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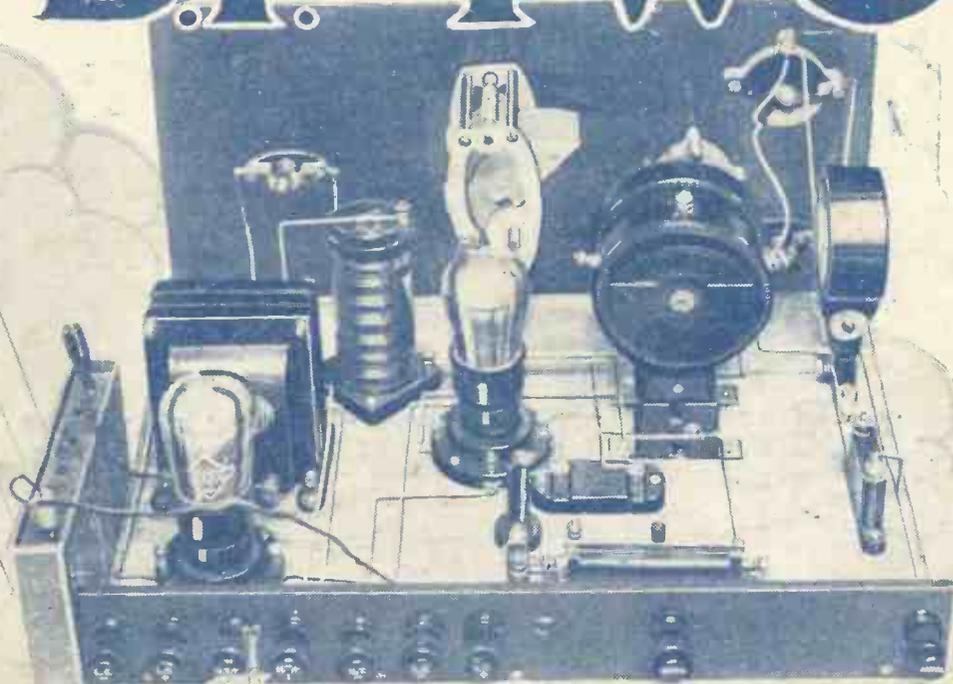
No. 419. Vol. XVII.

INCORPORATING "WIRELESS"

June 14th, 1930.

FULL DETAILS IN THIS ISSUE OF THE

"B.P." TWO



Special Articles This Week

WHAT DOES RADIO COST YOU?

By Victor King

THE MEANING OF SELECTIVITY

By Capt. P. P. Eckersley, M.I.E.E.

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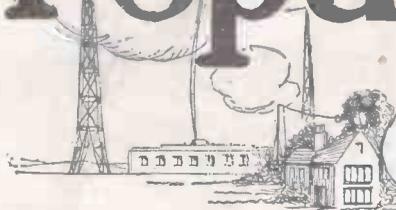


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RADIO NOTES & NEWS

"Those Freedoms."

IF you like hearing public men make speeches June 13th is worth noting. for on that day Inverness is to confer its freedom on the Prime Minister, Mr. Baldwin and Sir M. MacDonald, K.C.M.G., and there will be speeches, which will be relayed from Nat. as well as Scots stations. Birmingham and Midland listeners can hear on the same day a repeat performance of "The Dumbleton Fete and Gala." It will be on London Reg. as well. Don't forget the Festival of English Church Music; Royal Albert Hall, June 27th; choirs from seven cathedrals and churches take part in this.

Chamber Music Champion.

SIR WALFORD DAVIES has failed me. He says that when listening to an orchestra on the radio he often feels disappointed, but with Chamber Music never. Well, if perfection comes by elimination we could no doubt transfigure Sir Walford with ecstasy by broadcasting a one-string fiddle played in a cupboard. Whilst it is true that with a full orchestra one does not seem to get uniformity of value—the picture is faded in places, so to speak—nevertheless I consider that it is surely better to hear something of grandeur or nobility, even if imperfect, than the "pennygaff" whining so often broadcast under the name of Chamber Music. C.M. is real music boiled, strained and bleached!

The Moon and Radio.

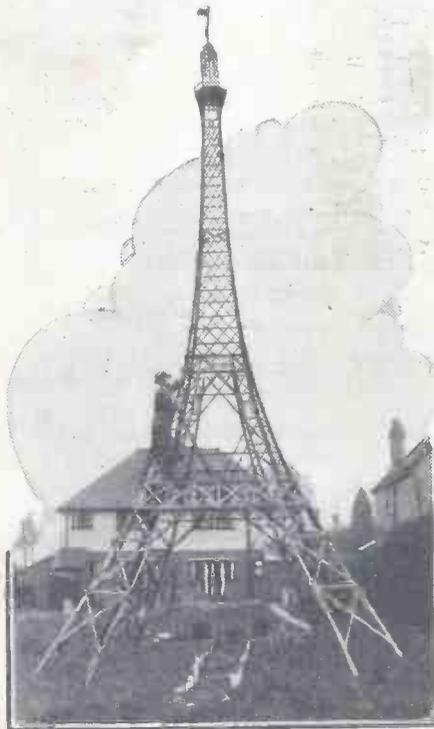
VERY pleased to receive a letter from Mr. Mijnlief, all the way from Java. (Very kind to our Amy Johnson, those Javan Dutch were, too!) He has been studying the relation (if any) between short-wave reception and the phases of the moon, and has come to the conclusion that reception is best in the following periods: (1) Moon full to moon quarter. (2) No Moon to three-quarter moon. I think that is what he means by "Waxing till 100%, till waning 3/4," and "Waning to 0% till waning 3/4." If anybody wishes to write to him about moons or any other subjects, address: Rapelplein, 16, Den Haag, Holland.

"Snowed Under."

THIS summery allusion springs to my mind as I contemplate the letters which have accumulated during my short absence. A representative lot, with some bright patches. "I have here a little

patent—" No, once bitten—! "Anyone got a set which they don't need? For a victim of a financial crash; must be four-valver, S.G.," etc. Friend, thy name is H. Oaks. A Hornchurch man wants us to design an up-to-date two-valver, (H.F. and det.). He may take it from me that we

EXCELSIOR!



Getting tired of "tishy" little aerial poles of the clothes prop variety, this Solihull enthusiast puts up in his garden the Eiffel Tower—at least, a model of it! It is made entirely of wood and has no guy ropes.

have it on our list waiting its turn, but one cannot force the fruit of genius. Next, a bill for bath salts? Now, who on earth—? Can one of those stenogs' be living beyond her pa's income?

But I Emerge.

AH! I see that the bath salts are for % of our Mr. Rogers. I remember how, he uses 'em for photography! S.G. (N. 16), whose letter seems to have

been in one of the P.O.'s performing mail-bags—it is dated Feb. 5th—offers articles. Full up, at present—but if you can always write as brightly as in your letter I think you should develop your style and attack the humorous papers. Seriously! Photograph of a flash of lightning at Malta from "Service's-Wite." Thanks! I remember that "atmospheric" well. O. H. (S. Africa) objects to my using "European," and not including residents in S. Africa. Sorry! Thought you prided yourselves on being "South Africans!" No offence meant.

Television in U.S.A.

SLOWLY creeping on to the real thing. Last month at Schenectady, U.S.A., several hundred people in a theatre saw and heard a "vaudeville" act which was being performed at the G.E.C. laboratory over a mile distant. The screen was six feet square and the sounds were perfectly synchronised with the movements. During the demonstration one of the performers came to the theatre and continued his part on the stage, his partner being seen by television. If this is a commercial proposition and not a too expensive laboratory experiment, then the "home theatre" certainly is "just round the corner," as Mr. D. Sarnoff says.

And Then Some!

BUT much more terrifying a prospect to those who smile at the League of Nations and keep their powder dry is opened up by a recent prophecy of Dr. E. F. Alexanderson of the Radio Corporation of America and the G.E.C. He is alleged to have predicted that in future wars the enemy will be seen by the Staff through the television eyes of a scouting plane, and a bombing plane, without a man on board, will see the target and be steered by radio right up to the moment when it hits it. I wish these American Elijah's would prophecy something pleasant and comfortable for a change.

News Items.

I LEARN that a Canadian magistrate has convicted himself and fined himself five dollars for not renewing his wireless licence. That's O.K. provided he paid it to himself and spent it on some nice girl. What a conscience! And then I hear that someone who recently equipped his set

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

with slow-motion dials has written to the B.B.C. asking them to emit their waves at a slower speed. Finally, it is brought to my notice that several German stations are in the habit of transmitting special programmes between 12.30 a.m. and 1.0 a.m. for the comfort of sleep-walkers, insomnia victims, rejected lovers and the fathers of "modern" daughters.

Modern Robinson Crusoes.

THE parallel between the classic castaway and the boundary riders of Central Australia may not be exact, but the idea is right. The cattlemen have to be away from the homestead for four-fifths of their time, and are so isolated that even the date and the name of the day slip them. Some of them have radio sets and they actually used to have to listen-in to Manila in order to learn the date and day; so now that data is included in the 3 L O news service. A beneficent service! One would hate to think of the boys missing their "Amami" night by pure inadvertence!

An Interesting Experiment.

BY the way, before we leave Australia, let me describe what an amateur is doing there with the telephony service from Gt. Britain. He tunes one set to 2 M E and another set to G B X, and has one headphone from each set connected to a head-band. So that he overhears both stations and sometimes is able to put each receiver through a loudspeaker. Once he found that G B X was putting 2 M E's signals into its own microphone, and the result was that the lucky amateur heard with one ear signals from 2 M E direct, and with the other the same signals after they had been to England and back.

Expensive Ether.

SPEAKING at the Aldwych Club, an official of the American National Broadcasting Company revealed that the charge for one hour of broadcasting time on stations covering the whole of the U.S.A. would be £2,000, and that anything from £300 to £1,400 would be spent on programmes to fill that time. He said that the average cost of a programme was £200 for each half hour and that that period would contain less than three minutes' sales talk. I hope they think it pays!

What Causes "Sulphating"?

WE have not got to the bottom of this matter yet, for M. J. (Hampstead) inclines to the belief which I originally held, namely, that persistent charging at a rate lower than that specified as the normal does not cause an accumulator to "sulphate." M. J. has trickle-charged his battery, of the "block" type, since early in 1923, and it appears now to be as healthy as ever, in spite of persistent under-charging. Will somebody give us some further evidence, either way? I wonder what the makers say on the subject?

Business First.

FOR zero cold-bloodedness it would be hard to beat the negro convict who was boarding and "rooming" at the Ohio State Prison at the time of the dreadful

fire there. This "cullud gennelman," who was gracing the prison with his presence because of some trifling little murder which he had executed, had the nerve to broadcast an eye-witness account of the fire *whilst it was actually occurring*. Never has there been such a "scoop" in the whole history of radio! Nero, having no radio, only fiddled, they say, while Rome burned. Same idea, though! A disgraceful affair and a sad commentary on the American broadcasting company which countenanced it.

The Truly Portable.

I HAVE now heard of a man who took a portable set on a walking tour; verily, there is nothing under the sun which has not been done—bar the Channel

SHORT WAVES.

KEEN ON APPEARANCES.

"Only the rich can afford televisions," says a writer. And they, of course, get them just for the look of the thing.—"Sunday Pictorial."

A University man complains that he cannot obtain a post with the B.B.C. because he stutters. But surely he is just the man to give a running commentary on a County Cricket Match.—"Punch."

"A wireless set was recently offered with every secondhand car sold by a New York motor dealer," we read in the "Autocar." The idea being, we understand, to save the expense of fitting a new electric horn.

NEWS ITEM.

One day last week an orchestra didn't broadcast a medley of good old tunes.—"Sunday Pictorial."

THE NIGHTINGALE.

Though men pursue thee now with micro-phones,
Seeking a prima donna without fee,
Thou scorn'st such obvious publicity.
Withholding steadfastly thy liquid tones
From the producers of the B.B.C.

But when some motor-cyclist hurries past,
Filling with odours vile the leafy lane,
Killing the scent divine
Of honeysuckle and of eglantine,
Thy gentle voice is raised above the roar,
For thus and thus alone dost thou complain
Of "modern" Goths whose ways we all deplore.
"Morning Post."

Tunnel. H. J. L. (Brockley, S.E.) had the bright idea of building a variometer-tuned crystal set in a cigar box, and this, with a pair of 'phones, ousted the camera from the pack. This was in 1923 and the set caused a sensation amongst the Thameside lock-keeping fraternity. Brother tramps, discard the camera, certainly, but I would either let it go at that or make up the weight with a couple of books.

Treatment of Fibre.

H. F. M. (Cirencester).—Cotswolds again! —kindly tells me that a friend of his, who is evidently a meticulous and discriminating needle user, keeps his fibre needles in a desiccator. I see. The fibre secretes moisture, which renders the point softish. Presumably the needles should be dried in the oven before being placed in the desiccator, which would no doubt be charged with quicklime—or should it be calcium chloride? (Memory of school "stinks" grows dim.) I have an idea that if the needles were to be permeated with some hard-drying substance, resin or the like, and then baked, they would stand up better.

The Fatal Flaw?

MR. WILLIAM CROWE, of Barking, worldly-wise he thinks, but perhaps not quite so forward-thinking as a critic should be, disagrees with Mr. D. Sarnoff's conclusion that television combined with radio will ruin the theatres and music halls. I agree with Mr. Crowe but not with his reason for dissenting from Mr. Sarnoff, namely, that courting couples will never forsake the gloom and comfort of the public places of entertainment for the parlour and family circle. Barking air breathes overmuch romance, methinks, for William is in error if he imagines that young 1930 woos in the twilight of the "gods." Too Victorian!

Moreover, count the lone huntresses, the spinster couples and the married folk in the audience—and tell me what percentage of the whole they constitute, William!

A Jubilee.

BENN BROTHERS, the publishers of our revered contemporary, "The Electrician" besides a score of other periodicals all more or less technical, have recently celebrated the jubilee of the firm. "P.W." humbly proffers its congratulations to the weatherbeaten but hale and hearty veteran of 50 years. Dealing with the development and applications of electrical practice, "The Electrician" is without doubt consistently sane and reliable. And if I add a word of admiration for the frank and sturdy individualism of the present head of the House, Sir Ernest Benn, I hope I shall not be suspected of corrupting my columns with ill-disguised politics.

Memories.

MANY present-day radio amateurs will be unable to remember the nineties, that remarkable decade which deserves a history book all to itself. They probably do not know, therefore, that "The Electrician" was the champion of Sir Oliver Lodge's work in radio invention, and published in 1894 Sir Oliver's "The Work of Hertz and his Successors," which had been first made public as a lecture before the Royal Institution in June of that year. The same paper published Oliver Heaviside's work on electromagnetic theory, which gave rise to a noted controversy, in which Sir William Preece took part, about cable signalling.

A Bouquet for the B.B.C.

MR. W. HARD, the representative of the National Broadcasting Company (U.S.A.), in London during the Naval Conference, pays a generous tribute to the B.B.C., and in particular to Sir J. Reith, in a letter to the "Times." The demands of the American journalistic broadcasters, he says, "were met by Sir John, not only with undiscouraged and unfaltering courtesy, but also with a very statesmanlike view of the ultimate results in Anglo-American intercourse over the ether..." The international broadcastings which were "put over" during the Conference, "would have been impossible without the cordial co-operation and the positive and constructive helpfulness of the B.B.C...." Now, Sir John, what about a lot more transatlantic broadcasts as a counterblast to the "America Conquers Britain" spirit?

ARIEL.



The MEANING of SELECTIVITY

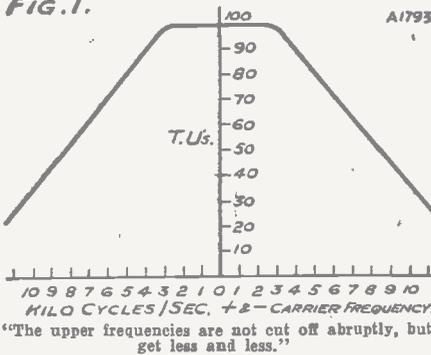
By Capt. P.P. Eckersley, M.I.E.E.

"Selectivity" is one of the hardest-worked words in the radio vocabulary, but in this article "P.W.'s" Chief Radio Consultant disentangles its essentials from side issues, and makes some Selectivity suggestions of interest to all radio enthusiasts.

THERE is a confusion of thought on this question of selectivity, and one must be sure what one means before one says that it is proportional to the band-width of response of a receiver.

In spite of discouragement I still firmly believe that the proper way to consider the problem of selectivity is to say that the modulation of the intensity of an ether wave produces other waves of frequency added to and subtracted from that of the modulated carrier-wave. That is to say, I believe in the side-band—so do a lot of other people. It would be lovely if we could not only think of a modulated carrier-wave as occupying no band-width, but if we had some practical way of putting our belief into practice. But for a long time it seemed obvious that a ten-pound weight would fall ten times faster than a one-

FIG. 1.

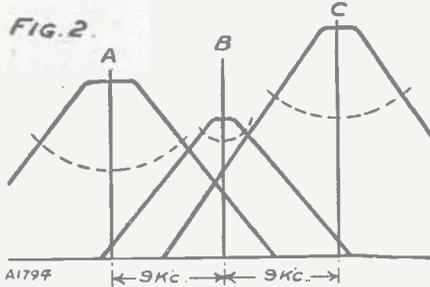


pound weight, so inverting the process it may be a long time before everyone will believe in side-bands.

Now what is the width of a spectrum of a broadcasting station? Everybody says it's 10 kilocycles either side of the carrier-wave. But that does not mean much, because the upper frequencies are not cut off abruptly, they get less and less until they ultimately disappear.

Representation of Side-bands.

