gives excellent definition on speech, the speech frequencies being



A close-up of the chassis assembly of the R & A loudspeaker referred to above.

well reproduced, while higher up the scale it continues to give bright reproduction.

It would appear that the choice of cone material has been carried out with care, and a great deal of the brilliance of the reproduction is probably due to this.

The speaker is sensitive, and with 350 milliwatts (used with an output valve of the P.220a type) it gives quite adequate volume for all ordinary purposes.

A practical point that can be commended is the arrangement for mounting the chassis. Many loudspeakers have been spoilt by a slip of the screwdriver when mounting, for once the diaphragm is torn the speaker is useless. In the "Challenger" such a slip is almost impossible as the mounting holes are facing the main chassis girders, which effectively protect the diaphragm.

### TOM CLARE TALKS ABOUT RADIO HUMOUR

(Continued from page 535.)

when they see their name in the programme.

A man cannot broadcast too often if he is good. In fact, it is only stating the obvious to say that the better he is the more people want to hear him. The only point is that he must not only keep his form but get better each time as well. This is difficult, but not impossible. Of course, no man could do it by himself; he would require help in preparing his material. Much of it he would have to buy outright, and there is no reason why he should not.

Perhaps some people will think this unfair at first, and suggest that every word he broadcasts should be his very own. But, after all, why should it? Do the soloists compose their songs? Do the players write their plays? Do the musicians invent their tunes? Of course not! Then why should a humorist, just because he is a humorist, be under the obligation of writing his own material?

#### Plenty of Responsibility.

But even if he had some of his material written for him, his responsibilities would not be removed altogether. In the first place there would be the task of finding witty writers who would work for a reasonable price.

Then there would be the work of examining all they turned out so as to make certain it was just the right kind of thing for him to say. Whether he wrote it himself or bought it, he would be the man who would have to say it and whose future depended on its success; he would still have more than enough to occupy his mind.

The public is always complaining that it does not get enough humour, and the reason is that the "top-liners" simply cannot provide it. They dare not risk a failure, and have to wait until a first-class subject for broadcasting strikes them.

In my opinion there is one very good way out of this difficulty, and that is for the B.B.C. to provide the material. The "top-liners" have been broadcasting quite long enough for Savoy Hill to know their style perfectly, and the vaudeville section have enough humorists to keep up a good supply. I think they ought to be able to maintain a high standard and a frequent appearance with ease.

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When you fit an "Ealex" Combined Switch you do more than interpose a switch between your aerial and Set, you put safety in the circuit because in every "Ealex" Switch there is incorporated a lightning spark-gap of approved pattern and robust construction that will short to earth lightning—even when your Set is working. It also incorporates a lead-in tube. This neat three-in-one gadget costs only 2/-. Beware of inferior imitations. You can have no better guard for your house and set than an "Ealex" Lightning Switch.

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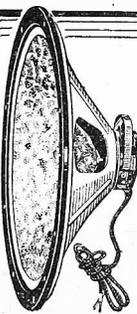
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THE PICTURE PAPER WITH THE MOST NEWS  
**SUNDAY GRAPHIC**  
and Sunday News

## THE LISTENER'S NOTEBOOK

(Continued from page 528.)

### The Music was Better.

On the other hand, the music was decidedly attractive, and as in the case of "The Pink Pink Vase," deserved a better libretto. One number—"Please Don't Mention It"—is about the best of its kind I've heard for some time, and I'm certain we haven't heard the last of it. Every musical body, from butcher boy to Henry Hall, will be tearing it asunder shortly, while Christopher Stone is certain to include it in every new record recital till Christmas.

It is amazing how long a good musical number can stand the strain. "Auf Wiedersehen" for example, is going as strong as ever with no sign of an early demise. I've always awarded the prize for persistent living to "Guilty" (excuse my disturbing resting bones), but I fancy this record will be broken by "Auf Wiedersehen." I base my conjecture on the fact that it is still given as a *new* number.

### A Speaker who is Different.

Any list of microphone personalities—and who isn't fond of drawing up lists?—should certainly include Mr. Lloyd James. For charm of manner he is surely unrivalled, and his Wednesday evening talks on English reveal him as a great teacher. One could, of course, cite other fine speakers, but there is something about Mr. James which differentiates him from the rest.

### The Advice of a Showman.

It has been said more than once that what the B.B.C. needs more than anything else is a showman. Mr. C. B. Cochran, the greatest showman of our time, said the other night: "I can give you no real road to success, as my predecessors have done, in the show business, because there isn't one—I have followed no guide but my own instinct—I have never tried to court the public taste—I put on what I want to see put on myself." And he added, by way of warning, "Without courage don't attempt to be a showman."

