

THE B.B.C.'s NEW STATIONS: By Alan Hunter

Popular Wireless

WHERE CONSTRUCTORS
GO WRONG

★ ★
TUNING BY REMOTE
CONTROL

★ ★
BARRY KENT CALLING

EVERY
WEDNESDAY PRICE 3D

AND TELEVISION TIMES

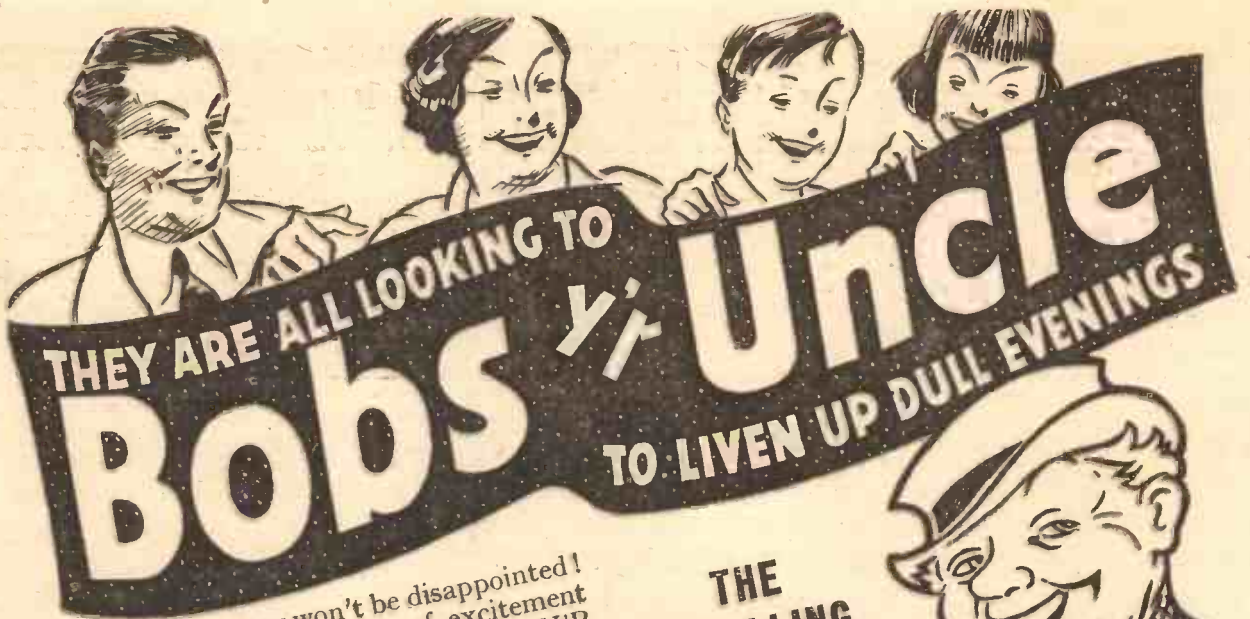
No. 687.
Vol. XXVII.
August 3rd, 1935.



THE SPECIAL RADIOLYMPIA PROGRAMMES.

Plans have now been completed for the special theatre at Radiolympia, which opens on August 14th. There will be three performances daily throughout the period of the Exhibition and among the favourites listeners will be able to see and hear are the B.B.C. Dance Orchestra, Elsie and Doris Waters, Lily Morris, Leonard Henry, and Elsie Carlisle. An outstanding feature will be the presentation at each performance of that immensely popular surprise item "In Town To-night."

A great number of these performances will be broadcast, so make sure you have a good set on which to hear them. In the photograph above are two enthusiastic listeners examining their new H.M.V. "Superhet Four-Forty-One." They won't miss any of the programmes!



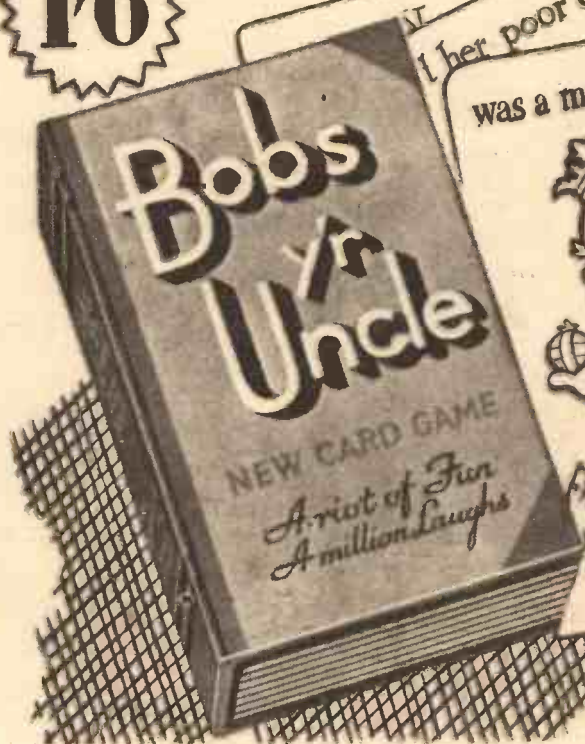
—and they won't be disappointed! It's one long spell of excitement and laughter when BOBS Y'R UNCLE is about. This jolliest of all card games is entirely new and the rules as simple as A B C. All the family can join in—and what a happy family it will be! The pack comprises 54 highly coloured cards featuring many amusing characters and familiar nursery rhymes—and when Uncle Bob turns up its just one roar of riotous laughter. Hurry up and get your pack and share in the fun and thrills of this exciting game.