So we might draw on an arbitrary scale the spectrum of a broadcasting station, as in Fig. 1. Now the curve of Fig. 1 is taken to be a curve drawn through the maximum intensity that every side-band can attain. Thus we have reason to believe that the harmonics of the fundamental notes of music and the "s," "t," "th," etc., sounds in speech have a less intensity than the fundamental and a less intensity than the "aa," "ow," "oo," etc., sounds of speech.



The effect of three stations, nine kilocycles apart.

Thus in normal conditions of working we might say that the spectrum of a broadcasting station is as shown in Fig. 1.

I have further assumed that the station is capable of giving 100 per cent distortionless modulation of the carrier-wave, so that the curve of Fig. 1 contains the intensity of the carrier-wave as well as that of the side-bands.

Perhaps we could criticise this way of looking at the problem from various points of view, but I am to show its implication in a relative way so that absolute errors of quantity do not concern us here.

Now, it is unfortunate (and yet it's an ill wind, etc.) that we live on an island, cheek by jowl with a continent called Europe. When I first possessed a conscious method of ratiocination, I was perpetually alarmed by the word "foreigner," but gathered some comfort from the fact that if, in all that I read and heard talked about, this species was like a wild beast, dangerous, nevertheless, the superiority of Englishmen was quite enough to hold any menace in check.

To-day we all have a different point of view, France nearly wins the Rugby football championship, Germany is youthful and athletic, and Italy is a model for any oppressor. And they are all very go-ahead people and, nearly as soon as us, they started to build wireless broadcasting stations like anything.

This brought about some intricate technical and international problems. Almost before any politically-minded people could make a happy debating ground out of the whole matter, technicians

rushed in and did something. The managerial body had hardly time to grasp that something was being decided in terms of simple technical fact before it was done.

Unfortunately, however, such phrases as "every nation has its inalienable right to determine its destiny within its own frontiers and cannot agree that any body however competent has power to dictate the limitations of its own liberty of action" made their usual impression upon what is always called the logical mind (why, heaven knows), and we find ourselves with a plan of wave-lengths which, while it owes its basic concept to technicians, has nevertheless had to forgo certain principles to achieve a 100 per cent argument.

Facts We Must Face.

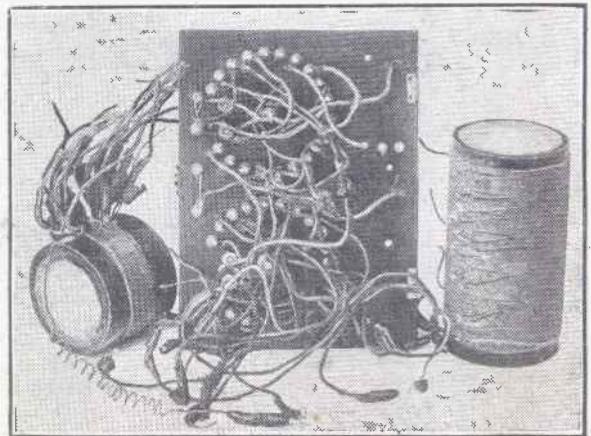
You know all the above could have been written in a few words saying that the absolute technical minimum of separation between broadcasting stations is 10 kilocycles but, in order to get even a paper agreement, we had to go to 9 kilocycles separation.

But I always feel that so much of the Prague Plan was based upon a negotiating principle "a kilocycle for a kilocycle and an exclusive wave for an exclusive wave" rather than a purely international idea, that I go all literary about it.

My idea has always been that the justest settlement of claims between nations will result in the best facilities for British people, but that a greedy fighting spirit delays the day when the ether will be clear.

(Continued on next page.)

AN OLD TIMER!



Found in a loft the other day, this old-time set shows that in early days set-wiring was a mass of self-capacity.

THE MEANING OF SELECTIVITY.

(Continued from previous page.)

Nevertheless, we have to face a 9-kilocycle separation and selectivity has got to be studied upon this basis.

So now turn to Fig. 2 and see what the ether has to stand with three stations 9 kc. apart. Notice at once that the spectra of broadcasting stations overlap, and that there is no ether anywhere that does not contain side-bands from two stations at once.

Effect of Sensitivity.

But after all we might add the American stations which work on the same wavelengths as the European stations and be puzzled to know how clear reception is ever possible. Of course, the point is that our sets have a limited sensitivity and, although the spectra overlap, the fringes of one are feeble compared with the fundamentals of the other.

So in Fig. 2 I have drawn a dotted horizontal line to show that the intensities of any disturbances below that line will with a given receiver be inaudible. As we move the line upwards the set is less sensitive, downwards more sensitive. But if we think of an "ideal" receiver response curve containing 10 kc. we see that when listening to fairly equal powered stations we are bound to get interference.

But if we narrow our band-width of response to less than a certain width and depth we can get clear reception of a bit of the spectrum, i.e. the ability to be free from interference depends not only upon the band-width of response but upon the sensitivity of the set also.

You must have

noticed this listening to distant if not to local stations. If listening to distant stations the signals fade and you push up sensitivity you are immediately aware of background. Look at the question another way and consider "cutting out" the local station.

Now, whatever the design of the receiver, it is impossible, if the diagram of Fig. 2 is correct, to get the full spectrum of any station 9 kc. away in frequency separation from another without interference. The local station, of course, completely masks the distant, and no receiver on earth or in the imagination will be able to pick up the far-away station if this station is separated by 9 kc. from the local.

But one has ambitions to design a receiver which will pick up any station on the World Radio list! To-day that is impossible, and with more and more high-power stations masking the lower-powered neighbours, the problem cannot be tackled.

I therefore say that there is a justification to ask the transmitting authorities to cut off all their transmissions at 4,500 cycles. This would mean that there would be no overlapping of spectra, and the problem before the designer of the ubiquitous receiver would be made possible of solution if, nevertheless, difficult enough, even then.

If transmitters cut off at 4.5 kc., and if the receiver did so as well, the receiver could have any sensitivity.

I do not swing my arms in the air and shriek and demand the immediate carrying into effect of such a policy; many points must be studied before the great majority of local listeners are sacrificed to the few distant listeners.

The real point at issue is this: If the frequencies above 4,500 do not much matter the step would recommend itself, but if the local station listener is sacrificed it would seem a wrong policy. Will the local station listener suffer if he is refused frequencies above 4,500? Gramophone records cut off at 5,000 and give very pleasing quality.

A Suggested Cut-off.

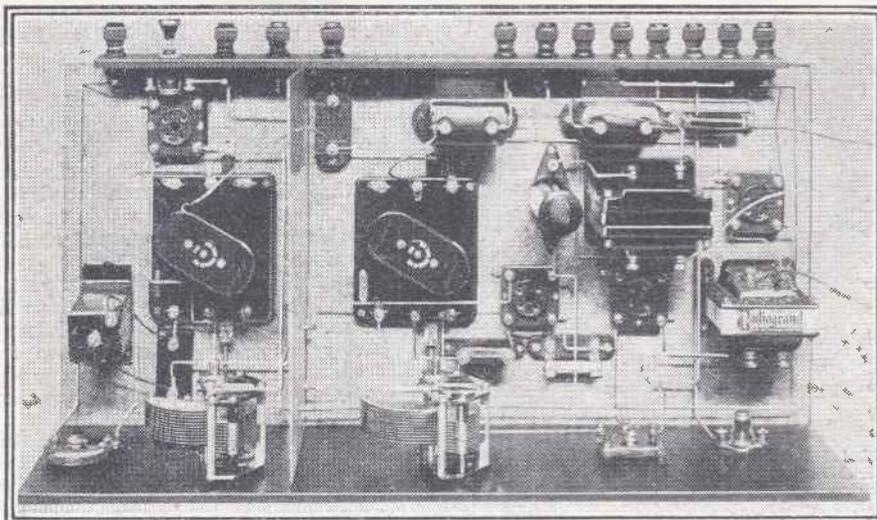
Nearly all broadcasting receivers cut down the frequencies between 4,000 and 10,000 severely, and most transmitters do not radiate these frequencies at anything like their proportion in the original disturbance. Land-lines cut at 6,000, too, and so it is to me a little doubtful if there is a great necessity for the higher frequencies.

I insist I do not know quantitatively what difference the sacrifice of these higher

frequencies would mean, but I do think the question should be seriously studied. The advantages of cutting off are many; it gives free ether to every station; it simplifies loud-speaker and circuit design, and it simplifies land-line, microphone and transformer design.

Perhaps readers of this journal may have views. Certainly selectivity is the paramount problem before the receiver designer, certainly the basic problem is simplified by a transmission cut off equal to half the fundamental separation of carrier-wave frequencies.

THE MODERN METHOD OF WIRING



Contrast this view of a modern receiver—the "Regional" Four—with the photograph of an old-fashioned set on the preceding page. Well-spaced wiring is necessary if the selectivity of several stages is to be retained.

Comparing Pick-Ups.

THERE are so many good gramophone pick-ups on the market at the present time, that it is often difficult when comparing two, to decide which one likes the better. You will agree that if you could hear one play the same passage as the other, and immediately after the other one had played it, it would be much easier to appreciate differences.

Here is a simple way of carrying out such comparisons. Mount the two pick-up arms at different points so that they can both run on the record at the same time.

You will next require a single pole change-over switch that has to be connected as follows: The centre or common contact is treated as one pick-up output lead, and the two outside contacts are joined to one of the wires from either pick-up.

FOR THE EXPERIMENTER.

Comparing Pick-Ups—Keeping Radio Sets Clean.

The remaining two wires from these instruments are joined together and treated as the other output lead. You will appreciate that when the switch is over to one side, one pick-up will be put into circuit, and when over to the other side the other pick-up.

The method of placing the pick-ups on the record is as follows. Start one off and when it has covered two or three grooves set the other one at the beginning. Thus one will lag behind the other as regards the

passage on the record that it is reproducing.

There are two cautions to give, and the first is that you must have a fairly powerful motor, or the effect of two needles will be to slow it down too much. The second is that due to this extra drag you should re-time the turntable with both pick-ups in position.

Keeping Radio Sets Clean.

DUST is capable of getting in everywhere. Of this the wireless experimenter is only too well aware, and even the owner of a set in a cabinet is often surprised to find the inside of it thick with dust.

The best instrument to remove the dust is a bushy varnish brush about 1 inch wide. The hairs on such a brush are springy and stiff enough to poke down into awkward corners

A PEEP AT PCJ



A WHILE ago I was having *uitsmyter* with a Dutch radio "fan" in a Cool Singel café—Rotterdam's main thoroughfare—and we were sketching radio circuits on the back of the menu card to while away the time. The conversation turned to the short-waves.

"How do you, in England, receive our little 'amateur' PCJ?" asked my friend. "They tell me that you hear him well. That is so?"

Run on Amateur Lines!

I said very definitely that it is so, and that when the short-wave coils are plugged into a set one of the first stations picked up is invariably the Dutch PCJ. Often it is better than our own 5 SW, for the skip effect of short waves prevents Chelmsford from being heard very well except at distances such as the north of Scotland or in the West country. I said how nice it would have been to have taken a peep at PCJ before leaving for home.

"*Ben je vrij?*" said the Dutchman, with sudden enthusiasm. "Then we will see it now. It is at Hilversum, thirty kilometres away."

So within a couple of hours we had

* * * * *

Those of you who listen on short waves will no doubt have heard this efficient Dutch transmitter, and will find great interest in this story of a visit to the station.

By A SPECIAL CORRESPONDENT

* * * * *

arrived at Hilversum, had crossed the cabbage patch through which a path leads to the transmitter hut standing in the middle of a field, and were standing in the electric glow of PCJ's valves.

"You are putting out nearly as much power as Brookmans Park," I said. "Why do you call this an 'amateur' station?"

Then, while the gushing of the valve-cooling water, the buzzing of the chokes and the blare

"wavelet" Huizen in this respect, because Huizen is run by a company specially formed to give programmes to the Dutch Colonies, while PCJ is—well, an "amateur"!

Inside the transmitter hut the scene is very amateur-looking. For instance, one of the valves had become hot during the evening, so an ordinary electric fan was placed near it, right in the "internals" of the transmitter, to aid the cooling!

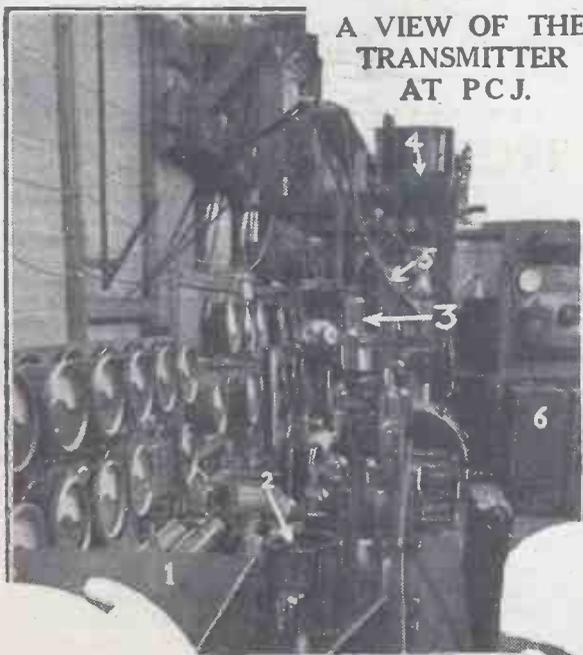
Water cooling is used for the bigger valves and the rubber water pipes trailed about

WHERE STATION PCJ WAS BORN.



The white arrow in this aerial view of Eindhoven indicates the laboratory where the PCJ transmitter was built, and where the station worked at first for about a year.

A VIEW OF THE TRANSMITTER AT PCJ.



The parts to which the numbers on the photograph refer are as follow: (1) A copper box containing control apparatus; (2) the main frequency-doubler coil; (3) the chief oscillation valve; and (4) its water-cooling apparatus; (5) is the modulator and (6) the controls for adjusting H.T. voltages.

of a "side-tone" loud speaker made concentration difficult, I had it explained that "*Pay-say-yer*" (Dutch pronunciation, that!) is a station run by the testing department of the Philips people, that laboratory officials themselves run the whole station and that the whole thing is conducted on typical amateur experimental lines.

Philips build transmitters, of course, such as Huizen, and much valuable test work is done at the smaller PCJ; and, at the same time, PCJ gives a regular broadcast programme so that listeners in the Dutch East and West Indies can get in touch with their native country. PCJ doesn't clash with the

awkwardly. Red-printed notices, "*Levens-Gevaarlijk*" (which means "danger of life") hang everywhere. A new crystal-control had just been installed and was temporarily placed in a copper box hanging from the ceiling, three thermometers projecting dangerously like the fuses on a bomb!

An Efficient "Lash-Up"!

What these keen "fans" have done is to take some of the best transmitting gear available and to sling it together in roughly-made wooden frames with no regard for good looks. Only results matter, they say; pardon the piece of string which holds up part of the aerial lead. The plain fact is that this little station manages to put out 25 kilowatts, and it is nightly heard in America and, of course, in the Indies.

An energetic Dutchman is, practically speaking, the station director. It is he who gives the announcements in English, Dutch, French, German, Spanish and, one might almost say, in American.

(Continued on page 386.)

LATEST BROADCASTING NEWS.

THE "BRITANNIC"
BROADCAST.A MARINE MONSTER—SHAMUS
O'BRIEN—ALL ABOUT SALFORD
—THE PITMAN'S DERBY, Etc.

HERE are some details of the broadcast arrangements of the ceremony associated with the start of the maiden voyage from Liverpool to New York of the motor-ship "Britannic"—one of a record number of outside broadcasts which listeners are to hear on Saturday, June 28th.

The "Britannic" is Britain's largest motor vessel, a monster of 27,000 tons, and fitted with engines developing 20,000 horse-power.

A Marine Monster.

She has a length of 680 feet, and is 82 feet broad, and can carry 1,500 passengers, a striking contrast to the first White Star vessel of that name, which was of 5,000 tons burden and launched in 1874. The broadcast on June 28th, which, by the way, will be heard by National and North Regional listeners, will be introduced by a very detailed description of the ship as she appears from the landing-stage, and will include a talk by the chief engineer, who will describe the many novel features of her engine-room.

The broadcast will also include a description of the purser's duties, and speeches by the captain of the ship and the Lord Mayor of Liverpool, which are to be relayed from the bridge of the vessel. Finally, the scene associated with her departure will be described by Lt.-Commander J. H. Craine, R.N.R.

The Irish Derby.

Another instance of the co-operation of the B.B.C. and the Free State broadcasting authorities is the arrangement to broadcast on Tuesday afternoon, June 24th, a running commentary (fixed up under the auspices of the Dublin Broadcasting Station) on the Irish Derby which takes place at the Curragh.

On the following day a programme of music by Madame van Aalst's Ladies' Orchestra from the Plaza, Dublin, and some dance music by the Embassy Six, from the same source will also be heard by Ulster listeners.

Shamus O'Brien.

Two performances of "Shamus O'Brien," a romantic comic opera in two acts, which is founded on the poem by Joseph Sheridan Le Fanu, will be given by the Wireless Symphony Orchestra, conducted by Percy Pitt, and the Wireless Chorus, conducted by Stanford Robinson, on Monday and Wednesday, June 23rd and 25th, respectively.

The first performance will be broadcast from the London and Midland Regional transmitters, and the second as part of the National programme, times being from 6.55 to 8 p.m., and from 8.35 to 9.45 p.m. on June 23rd; and from 7.55 to 9 p.m., and from 9.25 to 10.35 on June 25th.

All About Salford.