All this is very interesting in the light of what appears to be the policy of the B.B.C. Don't you think there's a strange similarity between the two, and don't you think that if the one policy succeeds, it is reasonable to assume that the other will? At any rate, it seems to me that we've got to recognise the fact that the B.B.C. has its greasy pole to climb, just as Mr. Cochran had, and that if at times it should slip back, it behoves us to be tolerant without losing our confidence in its ultimate triumph.

### Spoilt by Drastic Cuts.

Peter Creswell did well to get through Dr. Faustus in an hour. This, of course, was only possible by making severe cuts. It was a pity all the same, especially as a general speeding up of the play with less incidental music, would have allowed a good deal more of the dialogue.

Take, for instance, the scene in which the Seven Deadly Sins appeared. Did you ever hear anything like the long pauses between the several pieces of dialogue? Faustus himself was the chief offender here. The cast, was excellent, but if there was one character who caught my fancy more than another it was Cornelius. I was sorry his was such a small part.

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# TECHNICAL NOTES.

Some diverse and informative jottings about interesting aspects of radio reception.

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

## Amplification and Interference.

GET quite a lot of letters from readers complaining about interference with their reception due to electric trams and trains and all sorts of electrical devices in the neighbourhood. It is often very difficult to know how to deal with this type of interference, because it is outside the control both of the listener and of the B.B.C. It is true that the authorities do the best they can in exceptional cases to secure some sort of mitigation of the evil, but there are many cases in which this is not possible.

A good deal of the increase of trouble in this direction is due to the very much greater amount of high-frequency amplification which is generally used to-day. Things work rather in a vicious circle because with the overcrowded state of the ether we are bound to go in for selectivity, which in turn means the increasing use of high-frequency amplification, and this lays us more and more open to interference of the type referred to.

## Cutting It Out.

If you suffer from the effects of some particular local interference, you can often do a great deal by shifting your aerial either in position or in direction, especially the latter, or you may change from an outdoor aerial to an indoor one, or to a loop. This last is rather a drastic way of dealing with the situation, but I have known cases where the resort to a loop aerial was the only way in which bad local interference could be got rid of.

In some countries Government action has been taken with a view to stopping this nuisance, and manufacturers of electrical apparatus of all kinds have to design it in conformity with regulations, so that it is virtually harmless from the point of view of interference with radio reception.

Of course, such measures cannot be made retrospective, and there must remain a large amount of electrical machinery and apparatus which still offends from the radio point of view; but a time limit is placed upon this, and after the specified time has expired such apparatus will have to be scrapped and replaced by that which has been manufactured since the new regulations have been framed.

## Electric Signs.

The very great increase in the use of moving electric signs and neon signs has proved a source of serious trouble to listeners, especially those near the centres of large towns, where such signs are, of course, most prevalent.

The ordinary electric signs, using incandescent bulbs, cause trouble to listeners owing to the sparking of the contacts in the control machines, whilst the neon signs, in addition to this, are troublesome owing to the high-voltage current which is used, and to the transformers which are necessary for stepping-up to these voltages.

## Power Transformers.

A point which is often overlooked in the design of small power-transformers for use in radio sets is the fact that the performance of any particular secondary or output winding under load should be rated when the whole of the output windings are under load.

For instance, supposing a transformer is designed to give, say, two or three low-tension voltages and one high-tension voltage, the high-tension voltage should be tested when the transformer is delivering the full load from all the low-tension output windings.

In the same way the voltage and output from any one of the low-tension windings should be specified when the other low-tension windings and also the high-tension winding are delivering full loads. This is necessary because the loads on the various secondaries will react upon the primary and therefore upon each other.

The variation in the wattage output of any of the secondaries with the load, either upon that secondary or upon any of the

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other secondaries, depends upon what is called the "regulation" of the transformer.

## Voltage Regulation.

The "regulation" may be broadly defined as the ability of the transformer to maintain its rated output voltage irrespective of the load. This regulation depends upon the design of the transformer and also upon the amount of iron in the core and the allowance of copper in the windings.

A transformer which is skimped in these two last respects will naturally not have such good regulation as one in which the allowance is generous. Broadly speaking, large power transformers have much better regulation than small ones such as those used for radio receivers.

## Potential Drop.

Nevertheless, within fairly narrow limits as to load variation, I have come across small power radio transformers in which the regulation was really very satisfactory. I had a transformer sent to me a few days back by a well-known manufacturer in

(Continued on next page.)