Even to students of history the city of Salford, in Lancashire, could hardly be regarded as possessing a famous past, yet it is about to celebrate the seven hundredth anniversary of the granting of its charter by Ranulph, Earl of Chester, and Northern listeners will be told something about the Charter Celebrations in a talk which Councillor Samuel Finburgh, the Mayor of Salford, is giving in the Manchester Studio on Saturday, June 28th.

As a matter of fact, Salford has a history that goes back even further than the time of its first charter. It was visited in 71 B.C. by Agricola when he accepted the surrender of the native Britons, and by Alfred the Great in 887, when he confirmed the town as capital of what was then Salfordshire.

Flemish weavers began to settle in the town about 1360, while the notorious Guy Fawkes also went there in 1605 to arrange a few matters in connection with his little plot to play havoc at Westminster.

The Pitman's Derby.

Mention has already been made in our columns that a running commentary is to be broadcast on Thursday, June 26th, on the race for the Northumberland Plate, or, as it is better known in the North, the Pitman's Derby.

The commentator is Mr. R. C. Lyle, well-known for his broadcast descriptions of the Derby, the Grand National, and the St. Leger.

A large crowd is certain to be present at Gostorth Park, Newcastle (where the race has been run since 1882, when it was transferred from the Newcastle Town Moor), but they will represent only a fraction of those who will have a direct interest in the order in which three of the competing jockeys and their mounts pass the winning post.

The North has always been interested in the sport of horse-racing, the earliest records of a race on Tyneside goes back to 1634 when history records a meeting on Gillingworth Moor.

LIVENING UP THE STUDIO.



In order to introduce more "pep" into the microphone revue, Mr. Philip Ridgeway gets his artistes to do an opening dance so as to get warmed-up to their work before the "mike" is switched on. This photograph shows Mr. Ridgeway giving the "All Ready!"

Some Midland Items.

Mr. T. W. North, who for many years has been Borough Organist of Walsall, is giving a recital for Midland Regional listeners on the organ of the Church of the Messiah, Birmingham, at 6.40 p.m., on Friday, June 27th.

Mr. Percy Pitt, late Director of Music to the B.B.C., is to conduct a programme of his own works which the Midland Wireless Orchestra is giving in the Birmingham Studio on Friday evening, June 27th.

FOR THE LISTENER.

A Specially Contributed Criticism of Current Broadcasting Events.
By "PHILEMON."

Who will long be remembered for those wise and witty broadcasts entitled "From My Window."

Meteors and Stars:

THE worst of journalistic notes like these is that they inevitably pay more attention to the unusual and the rare than to the steady and the constant; to the meteors in the broadcasting firmament than to the quieter stars. This sometimes gets on my conscience.

I have tried several times to work them in, but they've always been crowded out so far; and now, unable to endure this neglect of them any longer, I am going to give them a show, a whole "packet" to themselves.

French!

There is, for example, M. Stephan. I often drop in on him for a few moments.

For I am one of those who can read French quite well, but who speak it terribly badly.

So badly that, when I am in France, my knowledge of the words goes for nothing, because nobody can understand what the dickens I am saying. Recently, however, I have noticed an improvement, some gleams of recognition in the eyes of the French cabmen, policemen, shop people.

It is entirely due to M. Stephan. He has a beautiful voice, the clearest articulation I have ever heard, and a most charming manner. He goes slowly, and I repeat words and sentences after him, imitating him. And if any of you happen to be in my case, this is a tip for you. Listen to M. Stephan.

(Continued on page 388.)



What Does Radio Cost You?

by VICTOR KING

A famous set designer has some very straight words to say about component costs and guarantees, and other points of vital interest to the home constructor.

IT probably costs you more than it should; perhaps you can afford to waste a few shillings a month. If you can't, read on. I have a few words to say *re* the finances and economics of home-radio.

There is an awful lot of platitudes poured out regarding component costs, so I must have a line or two to handle this part of the business right here and now.

How often have you read the words "Pay as much as you can afford?" A good many times, I will be bound. But I've never strung up such a sentence.

My personal sentiments are "Pay as little as you can." I'm *not* well off. Mind you, I agree that "the cheapest *may* be the dearest in the long run," but, on the other hand, the cheapest *may* be the cheapest to the very end.

Learning by Experience!

Of course, there is much more real honesty in radio nowadays; at one time the radio industry was a happy hunting ground for the "get-rich-quick" type of trader. I've bought wireless components in the past that weren't worth a tenth of the price paid. And I wasn't the only one who did that sort of thing—there were hundreds, perhaps thousands, of "P.W." readers keeping me company.

But I don't do that sort of thing nowadays, and I reckon that there are but a few "P.W."-ites who get caught like that.

It was a safe game for the junk-jobbers. Unless you can tear a component to pieces and test its innards with elaborate testing gear, it is not often you can detect the true merits of some types of components.

L.F. transformers, for instance. Externally an L.F. transformer generally comprises a neat little box, hermetically closed, upon which are four marked terminals.

What is there to tell anyone the conditions of the interior without complicated measuring apparatus?

Clever Opportunists.

But now most of those clever opportunists have been found out, and the majority have disappeared. Nevertheless, there are still a few snakes in the radio jungle, so it behoves the constructor to keep his eyes open.

I am now going to say a few words about "guarantees." There never was such a clever catch as that "guaranteed for a year (or more)."

But I must hasten to add that the guarantees given by all the well-known, reputable

article, because the radio trade as a whole is as clean as any other trade.

No, I am referring to the junk-jobber again. The tiny firm with a big-sounding name, the price-cutting type of rubbish distributor that often tries to get his adverts into "P.W." but doesn't succeed.

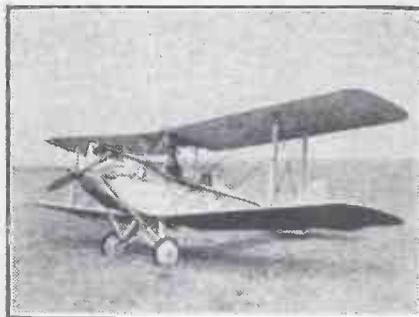
Watch out for the "bargain price" products of such concerns piled up in small radio stores—and look at them if you will, but don't buy 'em.

To return to the "guarantee" subterfuge. I could design an L.F. transformer which could be sold at 2s. 6d., and which could be supplied guaranteed for *ten* years—against breakdown.

But it would be a rotten transformer, and its results would be too awful for anything. You see the "catch"?

An L.F. transformer has got to do a job of work properly as well as abstain from breaking down. And it is far, far harder to

THE FERRANTI FLYER



This aeroplane is used in connection with the radio research of the Ferranti Co., and is believed to be the only aeroplane so employed.

design an L.F. transformer that will function like a Ferranti, Igranic, R.I., Varley, Lissen, or other such make, than it is to produce one that will merely be robust.

Wind a transformer with 18-gauge wire, double-cotton covered, on a stick of iron, soak it in paraffin wax and, at a total cost of but a few shillings, you have a component that would work for a lifetime. But let us repeat that word "work" in inverted commas!

And so with various other components. Remember that there is not an article in this world whose virtue rests on one quality and one quality alone. At least, I can't think of one and I do know that take what radio component you will, its successful

operation in a set depends upon a number of things.

You can get a guarantee that a loud-speaker diaphragm won't split inside a year and yet discover, before you've heard the thing vibrating for a minute, that if anything ought to split before the year's out it should be that loud-speaker diaphragm that's making such awful noises!

You see the point?

"I Make Compromises."

Let us take one more example. What about a high-resistance potentiometer "guaranteed against a fault occurring." Supposing the resistance of the thing is all out—that is a fault which may upset a set's functioning. Would *you* be able to detect it? Remember, it is mighty hard to tell the difference between 50,000 and 500,000 ohms without instruments!

So much for "guarantees." I hope I have proved that a "guarantee" is of value only when it is backed up by reputation and respectability.

When I contemplate purchasing a selection of components I always gather together the descriptive literature of the better-known manufacturers and weigh prices up against technical specifications. When there aren't any detailed technical descriptions, I give the makers concerned a miss. Not because I'm suspicious, but simply because the information is essential to my plans.

I don't "buy the best of everything;" I can't afford it. I make compromises all over the place, and I see that I get real value for money.

Studying the Market!

This is how I go about it.

"L.F. transformer?" Yes, that one at 26s. gives me a straight line from 15 to 5,000, while that one at 12s. 6d. slips down at 100 and again at 3,000 (my figures and prices are, of course, purely fictitious).

"My loud speaker won't go below 100, and I'm sure there won't be much high stuff getting through it. The cheap transformer for me.

"Variable condenser? There's one at 18s. 6d. with all sorts of refinements and one at 5s., that's just a condenser—no slow-motion or anything. Well, this particular set's no needle-sharp ether piercer," etc.

Is the result a rotten set? Not on your life. I bet it's better than a good many costing much more.

But don't let me spoil trade. Some of those higher-priced components and accessories are worth every bean of their costs—if they are used in sets that give 'em a chance to show their paces.

FROM THE TECHNICAL EDITOR'S NOTE BOOK.

Tested and Found-?



MAGNUM NEUTRALISING CONDENSER.

WONDER why it was that, in the early days of radio, some components were given excellent finishes while others always seemed to carry a bedraggled, lost-dog kind of appearance? The neutralising condenser always seemed to fall into the latter category.

So long as you had two pieces of metal capable of being moved nearer or further apart the manufacturers—or most of them—seemed to be satisfied. If the whole structure were a little bit crooked and the adjustment a hit-or-miss sort of affair, apparently that did not matter.

And yet a neutralising adjustment always was a moderately critical affair. However, the Magnum neutralising condenser of improved design, recently placed on the market by Burne-Jones & Co., is far from being a shaky, unattractive-looking proposition. Indeed, the moving vanes are supplied with two bearings and are particularly rigid, so that there is very little danger of their ever shorting. The component has a long ebonite adjusting handle. It costs 5s.

FERRANTI FIXED CONDENSERS.

I have received the following reminder from the Ferranti people regarding their fixed condensers:

"All FERRANTI Fixed Condensers are of the Relled Foil, not Mansbridge pattern, and they employ pure metal foil interleaved with high quality paper Dielectric. They are dried out in vacua and have an insulation resistance of not less than 200 megohms for 2 mfd.

It should be observed that its insulation resistance is at least double that claimed for the best continental condensers, and we believe is much higher than any English make of corresponding type.

Quite commonly the insulation resistance is as high as 800 megohms for 2 mfd.

The test voltages are higher than those of any condensers of corresponding types, and in addition are three times the working voltage in accordance with the latest Rules of the Institution of Electrical Engineers, and they are, we believe, the only condensers which therefore comply with these regulations."

The "reminder" is certainly justifiable, for Ferranti fixed condensers are not, I

think, quite as well known as they deserve to be.

That is one of the results of achieving such a reputation for *L.F. transformers!*

NEW OSRAM VALVE.

I am glad that the 2-volt valve has received such concentrated attention on the part of manufacturers, for I have always held the opinion that the 2-volter was the most desirable type.

After all, the L.T. accumulator is a bit of a nuisance, and the smaller it can be made, and the longer service a given capacity will give per charge, the easier that part of radio becomes for the amateur.

The 2-volter of to-day is superior in operation to the 6-volter of a few years back; indeed, there are now available 2-volters that will do all that is necessary in even the bigger types of household sets.

One such is the Osram P.2, which has the following characteristics:

Filament volts	2.0 max.
Filament current	0.2 amp.
Amplification factor	6.5
Impedance	2,300 ohms.
Mutual conductance	2.8
Anode volts	150 max.

The mutual conductance tells the full story of the efficiency of this wonderful little power valve. You get the "slope" of a valve by dividing its impedance into a thousand times its amplification factor.

Thus, you see, the higher this last in comparison with the impedance, the higher the mutual conductance. At one time a mutual conductance of 1 was an ideal to aim at; now here we have a 2-volter with a "slope" of 2.8!

The P.2 is a fine super-power valve and gives excellent results. It is just the valve you want in the last stage of a "Magic" Four, and other similar sets.

RADIO FOR THE MILLION.

I have perused the Spring issue of this popular Mullard publication with some considerable interest. It is extremely well got up and an excellent range of receivers is described. There are also several articles dealing with the famous "Master Three."

I have also had the opportunity of examining the Mullard Magazine, a monthly periodical which is issued by the Mullard Social and Athletic Club, price 3d. This well-produced staff magazine is indicative of the immensity of the Mullard organisation and proof of the excellent spirit of

cameraderie that exists among the very big staff.

UTILITY BAKELITE CONDENSERS.

If you substitute bakelite for the air between the vanes of a variable condenser you increase its capacity enormously. It follows, therefore, that if you take a given maximum capacity such as .0005 mfd., by using bakelite dielectric you can produce a very small variable condenser indeed.

Amongst others, this is what Messrs. Wilkins & Wright, Ltd. have done and their bakelite condenser is particularly neat and particularly smooth in operation. The introduction of the solid dielectric does introduce losses, but these are very small and do not make themselves felt in the average tuning or reaction circuit.

WHEN YOU ARE BUYING—

(18) SPECIAL SWITCHES.

Generally speaking it is essential that a switch used for a radio-gram change-over should be of a very low-capacity type, otherwise radio may get through when you are running records.

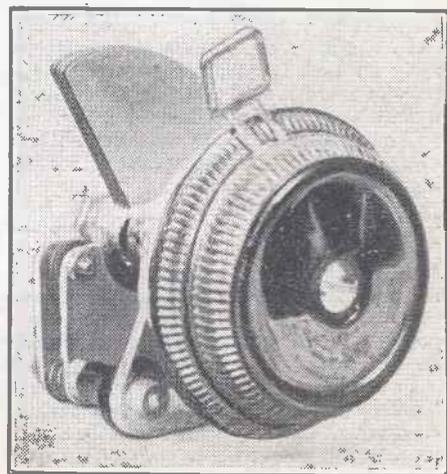
Also multi-contact wave-change switches should have widely-spaced elements in order to reduce their self-capacity.

Some switches have only soldering tags, but unless you can solder neatly and efficiently, get those that are fitted with terminals.

A switch should have a definite action and definite "on," "off," or "open," "shut" (etc.) positions. The contact springs should be of hard, springy material and should give an adequate pressure.

The advantages of the bakelite construction are compactness and inexpensiveness. The Utility bakelite condenser with .000 maximum capacity complete with dial costs only 4s., while with a vernier control it is still merely 7s.

Another new Utility component is a snap switch which has several radio uses such as for on-off L.T. control, simple wave-change, etc. It will handle as much as 3 amperes at 125 volts or one amp. at 250 volts. It is wonderfully compact and at 2s. 6d. does seem to be very well worth while bringing to the constructor's attention.



This is the "Utility" Bakelite Condenser fitted with a "Vernier" control.



LOUDSPEAKER PROBLEMS

A LOUDSPEAKER is not a musical instrument in the true sense of the term. Like the gramophone, it is intended merely to reproduce as faithfully as possible the musical performance of other instruments.

All true sources of music utilise the effects of resonance to impart the peculiar coloration or timbre by which one instrument is distinguished from another. On the other hand, in a loud speaker—as in a gramophone—resonance is a fundamental defect, because it introduces a spurious tone value, and in so doing distorts the original musical balance.

Frequency and Amplitude.

This in a nutshell is the outstanding problem of loudspeaker design—to produce an instrument capable of repeating accurately the highly complex band of frequencies present in orchestral music, and yet at the same time to have no “fundamental” or resonant frequency of its own.

Sound waves have two primary characteristics: frequency, which determines pitch; and amplitude, which conveys loudness or intensity of sound. A third characteristic—quality or timbre—is really a derivative of the first, because it merely amounts to the addition of overtones or harmonics to the primary frequency.

A loudspeaker, then, has not only to reproduce accurately all the frequencies present in the original sound, but it must do so quantitatively, i.e. it must maintain

Slowly but surely the path to perfection is being traversed by the radio scientist. But there are many knotty problems to solve, and this instructive contribution tells you something about them.

By J. C. JEVONS.

current fluctuates, so does the pull of the electro-magnet upon the fixed diaphragm. This, in turn, applies corresponding impulses to the adjacent layers of air, and so sets up a train of sound waves.

The displacement of the diaphragm should of course be strictly proportional to the amplitude of the applied current. Owing to

under these conditions there is not sufficient clearance left between the two to allow for adequate movement on the lower notes.

This is illustrated in Fig. 1 (A), where the normal position of the reed R is shown in full lines; and its maximum flexure, before it comes into contact with the pole-piece, is shown at R₁ in dotted lines. It will be seen that the angle between R and R₁, corresponding to maximum “swing,” is comparatively small.

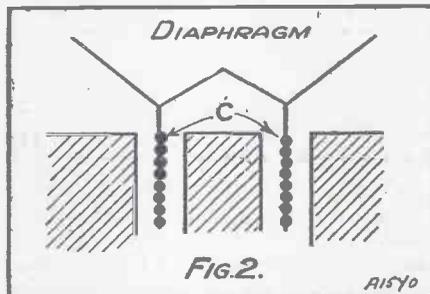
Musical Balance.

In the Lion type of loudspeaker the reed, as shown in Fig. 1 (B), is so pivoted that normally it lies at an angle to the face of the pole-piece. This permits of a larger swing without “chattering,” i.e. before the reed contacts with the pole-piece, and so allows greater justice to be done to the lower notes.

This particular difficulty does not of course exist in the moving-coil type of speaker where, as shown in Fig. 2, the up-and-down swing of the moving coil C is unrestricted.

In all cases, however, the restoring forces acting on the vibrating parts tend to produce a resonant action which “favours” certain frequencies at the expense of others, and so upsets the true musical balance.

THE MOVING COIL



The moving coil is almost unrestricted in its up-and-down movement.