**TECHNICAL NOTES**

(Continued from previous page.)

Lancashire, and I found that the drop in the output voltage of the low-tension and high-tension secondaries, on full load as compared with no load, was not more than about five per cent.

I should say, however, that this was a very good example of small-power transformer—very much better than some which I have tested at different times—and was generously proportioned with regard to the iron circuit.

It is well to be discriminating in the choice of a transformer like this, because nothing is more irritating than to find the transformer weak in the knees; what you want is a robust instrument which stands up to its load without any trouble.

**Balanced-Armature Tests.**

Among the many letters which I have had from readers with regard to the comparative merits of different loud-speakers is one from a reader in Kent, who is all in favour of the moving-coil as against the balanced-armature type. He says that although it has long been a popular belief that the balanced-armature speaker is more efficient than the moving-coil of a similar price, this belief is wrong, and has arisen because the comparisons have usually been made on sets with limited frequency range and power output.

In consequence of this, he says, frequencies below about 150 cycles are rarely produced at 20 per cent of their proper strength, whilst high notes are produced at considerably more than their normal strength, owing to harmonic distortion.

This state of affairs suits the moving-iron better than it does the moving-coil, and in these conditions the balanced-armature is usually louder. My correspondent contends that the only fair test is to use a "straight-line" set with ample power output, say, 500 milliwatts upwards, and with such a test the moving-coil comes into its own.

**Question of Power Output.**

If the power output is small, it may be that the balanced-armature compares favourably with the moving-coil, but when the power output is increased the moving-coil has the advantage. In this connection, my correspondent says that he carried out a number of tests with loudspeakers of both types, and these tests showed that on an average the moving-coil was more sensitive even when the output was as low as 250 milliwatts. As the output was increased, the difference in sensitivity increased, and when an output of one watt was reached the balanced-armature types of speaker could not possibly compare with the moving-coils.

As regards quality, he says he has never yet heard any moving-iron loudspeaker

(Continued on next page.)

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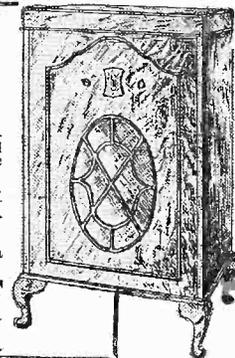
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## TECHNICAL NOTES

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which gave as good quality as a similar-priced moving-coil instrument.

### A Comparison.

The disadvantages of the balanced-armature are finally summarised as follows: (1) Restricted movement, so that soft and loud passages are not treated in proportion to their strength, and (2) variation in the impedance with frequency-change, making matching difficult.

I give the substance of the foregoing letter as being typical of many, but notwithstanding all this I have heard balanced-armature speakers, as no doubt a great many of my readers have also, giving really excellent results, especially on small types of set.

### Receiver Design.

It is surprising how receiving sets have shrunk and shrunk in size during the brief years since broadcasting started. In the early days we thought nothing of a three-valve set 3 feet long (or, roughly, one foot per valve!), and at one time, when the separate "unit" idea was in vogue, we had a whole series of "sets" all joined together like a sort of toy railway train.

The underlying idea wasn't bad; the idea was that if you wanted any more high-frequency stages you just clapped them on at the left-hand end and low-frequency stages at the right-hand end. It didn't work in practice (or in theory either, for that matter), and I have often thought that if it had worked it would have been a very bad thing for the progress of set design.

### Compactness.

It would hardly be true to say that in the modern receiver feet have been reduced to inches, but certainly the trend of progress seems all in that direction. This compactness is due to a number of causes. For one thing we have got away from the huge tuning coils and couplers which seemed so essential in the early days, and for another thing manufacturers have shown great enterprise in the design of instruments—for example, L.F. transformers—of extreme compactness and yet increased efficiency.

A further condition which has helped very much in set design is the use of screens between stages, as well as screened components, screened valves and so forth, and finally the various methods of decoupling which have lately come so much into fashion. By these means, altogether apart from the actual size of the components themselves, we are able to avoid that "spacing out" which was so essential a few years back.

### Alloy-cored Transformers.

As regards low-frequency transformers, the modern transformer with the special alloy core will do far more than its predecessors, and in a quarter of the space and with a quarter of the weight. Ganged condensers can now be obtained occupying no more room than single variable condensers of four or five years back.

The screening and other dodges are not confined to the use between components, but have even been carried within the components themselves. It is to the screen-grid and pentode valves, more perhaps than

to any other improvement in set or component design, that we owe the compact form of the modern receiver.