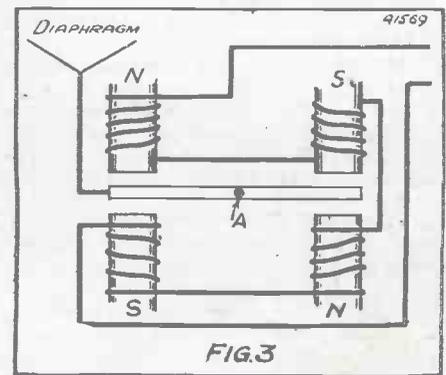
the imperfect elasticity of the material of the diaphragm, the restoring force tends to fall off for the larger vibrations, and this gives rise to a relative loss of power on the lower notes.

Also, since a high note is built up of a greater number of vibrations per second, the amplitude of each diaphragm oscillation is smaller for a high note than for a low note of equal intensity, so that any falling off in elasticity will be less pronounced in handicapping the true reproduction of high notes as compared with those lower down the scale.

Sensitivity and Swing.

In the reed type of loudspeaker, the greater-swing or excursion of the reed on the lower notes introduces an obvious difficulty. In order to make the speaker “sensitive,” i.e. responsive to relatively weak currents, the tip of the reed must normally lie close to the pole-pieces. But

A BALANCED ARMATURE

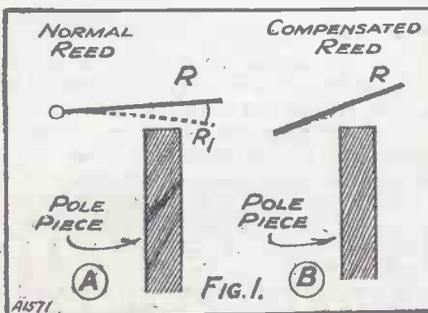


In this type the average value of the air gap remains constant.

Designers frequently attempt to minimise this “selective” effect by throwing the resonant frequency outside the audible range. (Audibility may be taken to lie between 50 and 5,000 cycles per second.)

(Continued on next page.)

REED TYPES



Showing how in one particular unit, an improvement (B) is made on the usual reed movement (A).

the correct proportion of intensity or amplitude of each tone.

In the ordinary fixed-diaphragm type of speaker the output current from the last valve of the receiver is passed through the windings of an electro-magnet. As the

REACTION CONNECTIONS.

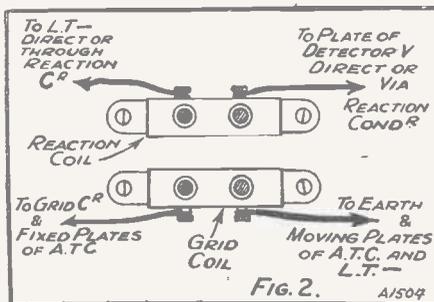
An explanation of an easily-remembered rule for joining the reaction coil in circuit.

By L. C. MUNN.

A FEW years ago when swinging-coil reaction sets were more the vogue, it was customary to advise the reversal of the leads to the reaction coil if it was found that reaction effects could not be obtained.

Nowadays the reaction connections are given for each particular set, but there are still some who are rather uncertain as to the direction of windings, and how to connect the leads if they wish to make up a receiver with combined grid-reaction coils of their own design.

WIRING THE HOLDERS



The method of connecting when both coils are wound in one direction.

The object of this short note is to show how the correct connections for any form of reaction may be deduced from one elementary and easily-remembered circuit.

Consider the simple and well-known circuit depicted in Fig. 1. Here we have one coil, all of it wound in the same direction, with a tapping at E so that it acts as a combined grid-reaction coil.

The upper portion, L_1 , which is tuned by the variable condenser C_1 , constitutes the grid coil, and the lower portion, L_2 , acts as the reaction coil, and is fed by the variable condenser C_2 in series with it.

It will be seen that the "live end," i.e. the high potential end of the reaction coil, is the end furthest away from the grid coil.

This indicates the connections for any reaction coils, at the filament or earth end of the grid coil (where the reaction turns should always be placed) when the windings of both coils are in the same direction. It holds good whether the reaction condenser is on the anode or earth side of the reaction coil.

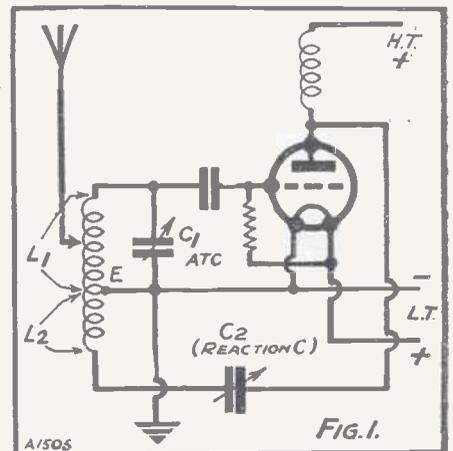
We can also adopt a simple scheme for plug-in coils, of honeycomb, basket or other similar types, assuming, of course, that all of them are wound in the same direction.

"The anode lead (direct or via reaction C) goes to the connection of the reaction coil holder diagonally opposite to that of the grid end of the grid coil." (See Fig. 2.) The positions of the pins and sockets have no bearing on the matter and therefore are not shown.

Where one coil is wound in the opposite direction to the other, then the reaction leads are reversed. They are also reversed where reaction is fed back from a detector, preceded by an H.F. stage to the grid coil of the H.F. valve.

Where reaction is fed back from a detector preceded by two H.F. stages, then the rule remains as stated, and requires no modification.

A CONTINUOUS COIL



The elementary principle of reaction and grid coil relationship is shown above.

In well-designed moving-coil instruments the resonant or inherent frequency is usually kept below 50 cycles per second, where it has no objectionable effect, except perhaps to slightly over-emphasise the bass notes.

With reed-driven speakers, it is impossible to design the moving system to have so low a resonant frequency. Accordingly, here the object aimed at is to throw the natural resonance above the higher limits of audibility.

In certain cases the resonant frequency of the reed and that of the diaphragm are deliberately designed to occupy different positions on the frequency range, so as to "spread" the resonant effect as uniformly as possible over the whole reproduction.

Supposing the diaphragm has been designed to respond faithfully both as regards frequency and amplitude, there is still the problem of communicating both movements accurately to the adjacent air.

A Natural Cut-off.

When a horn is used there is a natural "cut-off" frequency (depending on the length of the horn) below which sound is transmitted very inefficiently. This can be overcome by making the horn sufficiently long. As a matter of fact, the most nearly perfect loud speakers are made in this way but the size of the horn is then so unwieldy as to be quite unsuitable for home use.

A useful compromise is the logarithmic horn, where the effect of extreme length is cleverly simulated by suitably adjusting the ratio of "flare" to length.

When using conical diaphragms of large area acting directly on the air, another diffi-

LOUDSPEAKER PROBLEMS.

(Continued from previous page.)

culty arises. As the air is being compressed in front of the diaphragm, i.e. as the latter moves forward, a rarified region is simultaneously set up behind the diaphragm.

Low Note Loss.

On the lower notes, when the diaphragm is moving comparatively slowly, the regions of high and low air pressure, front and rear, have time to travel to the edges of the diaphragm and coalesce between successive impulses, thus losing some of the low-note energy. This can be prevented by the use of the so-called baffle.

On the other hand, on the higher notes the diaphragm may be vibrating so rapidly that there is not time for each impulse from the magnetic system to be communicated uniformly throughout the entire area of the diaphragm. Instead, therefore, of moving to and fro uniformly, like a piston or plunger, the diaphragm "breaks up" into wave-like or flexural vibration.

This means that while some parts of the diaphragm surface are moving forwards, others are moving relatively backwards, i.e. there is an "out-of-phase" condition, which in turn gives rise to mutual interference and a loss in the energy which should be communicated to the air. The remedy is to stiffen the diaphragm and leave its edges free so

that it can respond to the applied impulses in true plunger fashion.

The problem of "attack" also arises in loud-speaker design. To secure this effect in singing or playing, an artiste must not only hit the right note, but must start it at full volume. It is very difficult to reproduce this effect satisfactorily on a loud-speaker owing to the inertia of the moving parts.

In some instruments the desired result has been secured by imparting a slight permanent spring bias to the reed. The springiness constitutes a latent force which is applied suddenly and incisively to the diaphragm.

A Curious Effect.

Another curious effect arises from the interaction of the reed or diaphragm on the electrical values of the circuit components. For instance, as the reed vibrates its distance from the magnetic pole-pieces varies, so that the inductance of the exciting coil changes periodically, being greater for the half-cycle during which the reed is close to the pole than for the half-cycle when it is further away.

An asymmetric action of this character tends to set up a partial rectification of the applied currents, which, in turn, leads to a corresponding distortion in the output. This effect is eliminated in the balanced-armature type of speaker, because here the average value of the air gap always remains constant. As shown in Fig. 3, any variation on one side of the central pivot is compensated by similar changes on the other side.

"BENT-BACK" RADIO

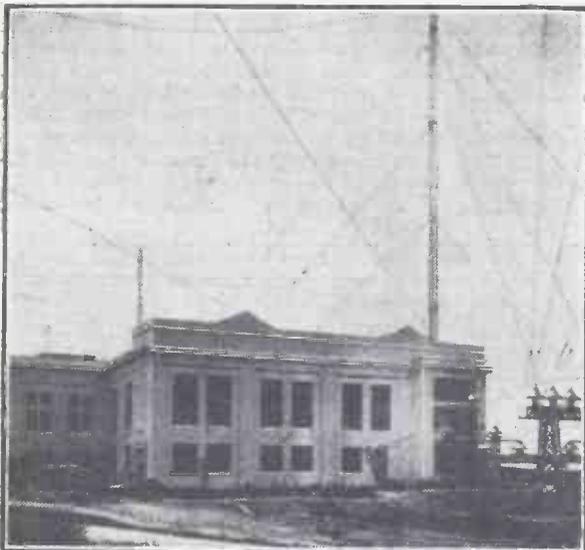
Dealing with the intriguing question of "where the waves go," this article is of special interest to every long-distance and short-wave enthusiast.

By MAURICE WENTWORTH.

ARE you a radio experimenter? If so, you are bound to be interested in the following brief account of one of the neatest and most satisfying experiments ever carried out for radio. It was a difficult experiment, but it can be explained in a few words.

Here are the details. Most of my readers know that Britain maintains several short-wave wireless services by means of the beam system. There is a beam to Canada; another to South Africa; and another to Australia.

THE GIANT OF RIO JANEIRO.



This building houses Brazil's high-power broadcaster, as well as a short-wave station, which has been heard all over the world.

By this beam system signals are not broadcast in all directions as in ordinary radio, but are collected into a more or less narrow beam and directed at their destination.

The aerial and the reflector for the South African beam, for instance, are arranged so that, north, east and west of the aerial the waves are, in effect, turned back by the reflector, and all the energy radiating from the aerial is pushed southwards in a beam directed at South Africa.

Returned from Outer Space.

What happens to that beam when it leaves the aerial? Like all short-wave transmissions it soon dies away along the ground, and most of it moves off in the form of free waves through the clouds and up into space, until it reaches the Heaviside Layer.

Here it is bent down again by the natural reflective properties of the Layer, and eventually some of it arrives on the South African receiving aerial—in fact, an

astonishingly large proportion can be successfully directed or "beamed" in this way.

The experiment in question was an attempt to follow the beam through space. After it left England and Europe behind it, its first "port of call" in space was the Heaviside Layer. Most of the energy arriving there was reflected southwards to South Africa, but, somebody thought, some of it may be scattered in other directions.

Some of it, in fact, might be returned to England again. Could it be true? A sensitive direction-finding set was put on the job, and with it a search was made through space to try and track the beam signals. And eventually they were found, weak but distinct enough, exactly where they ought to have been!

They were coming back from a point in space nearly one hundred miles above the earth's surface, and that point lay right on the line between the two beam stations! So the experiment proved that the beam, although it had left the earth far, far behind it, was still duly speeding South-Africa-wards!

By this experiment it was possible to check some of the work of the Heaviside Layer, and incidentally to lay bare one of its weaknesses. Had it been a perfect reflector, all the reflected energy would have gone South-Africa-wards, but the fact that some of it was bent

back again to England showed that there were losses in the layer due to "scattering."

The experiment thus throws a good deal of light on the fading problem of the reception of distant stations.

These and many other interesting facts were mentioned in the Chairman's recent speech to the Wireless Section of the Institution of Electrical Engineers. In connection with research work on the Heaviside Layer he pointed out that there are *two* more main layers where changes occur, the chief ones being at a height of 62 miles and 155 miles respectively!

Of immediate interest to all listeners is the



work recently done on the Regional scheme. Chief among the problems is the placing of the relay stations all on one wave-length, and the maintaining of exactly the same frequency at all the stations so that their carrier-waves all agree. At present, the steadying is done by tuning forks, but it is hinted that quartz crystal control may eventually give an alternative method.

The Radio "Lighthouse."

The short-wave man will learn with interest but without surprise that short waves have been scoring successes all over the world.

In addition to other well-known services, the Admiralty is working a short-wave service to Hong Kong and Singapore, and practically all His Majesty's ships have been adapted for short-wave working.

Another great field in which progress is hardly yet realised is in the method of direction-finding for ships by radio. Many methods of "D.F." are available.

In some of them the direction-finder is on the ship, and in others a direction-finding station ashore sends out a radio beam, like the revolving beam of a lighthouse, which tells all ships within range which direction the radio lighthouse lies.

BY BEAM TO THE FAR EAST.



When the Japanese delegate to the recent London Naval Conference was speaking, his words were carried by beam radio from Dorchester and reproduced in Tokio with perfect clarity.

SHORT-WAVE NOTES.

A chat about current affairs connected with short waves and short-wave reception.

By W. L. S.

I HAVE gone back on my previous statements (not for the first time!), and have been spending many weary days on evolving a short-wave super-het that really satisfies the requirements of the short-wave amateur bands. This is, of course, of more value than a super-het for short-wave broadcast, since the latter is usually so strong that it does not require a super-sensitive receiver to cope with it. The weak amateur signals from distant parts, however, are another story, and it is in this line of business that the enormous sensitivity of a good super is really worth while.

Doubtful Improvement.

As most of the amateur bands are not more than 200 kc. wide it is obviously best to use an intermediate frequency not lower than 100 kc., since then the two channels of any given station will be 200 kc. apart, and there will be no second-channel interference from stations in the band. This will be limited to the comparatively scarce commercials outside, which are not, as a general rule, very strong during the "DX" hours.

Up to the present I have been using my normal S.G. and detector, the latter serving as the first detector of the super-het, used on the outside aerial. A separate oscillator is unnecessary on these very high frequencies. After this I have two screened-grid stages tuned to 3000 metres (100 kc.) followed by the second detector and one note-mag.

The whole outfit is behaving quite rationally and doing just what one would expect, but I cannot say that I am convinced that I receive on it any signals that I cannot get on my standard set.

As short-wave conditions have been uniformly bad for some time, the order of the day is "wait and see," and this I propose to do.

Probably it will later be possible to apply the "Stenode Radiostat" principle to short wave-lengths where an ultra-selective receiver is needed.

Generally speaking, the ordinary detector and L.F. type receiver is *selective* enough for all ordinary purposes on the short wave-lengths, and it is not selectivity that is needed so much as the property of filtering out general untuned interference noises, which does not amount to the same thing by any means.

Advantages of S.G. Stage.

In this connection I positively refuse to make another short-waver that does not incorporate a screened-grid stage! It is such a joy to have the aerial "de-coupled" so effectively, and at the same time to be able to amplify the signals slightly without amplifying the "mush" that I should be like a fish out of water without any universal stage of S.G.

Yet two cases have come to my notice of successful amateur transmitters who use S.G. in front of their receivers for the higher

wave-lengths, and cut it out on 20 metres because they apparently receive better signals without it!

A Chingford reader mentions a phenomenon that threatens to rival the "G 5 B D effect." He was apparently ordered to bed some months ago, took his short-waver upstairs to the bedside and extended the aerial, putting the earth on a gas-pipe.

The result was that if anyone happened to stir a fire, light the gas, or turn the water on *in any part of the house* the signal walked off the dial and had to be patiently returned! This apparatus shows great promise as a burglar-alarm, but does not appear to be all that might be desired in the way of a short-wave receiver.

This reader, replying to my query of some weeks back, can claim 70 countries or more on short waves, including amateur signals. The holder of the record so far, however, is "G.C.A." of Bermondsey, with 92 different countries.

A number of listeners were apparently surprised on the occasion of the B.B.C. broadcast of a talk from New York to hear this talk coming across the trans-Atlantic

and with a reasonable number of plug-in coils, the colossal frequency-band from 28,000 kilocycles (about 10.5 metres) to 3,500 kc. (about 85 metres), which are the two limits of the shorter bands allotted for amateur work.

The amateur bands themselves are, as everyone knows, very narrow, but in between them one hears vast numbers of interesting stations, and does not want to miss even 20 kc. of the whole of this band.

I, personally, am naturally interested more in the amateur bands than all the rest of the space, and accordingly tune with a small condenser, with a slow-motion dial, across which is a .0001 reaction condenser with a plain knob.