### Valve Developments.

As regards valves, although enormous improvements have been made in the "works," the actual exterior of the valve has not changed very considerably, and size remains pretty much the same. In fact, if anything, there is a tendency for receiving valves, especially of the power and super-power types, to become larger than formerly.

During the intervening years we have had some very compact—even midget—kinds of valves, but we seem to have reverted again to what we may call the standard size. Anyhow, I don't know that it matters very much, because such a lot depends upon the efficiency of the valve (which itself in turn depends upon the electrode arrangements) that it would be a great pity, for the sake of saving a fraction of an inch, to cramp the valve manufacturers' style; and in any case, even if valves were 50 per cent increased in cubical volume, it would not make any appreciable difference to the compactness of a layout.

### Power of the Set.

Readers often ask me questions about the actual amount of power output from a set. Many seem to have only the vaguest notion as to whether the power is a horse-power or a fly-power. It seems to be generally known, however, that of the power supplied into the loudspeaker the percentage which is converted into audible sound is relatively very small, but also that the amount of energy in even a loud sound is comparatively small.

The output from the average receiving set is best measured in terms of milliwatts, being, of course, thousandths of a watt, and an output of two or three hundred milliwatts would be a fair average for a small set. An output of a thousand milliwatts, or one watt, with a decent loudspeaker will give you a sufficient volume to fill quite a large room.

### Conversion to Sound.

I think these figures will give you a rough idea of the sort of power in watts which is handed over to the loudspeaker, but, as I say, the proportion of this which is converted into audible sound is only a comparatively small percentage, and may be even as low as one or two per cent in some cases. The production of sound is rather like the production of light, inasmuch as there is a great wastage of energy in the processes involved in the production.

As you know, the actual energy in the form of light proceeding from a very bright artificial source is relatively small, and most of the energy supplied to the lamp which produces the light is lost in the form of heat. In the same way with the loudspeaker, by far the greater percentage of the energy supplied to the loudspeaker is lost in the incidental processes and only a small percentage converted into actual sound.

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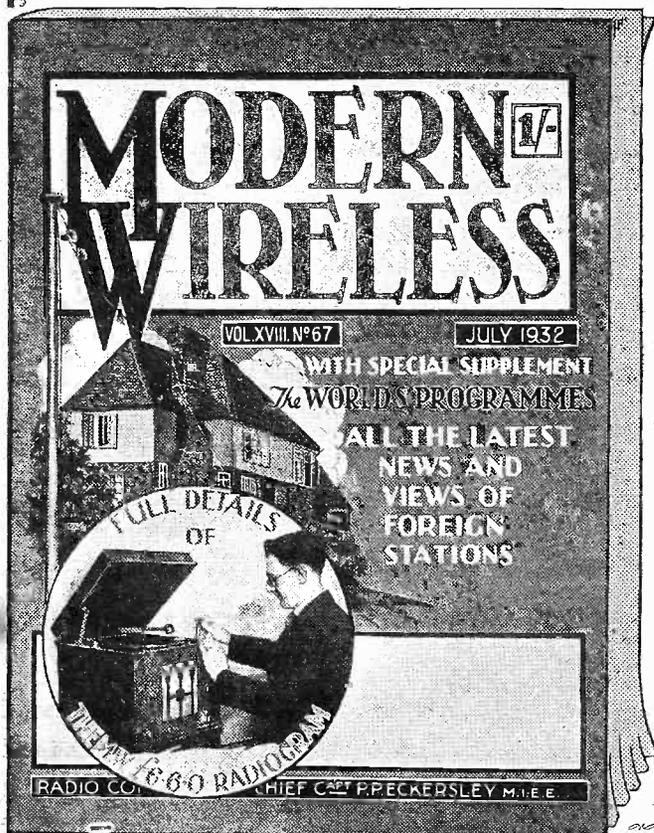
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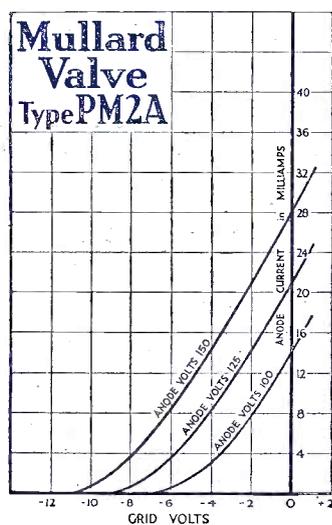
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