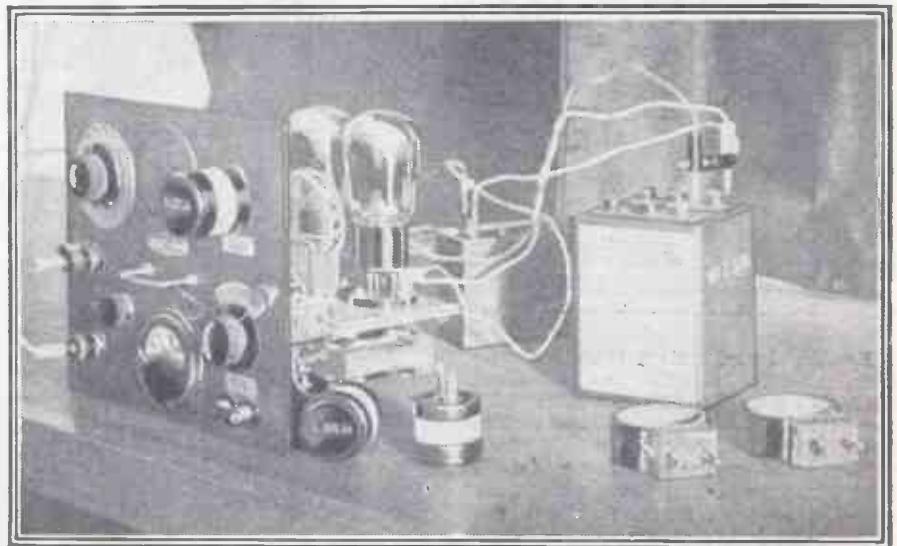
Thus I simply set the .0001 to some predetermined setting and the whole amateur band is then spread over the smaller condenser.

The Best Scheme.

Probably the best possible method of obtaining really easy tuning over the whole gamut would be this: For the .0001 reaction condenser substitute a .00015 or .0002, equipped with a slow-motion dial the same as the other, and mounted in an accessible place on the panel. Set this at zero, and tune right up from 0 to 100 on the other dial. Note what signal is found at this point, take the small condenser back to zero, and re-set the .0002 until he is found again. Then go up the whole 100 degrees of the small condenser once more and repeat the performance.

By this means you will get five or six

"A HOME FROM HOME"—FOR OSCILLATIONS



An institute has recently been inaugurated specially for the study of oscillations, and everything connected with oscillations. Here is a specially compact transmitter that is employed for producing oscillations with wave-lengths of 22-38 metres.

'phone channel. I don't know whether this is the first time that such a thing has been done, but the vastly improved reception over here (compared with the usual relays) certainly justified it.

Incidentally, such a number of short-wave listeners seem to derive great amusement from listening to the trans-Atlantic 'phone that the American phrase "I'll tell the world" now has a deeper significance, and to do so is rather more expensive than before!

I have always been rather worried over the problem of covering, with one receiver,

positions (which can be marked off in pencil if an indicator type of dial is used) giving, so to speak, the result of dividing the small condenser into the big one.

Then, to cover almost any range, set the big condenser to first one and then the next of these points, going all the way up, and doing all the tuning operations on the small condenser.

This strikes me as being much more practical than carefully cutting coils to size and always having to change them, particularly where the set is in a metal box with a tightly-fitting lid.



CAPT. ECKERSLEY'S QUERY CORNER

THE RIVAL TWINS—HOME CHARGING
—SHORT WAVES AND HAND CAPACITY.

Under the above title, week by week, Captain P. P. Eckersley, M.I.E.E., late Chief Engineer of the B.B.C., and now our Chief Radio Consultant, will comment upon radio queries submitted by "P.W." readers. But don't address your queries to Captain Eckersley—a selection of those received by the Query Department in the ordinary way will be dealt with by him.

The Rival Twins.

A. L. N. (Harpenden).—"I understand that the two Brookmans Park transmitters are of exactly similar power rating. Why is it, then, that it is the general experience to find greater volume given by the 'National' transmitter than by the 'Regional'?"

But, you see, lots of other people ask the same question, but state that greater volume is given by the Regional transmitter! As a matter of fact, most people find the shorter wave weaker. Only those very near the transmitter in open ground generally find the shorter stronger.

The point about it all is that in a large town like London the waves get shielded, and then strength varies hundreds of per cent. between points only a few tens of yards apart! The radiations being on different wave-lengths do not get shielded or even augmented in the same way, and at a given point one is strong, the other weak; at another point one is weak, the other strong.

Out in the open country the same effects are not so noticeable, but you find shielding in hills all the same.

MIND THAT ACID!



When examining your L.T. battery be careful you do not get acid into any cut you may have on your hand or finger.

Home Charging.

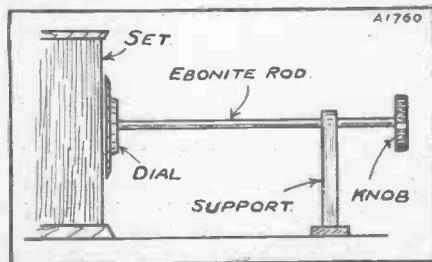
A. L. (London, S.W.3).—"I have in use an H.T. accumulator which naturally requires periodically recharging. As I must obtain for this some form of rectifier—since my mains are A.C.—the following problem has arisen.

"If a valve rectifier is obtained giving an output sufficient to charge an accumulator

when run down, the initial cost will be fairly high, but I understand the efficiency of this scheme is very good. An alternative scheme is to use a chemical rectifier—I know these are inclined to be messy.

"Do you think, however, that a valve rectifier would eventually pay for itself, since its efficiency is so much higher than that of a chemical rectifier, and it is also cleaner in operation?"

TUNING ON SHORT WAVES



A suggestion for curing hand-capacity troubles.

Work it out, sir! Thus:

Capital cost of valve rectifier in pence A.
revenue charge converted to write off in 1,000 hours =

$$\frac{A}{1,000} \text{ pence hour.}$$

Revenue charge for power, i.e. cost of input power for an hour's charging = x pence.

(One Board of Trade Unit equals 1,000 kilowatt hours, i.e. 1 amp. at 200 volts for 5 hours, ½ amp. at 200 volts for 10 hours, etc.)
Total revenue charge for valve rectifier =

$$\left(\frac{A}{1,000}\right) + x. \text{ pence.}$$

Then do the same for the chemical rectifier, assuming a life which the makers will give you. (Incidentally, I have guessed 1,000 hours for the life of a rectifier. Find out from the makers if this is right and if not change accordingly.)

Short Waves and Hand Capacity.

G. V. C. (Tottenham).—"I have a short-wave receiver with which I am experiencing a good deal of hand-capacity effects. I found that by the use of a metal panel the above fault is nullified, but signals have disappeared.

"Do you think that by re-arranging the coils at a greater distance from the panels, results will be normal? I ask this question, since it is rather a difficult job to re-arrange the coils without practically re-building the set. Hence, I do not wish to make this alteration if it is not likely to solve the problem."

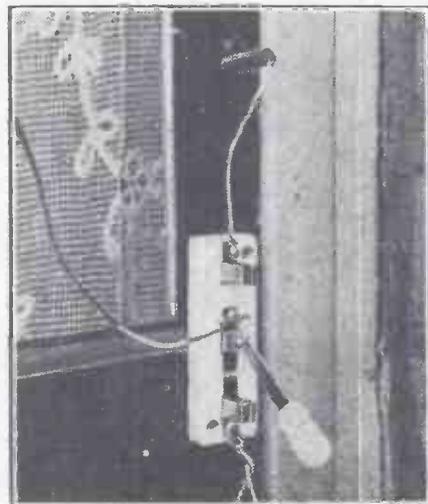
It's all a little difficult, isn't it, for me to say exactly what should be done without a nearer view of the set? But why not attack the thing another way so as to be certain of a cure, and so dispense with the metal panel but put a long rod on the condensers, as shown in my sketch?

I know it looks a bit unmechanical as I draw it, but you can use a support as shown, I suppose. I wonder why your signals should disappear though, because I don't see that the metal panel (unless you wrap it round your coils) should make all that difference.

You may have altered coil inductance (made it less), in which case put on a turn or so and make it more. You may have picked up all your signal on the coils before!

Try different lengths of aerial and different methods of connection. I am verily rather in the dark; but I do give you a cure, however clumsy!

DO YOU USE ONE?



A typical earthing switch by means of which the aerial lead (centre contact) is connected "down" to earth, or "up" to the set when this is in use.

THERE are certain things which are always cropping up in wireless, no matter in what direction one turns. Of these, selectivity is by no means one of the least prominent.

From the home constructor's point of view selectivity can be written down as a vital requirement for two reasons. The first is separating foreign stations when they can be received, so that intelligible reception is possible; and the second is cutting out the local transmission or transmissions so that foreign reception shall be practicable.

Selectivity in a receiver should be judged by the ease with which two stations working on wavelengths fairly close together can be separated, and not by the degree of critical tuning which exists. In the early broadcasting period it did not really matter how unselective a set was, because there were so few stations and they were well spaced.

As more and more stations were introduced, sets had to become more and more selective. Eventually the question of selectivity assumed an immense importance, and ways and means were developed by radio experts to meet all normal requirements of station separation.

Most of the early schemes were by no

means simple. The most general method was to use several H.F. stages all with tuned circuits, or some special scheme such as the "supersonic," but almost without exception they were tricky to work.

Successful Simplification.

But (as is always happening where scientific things are concerned) the experts, having attained their object somehow or the other, no matter with what complications, set to with the idea of getting the same effect in simpler ways.

After many evolutions there emerged the modern type of aperiodic aerial coupling which gave us sufficient selectivity to separate distant and weak stations with only one tuning dial. To overcome the local station trouble wave-traps were introduced.

These at first were complicated and needed critical setting. But the modern Brookmans Rejector is so simple that one almost forgets it is on the receiver, until it is accidentally put out of adjustment and the local swamps everything else!

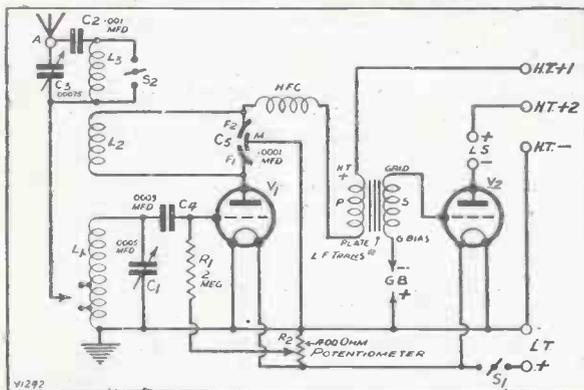
A Modern Circuit.

This business of obtaining what is desired "by hook or by crook" and then simplifying matters, is seen in other departments besides that of tuning. Sensitivity was once a matter of many valves and reaction schemes which were difficult to adjust and which upset tuning.

Now we can get all the sensitivity we want with half the number of valves and with the aid of "differential" reaction, which, of course, requires no introduction. And so we could go on, but this is enough to show that a modern circuit can be the essence of simplicity and yet give us all that we can desire in the way of good results, simple construction, and ease of operation.

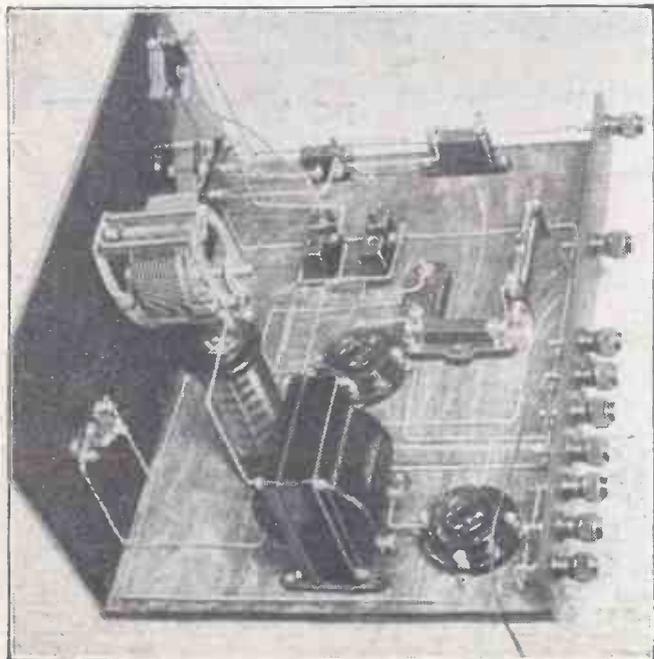
Look at the circuit of the "B.P." Two. Could you wish for a simpler two-valve arrangement? Yet this set will cut your local station right off the dial when neces-

ITS POWER IS AMPLE—



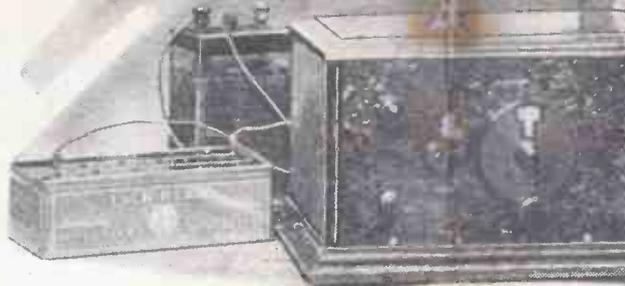
The well-tried detector and transformer-coupled L.F. arrangement is employed, with the addition of several modern refinements which make the set ideal for existing conditions. They include a simple form of the Brookmans Rejector, differential reaction, and a potentiometer return for the grid leak which ensures smooth reaction.

REAL QUALITY FROM THE LOCAL



As there is only one good low-frequency stage, feed-back between L.F. valves, which is a frequent cause of poor quality reproduction, cannot possibly take place; and the set is a real dry-battery proposition.

The "B.P." Two



Giving the Best Possible results from two valves, the "B.P." Two is sensitive and selective. It embodies the famous Brookmans Rejector, which not only will it bring in your local station as well as you want, but it will also shut it right out when you are after m

Designed and Described by the "P.W." RESEARCH

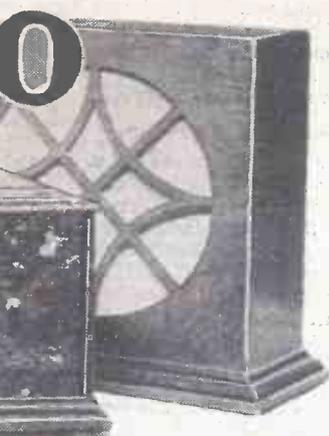
COLLECT THESE PARTS TOGETHER

- 1 Panel, 14 in. x 7 in. (Paxolin, or Goltone, Resiston, Trollite, etc.).
- 1 Cabinet with baseboard 9 in. or 10 in. deep (Camco or Pickett, Osborne, Lock, etc.).
- 1 .0005-mfd. variable condenser (Lissen or Dubilier, Lotus, J.B., Igranic, Ormond, Ready Radio, Formo, etc.).
- 1 Vernier dial (if condenser not of slow-motion type) (Igranic or Lotus, Lissen, Formo, Ormond, Brownie, J.B., etc.).
- 1 .0001-, .00013- or .00015-mfd. differential reaction condenser (Ormond or Lissen, Ready Radio, Dubilier, Lotus, Formo, Magnum, etc.).
- 1 .0003-mfd. fixed condenser (Lissen, Benjamin, Igranic, etc.).
- 1 .00075-mfd. "Brookmans" condenser (Ready Radio).
- 3 Single coil holders (Wearite and Lotus, or Lissen, Ready Radio, Igranic, etc.).
- 2 Sprung valve holders (W.B., or Lotus, Benjamin, Igranic, Wearite, Formo, Magnum, etc.).
- 1 H.F. choke (Varley or Lissen, R.I., Dubilier, Igranic, Lotus, Ready Radio, Leweos, Wearite, Magnum, Bulgin, Junit, etc.).

Just the Set You Need



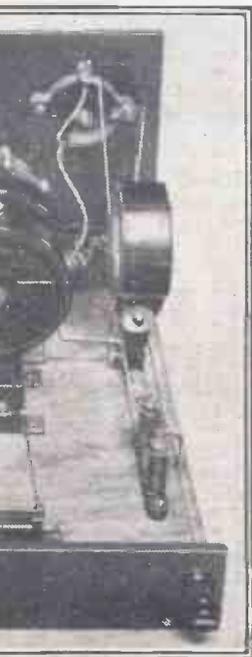
All the components employed are quite standard, including the three plus the right of the other two is in the rejector circuit which can be removed if necessary.



"P.P." is simple to make, means Rejector and not can possibly wish, but ore distant prey.

DEPARTMENT.

- ER.
- (Dubilier or Lissen, T.C.C., Igranic, Mullard, Goltone, Atlas).
 - 1 .001-mfd. ditto (T.C.C. or Lissen, etc.).
 - 1 2-meg. grid leak and holder (Graham-Farish or Ediswan, Lissen, Igranic, Mullard, etc.).
 - 1 400- or 200-ohms potentiometer (Ready Radio or Lissen, Igranic, Wearite, etc.).
 - 1 L.F. transformer (Ferranti or R.I., Lissen, Varley, Igranic, Telsen, Lewcos, Lotus, Mullard, etc.).
 - 1 Terminal strip, 14 in. x 2 in.
 - 9 Terminals (Belling & Lee or Igranic, Eelex, etc.).



Easy to Make and Work

y-in coils. The coil by itself to bles the local station to be

sary, and bring in foreigners with volume and quality, and with an ease which will astound you.

An X coil is used to give selectivity to the tuning, while a simple form of rejector with one adjustment, enables a powerful local station to be cut out. This rejector circuit is brought in and out of circuit by means of an ordinary push-pull switch on the panel.

Every precaution necessary has been taken to ensure that the silkiest of smooth reaction build-ups shall be obtained. A differential control of throttle reaction is employed, and this is noted for its velvety control. Also, a potentiometer for adjusting the potential of the detector valve grid ensures that the most obstinate of detector valves will be tractable.

Watch Your Wiring.

The coupling between the two valves is by means of an L.F. transformer arranged on orthodox lines. No special components are necessary, nor are any special tools required for the construction, which is so simple that we need not dwell on it for long.

The diagrams of the front of the panel, and of the wiring are self-explanatory. When marking out your panel do not forget to do so on the back, and to reverse the positions shown in the panel layout.

You will require three holes along the bottom of the panel for screwing it to the baseboard, and these must be at a distance from the bottom edge of the panel equal to half the thickness of your baseboard.

When mounting the components on the baseboard, follow the layout shown in the wiring diagram. This applies specially to the positions of the three coil holders, both as regards their relation to one another and the positions of the pins and sockets.

The last operation of all is wiring up. This is perfectly straightforward, and is merely a matter

of just a little patience for a good job to be made.

See that all joints are "real" joints, and that you have properly tightened all nuts and terminal screws. Bad connections cause more troubles in wireless sets than can be attributed to any other single cause.

The Valves to Use.

And now for the accessories which you need. The first valve should

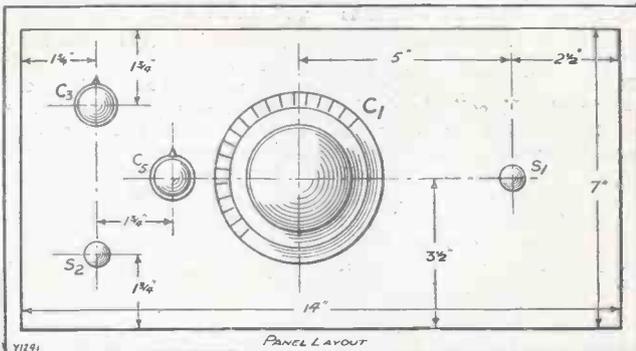
be of the H.F. type if you are going to buy a valve specially for it. Otherwise practically any General-Purpose, Det., R.C., H.F. or L.F. valve will work satisfactorily in this position.

The second valve should be of the small power type. An accumulator of the same voltage as the valves, which may be rated at 2-, 4- or 6-volts is required, and an H.T. battery of at least 100 volts.

The wave-trap coil L_3 , should be a No. 50, or No. 60 if the station you wish to cut out is near the top of the normal broadcast band. When receiving on the lower wave-band, L_1 should be a No. 60 X coil and L_2 a

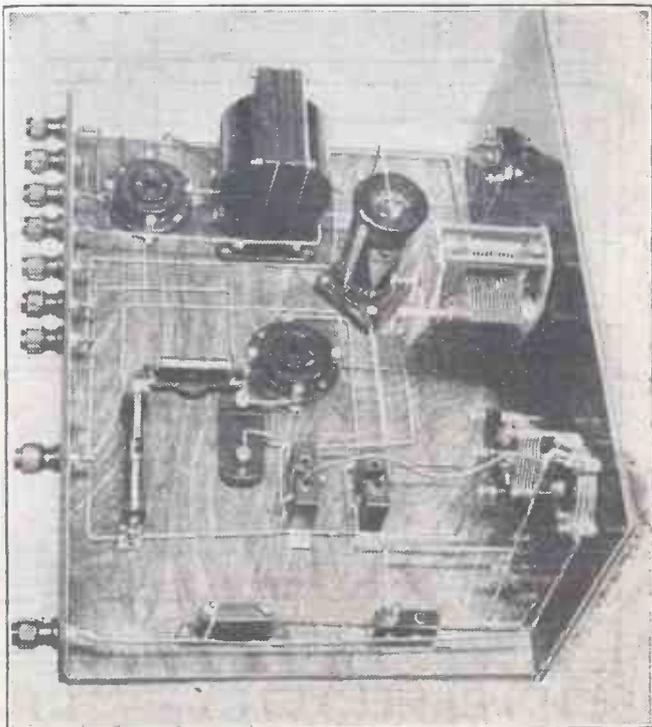
(Continued on next page).

—ITS CONSTRUCTION IS SIMPLE



Drilling the panel is one of the easiest constructional jobs, and the positions for the holes are shown on this diagram. The controls are logically placed so that the main ones, C1 and C5, are the most convenient for handling.

CONTINENTALS TUNED-IN EASILY



The potentiometer, which can be seen near to the earth terminal, ensures a very smooth control of reaction so that distant stations are easily received. When used with telephones dozens of foreigners will roll in, and some of them will be received at loud-speaker strength.

THE "B.P." TWO.

(Continued from previous page.)

No. 50 coil. For long waves use a No. 250 X coil for L_1 , and a No. 100 for L_2 . A 9-volt grid-bias battery will also be required.

When you first try the set out, put the potentiometer slider to the positive end, namely that nearest the L.T. positive terminal, and pull the switch S_2 out, thus putting the rejector out of circuit.

Coil Connections.

The flex lead to the X coil should be attached to the terminal on the coil with the higher number marked against it; 60 volts will be about right for H.T. + 1, and the maximum available for H.T. + 2.

If under these conditions you find that reaction is a little "ploppy" or has a slight overlap, move the potentiometer slider a little towards the other end. Do not move

it more towards the negative end than is absolutely necessary, though.

You will find that the handling of the set is quite normal with the wave-trap out, and also with it in once the correct setting has been found. Suppose you now find you want completely to remove your local station so that Continental stations may be tuned in; proceed as follows:

Push the switch S_2 in, and set the condenser C_3 at its maximum. Next, tune-in the interfering local station to its maximum (no matter if it overloads the last valve) and slowly rotate the C_3 condenser towards its zero position.

As you do this you will arrive at a point where the unwanted programme either vanishes completely, or is at a minimum. The rejector circuit is left at this point, and when it is not desired to cut out the station you simply pull out S_2 .

When you are searching for stations remember that the most sensitive condition will exist when the set is just off oscillation. Since the reaction control on the "B.P." Two is so smooth this point will not be sharply defined, but will be indicated by a

slight rushing noise and by a feel of general liveliness in the set.

Should you find that you could do with a little more general selectivity, move the tap on the X coil to the lower tapping. This applies, of course, to both ranges of wave-lengths.

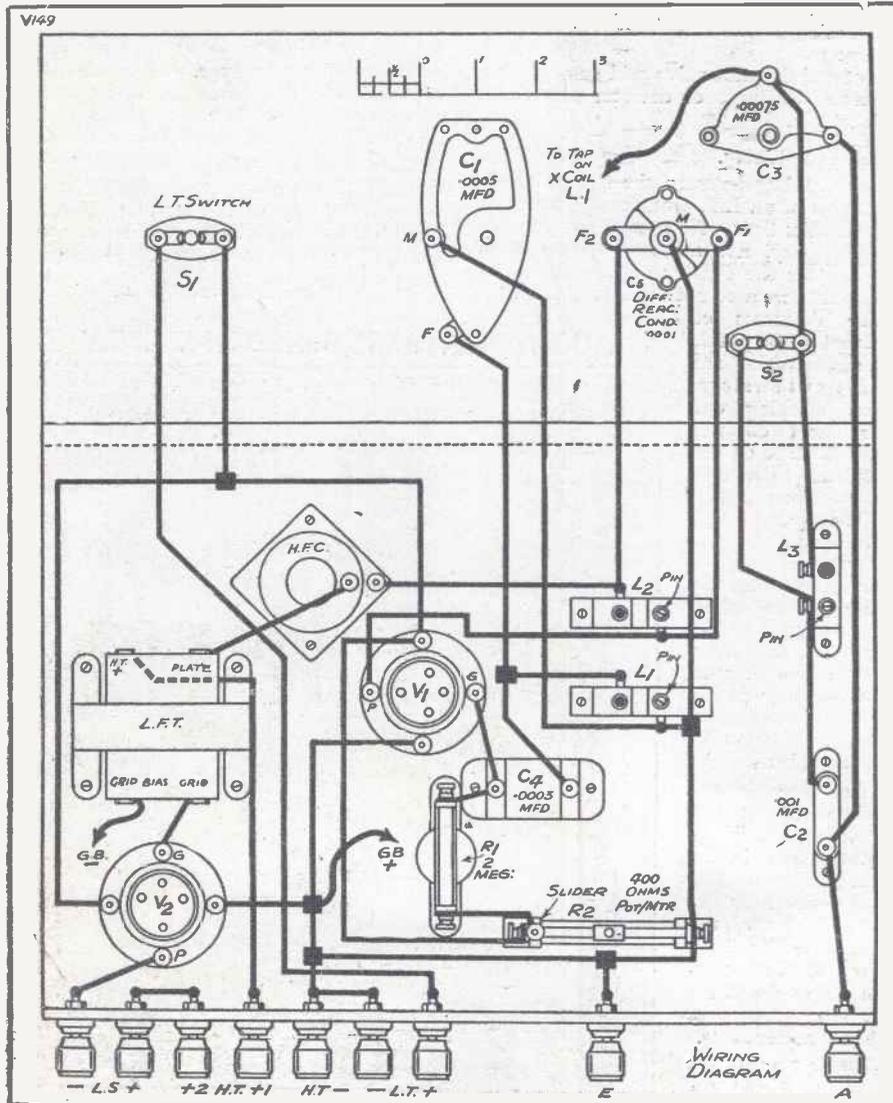
Using "Centre-Tap" Coils.

There is no reason why centre-tapped coils should not be used in place of X coils if you already have them and do not live near to a broadcasting station. It must be remembered, however, that with them the selectivity will not be anywhere near so good, as the number of turns in the aerial circuit when they are used is considerably larger.

You will be able to get several stations on the loud speaker, including a few Continental ones. For the weaker Continental stations, and the more distant ones, headphones should be employed.

Should you decide to use the set on headphones only, it will not be necessary to have a power valve for V_2 , and an ordinary L.F. type valve can be used instead. In this case a 60-volt. H.T. battery would suffice, both H.T. + terminals being joined to the maximum tapping.

THIS DIAGRAM ENSURES GOOD RESULTS



At the top of this diagram you will see a scale which represents inches, and will enable you to measure out exactly the positions of any of the components. When the wiring is completed, you should check back the connections with this diagram.

FOR YOUR RADIO NOTEBOOK.

Keep your aerial as far away from your neighbour's as possible, as running them close together will give rise to many undesirable effects.

When two aerials run close together there will be interaction between them which will affect the selectivity of both sets.

H.T. batteries which are partly run down will often give rise to buzzing and cracking noises, which are particularly noticeable if good L.F. transformers are being used in the set.

A separate H.T. + tapping for each valve is one good method of reducing the effect of battery coupling.

AN EARTH-LEAD TIP.

One old-fashioned cure for electrical interference picked up from adjacent electrical machinery is to try a new earth, and if a fixed condenser is placed in series with this the hum can often be eliminated altogether or greatly reduced.

Do not throw away your old shaving brush, but keep it with your soldering kit, for such a brush is an invaluable aid to cleanliness and quick soldering.

Electricity supply companies charge anything from 1d. to 8d. per unit (according to the districts), but the cost of one such unit supplied from batteries would run into pounds.

Do not use the same earth plate as your neighbour, as this is a common cause of interference between receivers.

In general, the primary coil of a pair of coupled coils is one size smaller than the secondary, though aerials and conditions vary so greatly that this is by no means always the case.

A HIGHER CONDUCTANCE MUTUAL ANY OTHER BATTERY- THAN HEATED POWER VALVE.



**P. 240
PRICE
15/-**

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For a given type of valve the higher its amplification factor and the lower its impedance the better the performance which can be expected of it. The Mazda P.240 has the highest magnification factor for its impedance of any 2-volt power valve. This quality is expressed as mutual conductance and the higher the mutual conductance figures the better the valve.

It can therefore be truthfully claimed that the P.240 is the finest 2-volt power valve on the market—without exception.

THESE FIGURES PROVE IT . . .

Amplification Factor	- - - -	7
Anode A.C. Resistance (ohms)	- - - -	1,900
Mutual A.C. Conductance (MA/V)	- - - -	3.7



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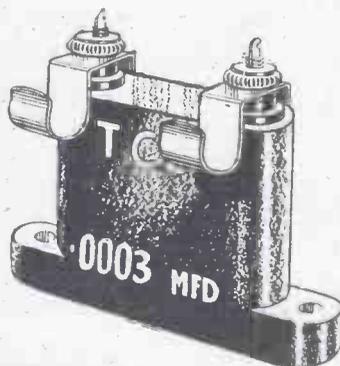
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...reliability and accuracy all the world over. It is a standard by which time itself is judged.

T.C.C. too, is a standard—a standard by which other condensers are judged—a standard of accuracy, reliability and dependability. The letters T.C.C. are an assurance of good service—recommended by experimenters, scientists and amateurs alike—the famous “condenser in the green case.” So, remember this, when next you ask for a condenser.



Illustrated above is a .0003 mfd. T.C.C. Upright Type Mica Condenser. Price 1/6 each. Other capacities in this type are made from .0001 mfd. to .25 mfd. Prices 1/6 to 18/-.

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In the Watmel Binocular H.F. Choke, every detail in design has been carefully investigated with a view to obtaining the greatest possible efficiency in high frequency work.

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It is of very low minimum self-capacity, with special low-loss formers and terminals mounted on top.

Inductance always remains constant. It is mounted on a moulded Bakelite base, and overall measures only 2 in. long by 2 1/2 in. high.



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For specially efficient H.F. work.

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For all ordinary purposes.



Curve of DX3 Choke



★ Send for our Folder No. B.90 showing you how to make up a fine loudspeaker; also folder and Blue-print for building a modern 3-valve set.

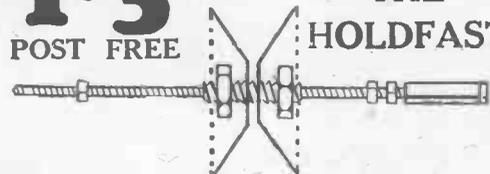
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The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject 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.

HIS FIRST AERIAL.

D.G. (Buntingford, Herts).—"Would a 60-ft. aerial be all right? What wire should it be, etc.?"

A 60-ft. aerial is perfectly satisfactory, especially if you can raise it 25 or 30 ft. at the house end, and run it to a mast which is not lower than this—preferably higher.

We should use a single, not double wires, of stranded copper or similar high conductive material, the kind known as 7/22 being particularly suitable. Enamelled wire makes an excellent aerial, and although insulated wire can be used, this insulation is not usually necessary, and is sometimes a disadvantage.

CAN WE HELP YOU WITH YOUR SET?

Perhaps some mysterious noise has appeared, and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

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

Full details, including scale 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 free and 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 Fleetway House or Tallis House.

Avoid any breaks or joins in the aerial wire, and be careful not to kink it when unwinding from the reel. The ideal method of installing it is when the aerial runs from the farthest insulator right down the lead-in without a break in the wire.

Use an adequate number of insulators (generally two or three) of the type that will remain dry even under severe weather conditions, as there may easily be considerable loss if only one of the small egg insulators is used.

All the contacts in the aerial system should be really sound. If you are to use an aerial earthing switch (and it is advisable to do so), arrange that the whole switch is covered with some protection (such as a wooden box), against the effects of the weather, and finally pay attention to the spacing of the aerial lead-in.

Be particularly careful not to take the wire through

the window close to any metal, or run it along within say a foot of any wall, gutter pipe, etc., as serious losses often occur in this way. Except at the point where it enters the house, the wire should be well spaced away from all walls, etc.

"ALL THE STRENGTH HAS GONE."

R.M. (Warwick).—"It has been a good set but now all the strength has gone. I can still hear it but only close to the loud speaker, whereas before it rang out in the room although it is only a two-valver. What makes it all the more disappointing is that only a couple of months ago I bought a new power-valve and since then it has been better than ever until this trouble came along. I have had the H.T. tested and it is showing 101 instead of 108. Surely that wouldn't cause the drop in strength? L.T. I know is all right, but the set seems dead. Can you suggest anything I can do?"

In your case we should certainly try replacing your detector valve (with another one of the same type), to see if it has "lost emission." All the symptoms point to this, for although the valve filament may be intact and appears to light up as before, if it is a fairly old valve you may have used all the active material from the filament (which gives it its peculiar property of emitting large quantities of electrons when it is slightly heated.)

You can get its emission tested by any dealer, and if it is not up to standard you can get a new valve from him. Or, alternatively, you can borrow a new valve of the same type and just try it in your set without altering anything else, when, if the emission of your present valve is faulty and is causing the present trouble, you will find that the set is immediately restored to life by the new valve.

THE PICK-UP'S POSITION.

W. R. (Hampstead).—"Can a pick-up adaptor be plugged straight into the detector stage or should it be in one of the stages of low-frequency amplification?"

You can use the pick-up in either the detector or one of the low-frequency stages, whichever gives the best volume for your purpose. All you have to do is to remove the valve from the set, plug in the adaptor in place of it, and then replace the valve in the adaptor.

MAKING UP A SET FROM WIRING DIAGRAM.

F. L. (Leigh-on-Sea, Essex).—"I am 63 years of age and have never until lately had much time for wireless. Having once taken the plunge I am getting extremely interested in it.

"Crystal sets I can manage easily, and two of my one-valve sets have been remarkably successful, but I am afraid to fly higher than this as I am not very handy with tools. Also I find a difficulty with the diagrams because they are not the exact size the set will be.

"I notice that on the wiring diagrams you give a scale marked off like a ruler, and

I have a feeling that if I could use this properly I could do the constructional work better. I do not know how to use it, and I've never seen anything about it in the article. What is the idea of it?"

The reason we do not give the details for using the scale with every article is that they have already appeared so many times, that we are afraid of readers getting tired of seeing them! But as you apparently missed previous descriptions we have pleasure in summarising them once more, for properly used the scale is an enormous help when making a set.

Every "P.W." wiring diagram is drawn to scale, and the positions of the components shown are relatively correct. That is to say, that the valve holders, chokes, neutralising condensers, terminal strips, fixed condensers, etc., are all correctly placed on the diagram. But you cannot measure the various distances between the "components" on the diagram with an ordinary ruler because the diagram itself is much smaller than the set will be (a regrettable necessity).

So to get over the difficulty we give on every wiring diagram a scale marked "0, 1, 2, 3, 4 in.," etc. From this you can make a small "ruler," which will tell you the exact distances between the various parts.

All you have to do is to take a strip of cardboard of convenient length, say about 10 in., cut it straight to form a cardboard "ruler," and mark it not with ordinary inches but with inches from the little scale on the diagram.

(True, this scale is not 10 in. long, but the divisions on it are equal ones so that having marked 1, 2, 3, 4, off you can move your little cardboard ruler along and make four more equal divisions which will stand for 5, 6, 7, 8, and so on.)

When you have completed your little cardboard "ruler" you use that for measuring distances on the diagram, remembering that the cardboard ruler will be for the diagram, exactly what the ordinary ruler will be to the set itself.

So that if the cardboard ruler shows that the reaction coil is 6½ "in." from the H.F. choke for instance, you know that on your set the reaction coil will be 6½ real inches away from the H.F. choke. You see the idea?

With the simpler "P.W." sets the fact that components are not crowded allows you to place them with sufficient accuracy without any careful detailed measurement at all. For if you place this valve holder level with that coil opposite the other terminal and so forth, to agree with the wiring diagram, you will find that your finished set will look almost exactly like the photographed one.

With larger sets exact spacing becomes important. In such cases you will find the little cardboard ruler invaluable.

As all the components are drawn exactly to scale, and as they are "sealed" on the baseboard every measurement can be checked and rechecked until you are sure you have it exactly right. The whole

(Continued on page 384.)

WHAT DO YOU THINK ABOUT THIS?

A Safron Walden reader of "P.W." knocked up a cheap one-valver using condenser-controlled reaction.

Although coils and H.F. choke were of the home-made variety, results were excellent on ordinary waves. The reaction was delightfully smooth, and foreign stations rolled in, so he made some long-wave coils—on the same lines as the others. (They were apparently constructed quite as efficiently.)

But the set "wouldn't have them." Fierce oscillation occurred irrespective of the reaction setting, and no adjustment of H.T., filament volts, etc., would stop the instability.

Could you have told him

WHAT WAS WRONG?

N.B.—There is no prize for answering this but from time to time we shall give a radio problem (followed the next week by the answer) in the hope that readers will find them both interesting and instructive. (Look out for the solution to above next week.)

Last week's volume control fault was one against which we have often cautioned readers. The connections were all right, but a low-resistance (400 ohms) potentiometer was used, instead of the correct high-resistance type.

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from previous page.)

secret is to make up a fresh "rule" for every fresh diagram. From that diagram, and use that "rule" for measurement on that diagram only, all the measurements on the actual set being made with an actual ruler.

FITTING A DE-COUPLING RESISTANCE.

R. A. (Jersey, C.I.).—"My set is rather an old-fashioned arrangement of detector and two L.F. amplifiers, both transformer. Reception is everything I could wish for except when the batteries are running down, and I am told that the roughness which I notice then could be overcome to some extent if I used a de-coupling resistance.

"I have a 30,000-ohm wire wound resistance on hand, and also a large fixed condenser of 2 mfd. Are these suitable, and if so what are the connections?" (Diagram was enclosed.)

The resistance and fixed condenser are quite suitable for your purpose, and all you have to do is to break the lead which goes from the first low-

switched off when the alteration is made? I ask, because I have twice been told this, yet in neither case could I get a satisfactory explanation why, and for the life of me I cannot see a reason."

Although there is not much gain in switching off a set when the grid bias to a high-frequency stage is altered, it is a different matter with low-frequency. So probably your informants were right, for grid bias is far more commonly used on the L.F. stages than on the high.

Negative grid bias on a low-frequency stage enormously reduces the current which is being taken from the H.T. battery and passed through the valves. Suppose, for instance, you are using a power valve, which with a negative grid bias of nine volts takes an anode current of 8 milliamperes and you wish to increase the grid bias a little, which will have the effect of sending the steady anode current down a trifle (providing H.T. remains constant).

It might seem at first sight that all that is necessary is to take the plug out of "nine," and put it in at the extra 11 or 3-volts negative while the set is on. But if you do this you do not merely alter the negative grid bias from 9 to 12; but during the period in which the change over is made you move the bias away altogether!

That is where the damage may arise, for directly the plug is moved from 9 volts negative the anode current goes up enormously until the plug is replaced in the G.B. battery. Instead of taking, say, 8 milliamperes, the valve unbiassed may be drawing anything from two to three times that figure. This is so bad for the battery and for the filaments that in the interest of economy you are recommended always to switch off while the change-over is being made.

Aerial to one side of the aerial coil holder. Other side of aerial coil holder to earth, to a centre tapping on the second coil, to L.T. -, H.T. -, G.B. + and filament socket on the valve holder. Other filament socket on the valve holder goes to one end of the 2-meg leak, and to the L.T. switch, the other side of which goes to L.T. +.

The grid socket on the valve holder goes to the remaining side of the 2-meg. leak and to a .0003 fixed condenser. Other side of this condenser goes to one side of the tuning condenser of .0005 mfd. and to one end of the grid coil. The remaining end of the secondary coil goes to the remaining side of the tuning condenser and to one side of the reaction condenser.

This should be much smaller than is usually employed; .00005 mfd. is a good value, and although .0001 may serve at a pinch a smaller size is usually preferable.

The remaining side of the reaction condenser goes to the plate socket of the valve holder and to one side of the H.F. choke. Remaining side of this choke goes to one 'phone terminal, and the positive 'phone terminal goes to H.T. +. This completes the wiring.

ADDING A NEUTRALISED H.F. STAGE.

L. A. T. (Isle of Wight).—"I should like to add an H.F. stage, (using my spare H.F. valve) to be of the neutralised type and not S.G. I have plenty of ordinary coils and a spare neutralising condenser, box with panel. 7 in. x 6 in., terminals, etc. What should be a suitable system of connection?"

In addition to L.T. - and L.T. + terminals you will require one for aerial, one for earth, one for H.T. +, and one for "output." On the panel, mount an L.T. switch and tuning condenser, and on the baseboard, a valve holder, two ordinary coil bases, a neutralising condenser, H.F. choke and .001-mfd. fixed condenser.

The connections are: aerial terminal to one side of the aerial coil holder, which is placed about 1 1/2 in. from the grid coil holder. The remaining side of the aerial coil holder goes to earth, to negative L.T., to one filament terminal on the valve holder, and to the centre tap on the grid coil. (This latter connection is made by means of a flexible lead.)

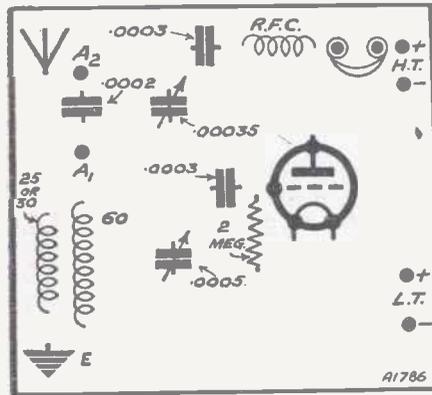
The positive low-tension terminal is connected to one side of the on-off switch. The remaining side of this switch goes to the remaining filament terminal on the valve holder.

The grid terminal of the valve holder is connected to the nearest grid coil holder terminal, and also to one side of the .0005 mfd. variable condenser (fixed vane). The remaining side of this variable condenser is taken to the other side of the grid coil holder and to the neutralising condenser.

The plate of the valve holder is connected to one side of the H.F. choke and to the remaining side of the neutralising condenser, and also to one of the .001 fixed condenser's terminals. The remaining terminal on this fixed condenser goes to the output terminal.

H.T. + terminal is connected to the vacant side of the H.F. choke, and this completes the connections. In use, the H.T. +, L.T. + and L.T. - terminals are carried through the unit to the ordinary batteries, or to the leads which come from these to the set itself. A lead from the output terminal to the "A" terminal on the set will be necessary, the aerial being removed from the set and placed on the unit. For the ordinary wave-length you will require a 25 or 35 coil for the aerial and a 60 centre-tapped coil for the grid circuit.

POPULAR "WIRELETS" No. 12



The "components" shown above are those for a simplified Reinartz one-valve, in which the primary serves both as aerial and reaction coil. Can you "hook up" this circuit? (Look out for the answering diagram next week.)

WHEN THE SET "PACKS UP."

T. N. N. (Surrey).—"Nobody could want better programmes than we had, but last night it went silent and since then, nothing. What can we do about that?"

In such a case the first thing to do is to look over the set carefully and make sure that no lead has come off. If all the connections appear O.K. make sure that the 'phones themselves or the loud speaker is working properly.

You can test by comparison on another set or by borrowing another pair of 'phones or loud speaker and testing on your set, or by one of the methods described from time to time in "Radiotorial." If the 'phones or loud speaker prove to be O.K. and the set itself has not been tampered with in any way and appears to be normal, the next thing to do is to examine the aerial and earth connections outside.

If the aerial wire is touching a roof or water pipe, if the aerial or earth wire has become broken, you will probably hear no broadcast. Remember, too, that the earth lead may be broken underground where the fault is out of sight, so this test of the aerial and earth connections should be a very thorough one.

If you cannot find any trace of a broken wire the most likely cause of the trouble is the breaking of a wire inside the set, or a faulty contact. Incorrect connections of the battery would be sufficient to cause trouble and so, of course, would be a broken battery lead.

Generally any broken contact will disclose itself if gently touched with the finger, by the noises it sets up when "made" and "broken," but great care must be taken not to allow the high-tension wiring to come into contact with the low-tension wiring. (High-tension wiring is everything connected to the high-tension positive, and the "low-tension" wiring is that connected to the filaments of the valve and L.T. batteries.)

Unless great care is taken to keep these two separate the batteries may become shorted or, worse still, the valves may be burnt out. By going carefully over the set on the lines indicated, we think it is certain you will come across a faulty contact. If not, you will, we are afraid, have to call in expert advice.

This need not necessarily be a highly-paid or highly-skilled technician, for anyone who has used a valve set for a few months and who has been really interested in it will probably be able to detect where your fault lies after an inspection of the receiver and of the aerial and earth.

Do not forget that when interfering with the wiring of a valve set the H.T. - plug should be removed from the battery if risk of shorting or burning out valves is to be obviated. The only exception to this is when H.T. must be connected in order to listen to the effects of moving flexible wires, etc., but in such a case the very greatest care should be taken, for an accident to the H.T. and L.T. wiring is fatal to your pocket.

THE HARTLEY CIRCUIT ONE-VALVER.

M. S. (Worcestershire).—"A friend of mine writing from Canada tells me he has had great success out there with the Hartley circuit, using one valve and 'phones. I should like to try this, but do not remember seeing it described in 'P.W.' What are the circuit connections?"

You need a 25, 35 or 40 aerial coil for one plug-in coil holder and a 75 or 100 for the other. Connections are as follows:

frequency transformer's primary to the H.T. + 2. One side of the break goes to one end of the resistance, and its other side to the other end.

Now take a wire from one side of the 2-mfd. condenser to that side of the resistance which you have joined to the terminal of the transformer. The other side of this fixed condenser goes (by as short a wire as possible) to the L.T. negative wiring on the set.

When this has been done you have made the necessary modifications and should find the set much improved as a result.

VALVES FOR THE "B.P." TWO.

"UNCERTAIN" (No address).—"I have been recommended to a "B.P." Two. Do I need 2-volt or 6-volt valves?"

The valves for the "PB." Two may be either 2-volt or 6-volt, the former for extreme economy, and the latter if utmost results are the main object.

The first valve should be of the H.F. type, with some 45 to 60 volts H.T., while in the second valve socket you should use a power valve with all the H.T. you can muster up to 120 volts, if you want real quality on the loud speaker. Certainly you should not use less than 100 volts if the signals are fairly strong, but if you are so situated that you are going to use the set for "telephones" only, a somewhat lower high-tension—say, 60 volts—will serve quite well.

Whatever you use, of course, be careful to use the correct grid bias specified by the valve makers. This is an important point if you wish to secure the best results and have a long life from your H.T. battery

ALTERING GRID BIAS.

W. E. (Richmond, Surrey).—"Is it true that when altering the grid bias, the set should be

TECHNICAL TWISTERS

No. 14.—MICROPHONIC NOISES.

CAN YOU FILL IN THE MISSING LETTERS?

The usual source of microphonic noises is the valve.

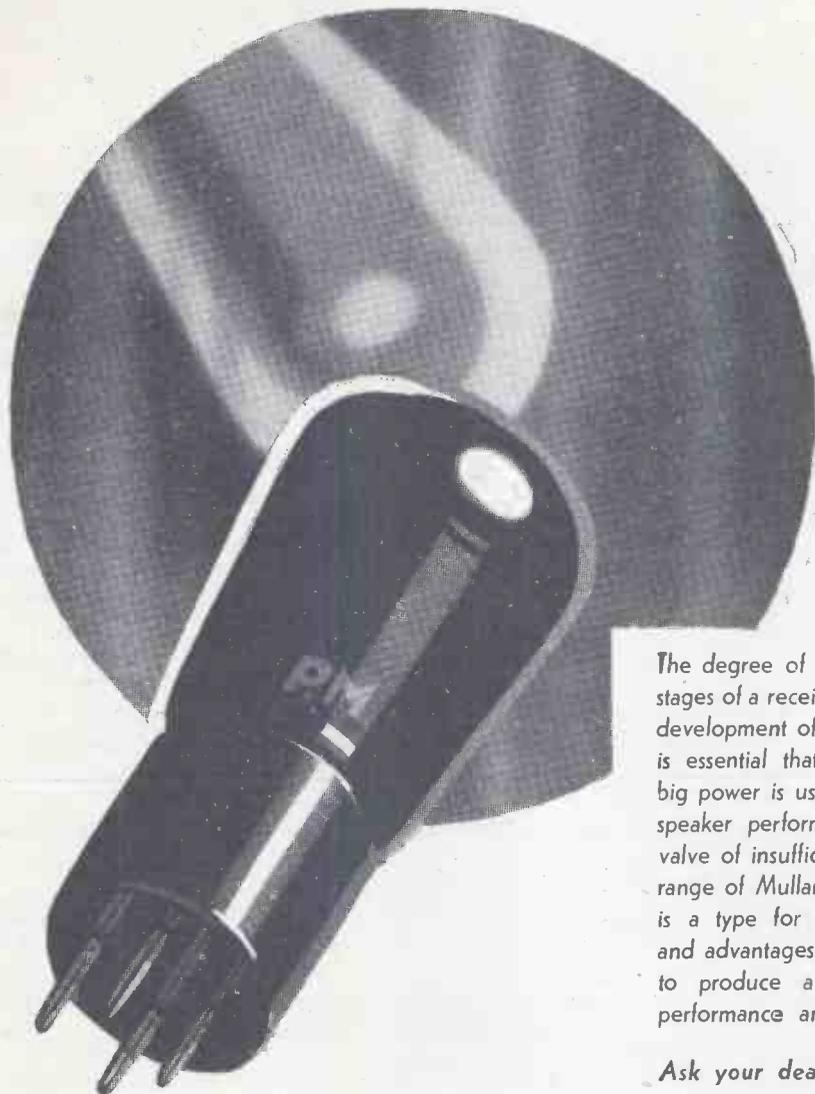
The cause of microphonic noises is usually the shaking of one of the inside the

It may be started by placing the too near to the

A valve holder should not be used where microphonic noises are troublesome.

Last week's missing words (in order) were: Buried. (or Direct); Under (or Below); Insulated; Earthing; Sharpens.

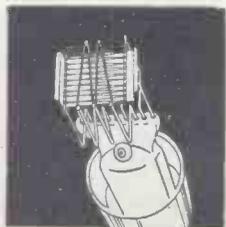
PLAIN FACTS ON THE POWER VALVE



The degree of signal energy produced by the amplifier stages of a receiver has tremendously increased with the development of modern radio design. As a result it is essential that an output valve capable of handling big power is used in the last stage. A harsh distorted speaker performance is the result of using an output valve of insufficient power-handling qualities. In the range of Mullard Power and Super Power valves there is a type for your own receiver. Long experience and advantages in the manufacturing process enable us to produce a power valve that is unsurpassed in performance and service.

Ask your dealer for the following type numbers:—

<u>Power</u>	<u>Super Power</u>
2 volt P.M.2.	P.M.252.
4 volt P.M.4.	P.M.254.
6 volt P.M.6.	P.M.256.



Above: The Mullard P.M. Filament, which since its discovery, over four years ago, has set a precedent in radio valve design.

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Arks.

A PEEP AT P C J.

(Continued from page 369.)

This station director, *Mijnheer* E. Startz, speaks fluent English with a strong Hollywood accent (he spent many years in America, but is a German by birth), and will tell you with boyish enthusiasm of the "fan mail" which arrives daily from "Amurrican 'hams.'" The ease with which he makes each little announcement in five languages, without pausing for translation, leaves one gasping.

Complete L.F. Screening.

The studio, waiting-room, amplifier-room, and so on, are just rooms in an ordinary little suburban villa a few minutes' walk from the transmitter hut. One passes under the aerial in walking across to the villa. It is nothing very elaborate: just a single wire with the free end hanging on one of the steel lattice masts of the long-wave Hilversum broadcasting station. There is no proper earth connection, but a form of counterpoise.

Shielding seems to be the secret of P C J. You short-wave enthusiasts might care to take the hint. The L.F. amplifiers downstairs in the lounge—the room below the studio—are all in metal boxes. Even the milliammeters are inside the screening boxes, and little slots are cut in the sides so that the very essential parts of the dials can be seen.

A standard three-valve short-wave set

NEXT WEEK

Don't forget to order your "P.W." for next week. It is a

SPECIAL VALVE NUMBER

full of interest for the long-distance listener and the seeker after quality reproduction.

Read all about the Modern Valves, and how to use them for best results, in next week's

POPULAR WIRELESS

Usual Price Threepence

with a moving-coil speaker is used to give an indication of quality, and this side-tone test is fairly good, for the amplifier-room is some 100 metres from the actual aerial.

Our old friend, the metronome, is used as an interval signal, and at this amateur station there is no formality about the "met." It stands right on top of the microphone, and when the mike is to be silent the announcer sets the metronome ticker in motion.

Fine Collection of Records.

Some of P C J's music is "canned," of course, but I must confess that they have one of the finest collection of records, all neatly filed, that I have ever seen. Broadcast gramophone music is all right if the records aren't old-fashioned, as is the case with the smaller French relays; P C J's gramophone recitals are worth listening to. Occasionally special orchestral concerts are given. H.M. the Queen of Holland has spoken from P C J.

Special National Broadcasts.

Holland is proud of this little station, and that is why special national "hours" are given for the benefit of England, France, Spain, and so on. The actual wave length is 31.28 metres, and it works on Thursdays, Fridays and Saturdays, generally between 7 p.m. and midnight, and sometimes in the early hours of the morning.

"You see," said my Dutch friend, referring to P C J's world-wide scope, "When it is morning here, it is evening over there"! But I politely refrained from trying to translate into Dutch the old song, "When it's night-time in Italy—"

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Your A.C. Mains Receiver, battery eliminator or charger
see that it incorporates

For those who prefer to make up their own sets, our book "The All-Metal Way, 1930," will be invaluable. It contains 32 pages of circuits and instructions covering all types of A.C. Mains Units. Send a 2d. stamp with your name and address to:—

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Advertisement of Oliver Pell Control Ltd., Kingsway House, 103, Kingsway, London, W.C.2. Telephone: Holborn 5303.

FOR THE LISTENER.

(Continued from page 370.)

Organ Music.

I am not really very fond of organ music. A good deal of it comes over, on my set, very confused for some reason or other. The constant changing of the stops puts me out of the musical frame of mind; too many tricks; too much juggling with tones.

But they give a lot of pleasure to many. And, good lord, what a lot of them there are! I never knew there were so many organs! Big ones, I mean. They all sound the same to me. And I simply can't stand the Vox Humana.

And the Tremolo drives me mad! But I have liked Pattman; and I have wondered whether he is one of the princes in the organ world, having only a surname. And when Reginald Foort plays quietly to me, an old song, perhaps with a subdued accompaniment on the swell, I like him too.

The Daily Service.

Somebody gives a lot of thought to this. It is rather too early for me; for I can't listen from ruddy morn to dewy eve; but once or twice I have listened to see what it was like, and feeling oddly shy, as if I were surprising a prayer meeting. I wonder who uses that service?

Sick people, old and lonely folk, and fragrant piety that has leisure; hospitals, perhaps; and vicars seeking inspiration for next Sunday's sermon.

When I have listened I have found it simple, restful, and, in its own quiet, moving way, refreshing. For there is something in us all which, at times, responds to solemnity and the sense of the invisible.

A Shy Little Voice.

And whose is the shy little voice that has just told me that I have heard a "Romance" by Cyril Scott? It is a very engaging voice, a little husky and timid; as if she had come creeping up to the microphone on tiptoe.

She gives me music in between times, when somebody is late, or when somebody has finished early, or to soften the jar between the Stock Exchange Prices and Mr. Harold Nicolson! And when they fade her out before she has had time to tell me what the piece was, I am very annoyed.

The Dance Band.

Alack and alas! my dancing days are over! In any case, my little room isn't big enough to swing a cat in, much less a girl! And I'm not a Jazz fan.

But I hear Jack Payne and his Band at the vaudeville shows. I like him when he comes sailing in with his merry men on the wires after we have been over to the Palladium or somewhere; they seem to float into the studio on air, playing as they come.

And they blow away the wrack of a poor turn, and they enhance the glory of a brilliant exit. The artistes must be grateful to them. And Jack Payne must be a very patient fellow, for everybody seems to make use of him, sometimes a butt of him, like the comic men do to the conductor of the orchestra in the music hall.

"Are you ready, Jack?" "Now, hold on tight, Jack!" "Bring in the pain, Jack!" I feel that I should like to call him "Jack" too, if he would allow me. But I'm not comic. I mean I don't intend to be!

The Children's Hour.

This comes just about my tea-time, and I often eat a biscuit with them. They are a jolly crew. Aunties and Uncles no more, but still the same old happy spirit that made those mythical relations famous in the days of the beginnings.

So eager about it, as if they were pulling one another away from the microphone to get their turn in edgeways. A slightly disorderly, impromptu, feeling about it, which contrasts well with the clockwork of the programme generally. And still those long lists of birthdays!

RADIO REMINDERS.

If you are troubled by rattling on your loud speaker do not forget that this is sometimes due to a small nut getting loose.

Among the common causes of a sudden weakness in signals are the aerial or lead-in touching an obstruction, L.T. battery running down, break in the earth wire, and "wipe-out" from neighbouring sets.

A gradual weakness of reception is often due to a loose or dirty contact in the aerial or earth lead, to the H.T. battery running down, or to the telephones or loud speaker becoming demagnetised.

A loose connecting bar on the accumulator is one often unsuspected cause of "fluctuations" in signals.

If the aerial is allowed to touch or swing near a gutter pipe, tin roof, or similar large metal surface, you may be troubled by "fading."

The core of a mains transformer should be earthed and should be of the double wound type in which the winding that is in direct connection with the supply mains is effectively separated from all other windings either by an earthed metallic screen, or by adequate insulation capable of withstanding 1,000 volts A.C.

One of the lesser known advantages of the output filter circuit for the loud speaker is the fact that it frequently improves stability.

USING TWO TRANSFORMERS

IN this issue we print a Ferranti advertisement which includes a reproduction in full of a letter sent to Messrs. Ferranti by a "P.W." reader.

This reader regards certain statements in a recent article, "Transformer Troubles," as "erroneous," because he is using two Ferranti transformers very successfully, whereas the general view is that, as a rule, two transformers of the same make and type are not always certain to give successful results. This is a matter of considerable technical interest, and we propose, in next week's issue, publishing an article dealing more fully with this point raised by Messrs. Ferranti and their correspondent.

TECHNICAL NOTES.

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

Peculiarities of Mains Units.

THOSE of you who use a mains-supply unit incorporating a metal rectifier will probably have noticed that when the unit is first switched on the behaviour of the receiver is not constant but gradually changes, soon, however, reaching its normal condition.

This is due to the fact that the rectifier gradually warms up when in operation and the output of the unit does not reach a steady value until a few seconds, or perhaps even a minute or two, after it is switched on.

The action of a metal rectifier depends to some extent upon the temperature of the rectifying contacts and, of course, a certain amount of heat—in fact, quite an appreciable amount—is produced when the rectifier is working.

It is for this reason that alternate elements are provided with extended cooling vanes, usually of copper, so as to carry the heat quickly away from the rectifying contacts (where it is produced) and dissipate it to the air.

In small rectifiers, as used for radio work, the air-cooling is quite sufficient, but for larger rectifiers oil-cooling is sometimes used.

Metal Rectifiers.

There is one important point which constructors should bear in mind when building up a mains unit incorporating a metal rectifier, and that is to take great care that the rectifier is not so enclosed or confined that the air cannot circulate freely around it.

The designers of the rectifier have probably allowed for adequate cooling, but, of course, they do not expect that the rectifier is going to be put into a closed box, for example. No amount of design by the manufacturers can properly compensate for an error on the part of the user such as I have mentioned.

I have actually seen metal rectifiers, in home-constructed mains units, where the ventilation allowed for was quite inadequate. This means that under steady working conditions the rectifier will be operating at a higher temperature than that intended, and this, in turn, means that the life of the rectifier may be shortened and its efficiency probably lowered.

Under proper conditions the metal rectifier will give excellent service and remarkably long life, but it is not expected that it will be used under improper conditions.

Effect upon Receiver.

As regards the effect of this gradual output rise, this will differ in different cases, depending upon whether the set is very sensitive to slight variations in H.T. voltage. In the majority of cases the effect will be hardly perceptible.

Acoustic Materials.

In view of the rapid increase in the number of sound studios for broadcasting purposes and for the making of talking pictures, the question of the acoustic properties of the materials used to cover the

(Continued on page 390.)

In an article in this journal dated May 31st, entitled "*Transformer Troubles,*" the following statement occurs:—

".....the odds are heavy against good reproduction if two identical Transformers are used, whatever set he is building."

With this statement we entirely disagree. It can be demonstrated that two FERRANTI Transformers are entirely satisfactory when working together and are capable of giving results unsurpassed by any other combination.

We give below a reprint from a letter just received which supports our claim.

Hall Green, Birmingham.

29.5.30.

Sirs,

You will have seen the article in this week's "Popular Wireless" on "Transformer Troubles," and in particular about not having two transformers of the same make in a set. Don't you think you ought to do something to combat this erroneous impression?

Last week I took home a Wireless Fan (if "Fan" means Fanatic then he was a "Twicer") to hear my loudspeaker which is a "Lion," Mullard valves, and a simple detector and two L.F. Set, wired the Ferranti way. This Fan sat spellbound at what he was pleased to call the "beautiful naturalness" of the tone. All he had ever heard before was noise, and here's my point. I have in my set three Ferranti Transformers, and for quality I have never heard any kind of an outfit or loudspeaker giving the same beautiful tone as my own.

I am, Yours faithfully,

(Signed) _____

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British Institute of Engineering Technology, 101, Shakespeare House, 29-31, Oxford Street, W.1

TECHNICAL NOTES.

(Continued from page 388.)

walls of the studios has, during the past year or two, received considerable attention. Quite a variety of special sound-absorbing materials have been produced and are now manufactured specially for this purpose.

Of course, everyone knows that materials such as felt and heavy cloths like velvet are good sound absorbers, and these are commonly used in studios, theatres, and so on where it is intended to prevent echo and reverberation from the otherwise bare walls.

Effect upon Reproduction.

Since this subject has been carefully studied, it has been found that the sound-absorbing properties of a material depend largely upon whether the surface of the material is porous. The belief is that the sound-waves, by penetrating the pores of the material, are broken up into very small parts and so dissipated.

With a large, bare plaster wall the sound waves are more or less regularly reflected, and this is what gives rise to the pronounced echoing effects in large halls, churches, and so on.

In the case of the music of an organ (for example, a cathedral organ) these reverberation effects are generally considered to enhance the beauty of the music, but where speech is concerned they often have the effect of making the speech completely unintelligible.

Sound Absorption.

One of the substances newly prepared is a kind of hair-felt, about an inch in thickness, with an oilcloth covering, this covering being perforated with innumerable tiny holes. Apparently these holes have an important influence on the sound-absorbing efficiency of the material.

The development of these sound-absorbing materials is an interesting research work to newly-arising everyday problems.

Selectivity.

I understand that experimental developments are rapidly taking place in connection with the Stenode Radiostat principle of Dr. Robinson, which was publicly announced some months ago, and that the principle is now being applied to ordinary home radio receivers.

It has been said that the ability to introduce a large number of different broadcast wave-lengths with a given frequency band is not of practical use unless or until such transmissions are brought into being. This might seem to be true, but if the Radiostat principle can be applied in a simple and practical way to increasing the selectivity of home radio receivers for the reception of existing broadcasting stations, this should certainly be a valuable advance in the meantime.

Amplification Factor.

Newcomers to wireless are often a little puzzled as to the precise meaning of some of the terms employed, although these terms are naturally quite familiar to the old stagers. One of these terms is the "mu" or amplification constant.

The meaning of this at first sight seems to be self-evident, but at the same time it

(Continued on next page.)

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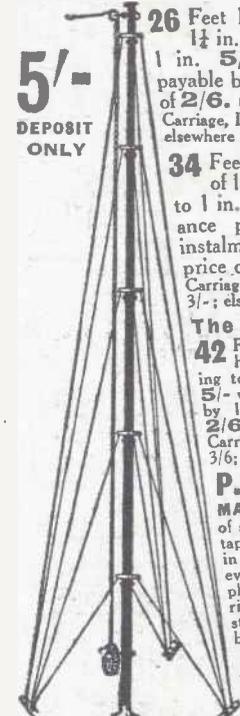
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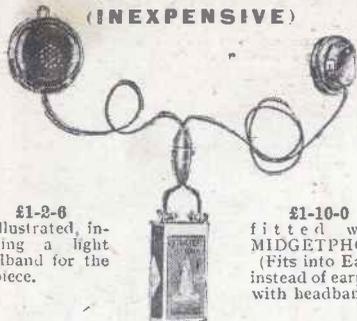
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TECHNICAL NOTES.

(Continued from previous page.)

is often misunderstood in its application to a valve. The amplification constant is the maximum voltage amplification (as between grid and plate) of which the valve is capable in theoretically perfect conditions.

It refers to the voltage amplifying characteristic, but does not relate (as is so often thought) to the power which the valve is capable of handling. In practice, this maximum amplification factor is never realised, although in a specially well-designed circuit to suit the valve as much as perhaps 80 per cent of the theoretical voltage amplification may sometimes be obtained. In the majority of cases, however, probably no more than 25 to 30 per cent is realised.

Anode Impedance.

The plate impedance, or anode impedance, is another term which, although simple enough, is often misunderstood. Inasmuch as a voltage has to be applied to drive the electron current from the filament to the plate we may regard the space between the two as having a definite resistance, or, since we are dealing with alternating currents, we prefer to use the term "impedance."

The plate impedance relates only to the impedance of the valve itself. An important point to bear in mind is that the plate impedance (unlike the impedance of an ordinary component, such as, for instance, a choke coil or a winding of a transformer) depends upon the voltage applied to the plate. Again, unlike the impedance of a choke or transformer, it is practically independent of the frequency of the A.C. current.

Mutual Conductance.

Another term which is often used is "mutual conductance." Using this term in a general sense, it gives us at once a notion of the general merit or usefulness of a valve. I believe the term was suggested first by Hazeltine, of Neutrodyne fame, about ten years ago. It is necessary, however, as in all scientific terms, to give an exact definition, and the mutual conductance of a valve is defined as the amplification constant divided by the plate impedance.

You will see from this that the greater the amplification constant the greater the mutual conductance and (speaking very generally) the better the valve will be for radio purposes. The lower the plate impedance the greater will be the mutual conductance. We may think of this in the same way as we think of a low-resistance component wherein less voltage is required to drive a given current through it.

A Grid-Bias Point.

I have more than once recently referred to the importance of the correct amount of grid bias and its effect not only upon the quality of the reproduction but also upon the current consumption in the anode circuits.

A reader tells me that he lately had trouble the cause of which took a long time to discover, and which proved to be due to the grid-bias battery being the wrong way round.

(Continued on next page.)

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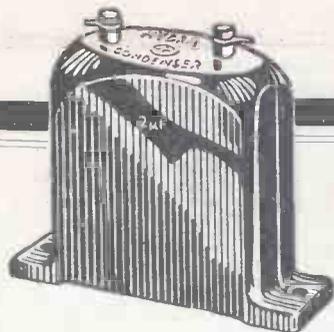
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TECHNICAL NOTES.

(Continued from previous page.)



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Curiously enough, the G.B. battery was connected correctly according to the markings on the battery, but on being finally suspected and tested out, it was found that the battery had been wrongly marked by the manufacturers.

I have never had a case of this sort myself and imagine that it must be rather rare. Certainly, it is about the last thing one would think of, and I mention the matter in case any of you may have mysterious trouble with your grid bias.

If you wish to test the grid-bias battery, by the way, for polarity, remember to use a polarised ammeter or milliammeter, and to include some resistance in the circuit—a fairly high resistance if you use a milliammeter, at least 1,000 ohms.

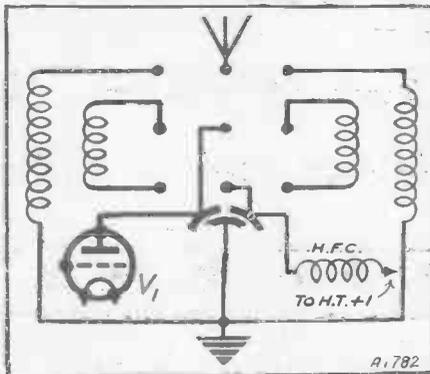
CORRESPONDENCE FROM OUR READERS.

"MAGIC" WAVE-CHANGING.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have had several inquiries regarding my scheme of wave-changing, as published in "P.W.," dated April 19th, 1930. Presumably, the diagram became a little altered in reproduction, as the lead to the moving plates of the differential condenser is not quite as shown, while the absence

COMPLETE CHANGE-OVER



of connections to the valve makes it difficult for some people to follow, judging by the letters I have received.

There is evidently a demand for a method of switching this excellent series of "Magic" circuits, so possibly you will be able to find room for the appended diagram.

Yours truly,
W. A. JONES

Llansantffraid, Mont.

FROM RONALD FRANKAU

The Editor, POPULAR WIRELESS.

Dear Sir,—In a recent interview with me published in your paper it is suggested that I had produced more radio revues than anybody else.

I have no recollection of making this observation, although I am as big a 'boaster' as anyone in this profession, but such an assertion would have been ridiculous in view of the fact that I have never produced one.

I write all the revues we do and arrange the programmes, but producing for the microphone is so entirely different from producing for the stage, that I have invariably bowed to the superior knowledge of such adepts in the art as Gordon McConnell, Bertram Fryer, etc., who have produced more radio revues than I shall ever be in.

In case the interview has given a wrong impression, I should be glad if you would print this letter—written in all humility by

Yours faithfully,

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JACK HOBBS

on

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