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VESUVIUS ANNOYED!
TELEVISION
SELLING TIME
U.S.A. RECEPTION

RADIO NOTES & NEWS

GUNNING GEESE
MYSTERY MUSIC
"EASY TERMS"
RADIO NATIONS

Jobs for Instructors.

WIRELESS is one of the trades named in the list issued by the Royal Air Force in connection with the recruitment of skilled classes now being undertaken. This is inevitable under the new plan for expansion.

Instructors in wireless are required at a commencing salary of £4 a week, with the prospect of a quick rise in pay. Morse tuition, also, is demanding new instructors—despite our pessimistic reflections upon the decline of Morse, a few weeks ago!—and would-be instructors are invited to apply for appointments to the Commanding Officer, R.A.F. Reception Depot, West Drayton, Middlesex.

The R.A.F. is a business in which you can rise to great heights!

Gibraltars of the Ether.

THAT diminishing band of stalwarts who remember the wireless stations of ten years ago will recall that one of our major inflections in those days was wavelength wobble. To tune in an old-time station was bad enough, but to hold the inconstant nymph was impossible, for its carrier-wave frequency might wander thousands of cycles away in a few hours.

I have been reminded of those digressive dial-readings of the past by M. Braillard, the Director of the International Broadcasting Union's control station at Brussels. With the finest collection of sensitive receivers and meters in the Old World, he watches Europe's wavelengths day by day, to stop any frequency-fluctuation that may be occurring. And he says that the principal European stations do not deviate by more than one or two cycles a month from their allotted frequencies. Since these frequencies range from a few hundred-thousands to well over a million cycles per second, errors of one or two cycles are too microscopic to matter—except to a technological idealist like M. Braillard.

Volcanic Reaction.

THE recent broadcast to American listeners of the rumbles and mutterings from the crater of Vesuvius was quite successful; but nervous Neapolitans pointed out that the mountain was noticed belching out some nasty black smoke soon afterwards, and two new craters appeared. Therefore, they argued, Vesuvius was annoyed.

Such a too-hasty linking of effect and cause reminds me of the conjurer who tried to distract passengers on a liner in war-time

by doing some nifty tricks, in which a parrot assisted.

"I will next," he said, "do the great disappearing trick. One—two—three"—**BANG!**

The bang was a torpedo from an enemy submarine. The ship disappeared, and all that was left was a dazed parrot perched on a floating box. Casting an eye at the heavens above and the waters beneath, he shook himself, and then observed, with reluctant admiration, "Marvellous! Marvellous!"

London's Television Station.

THE keen eyes of dwellers in North London have been looking eagerly at Alexandra Palace to see signs of the B.B.C.'s first television station. Verily, they have their reward, for the upper part of the south-east tower has now been nibbled at by the engineers, where they are strengthening it for the mast.

The actual high-definition television tests, we are told, may begin in November or December, but the general opinion is that British television is hanging fire.

Berlin has public viewing rooms where about 2,000 people can look at the programmes every day. All Londoners can do is to go to Alexandra Palace and look at some displaced masonry!

A Luxembourg of the South?

WHEN Luxembourg succeeded in selling time to advertisers, it was expected that other stations would be planned to work on similar lines and to show similar financial returns. The suitable site, however, presents the difficulty, for most countries take an attitude of aloof but emphatic refusal.

The promoters of the scheme are still angling, and there is talk of a station going up on the Balearic Islands, in the Mediterranean. Another report suggests Morocco, but I pity the poor advertiser who hopes to sell anything to the wily North African—those dusky boys would sell you a slice of the Sahara, describing it without a blush as "rather light soil"!

He Won't Lie Down.

THE Air Ministry has closed down its radio-meteorological station at Heston, Middlesex, and we are told that a new station has taken over the service, at Borough Hill, Northamptonshire.

"Borough Hill, Northamptonshire," indeed! They can't put that one across, for the reader-sleuths have risen to the bait and cried, with one accord: "That's Daventry!"

Yes, Daventry it is, with wavelength down to 1,181 metres, and just a couple of kilowatts in the aerial. The change-over is particularly noteworthy because it is the first time that the B.B.C. has relinquished a station to a Government department's service.

Have You Heard Them?

A SHREWSBURY reader tells me that a townsman of his has been claiming the reception in July of American broadcasting stations on medium waves.

We all know that these stations can hop the Atlantic in winter, luck permitting, but my correspondent is staggered to hear they can get across in midsummer.

I am not so staggered, because from time to time I get reports of freak reception that convince me there is no limit to the radio tricks up Nature's sleeve. For example, I recently mentioned the breakfast-hour reception of low-powered Continentals. The picking up of American stations in the small
(Continued on next page.)

TRYING A NEW RECORD



Mr. Christopher Stone, the well-known gramophone expert, trying out a record on his Pye Universal Receiver.

THE PLANTER AND THE THIEVING HOUSE-BOY

hours is on a par with these freak results—inexplicable and exciting.

Scientific Sport.

SPORTSMEN of the old school will shudder at the ingenuity of a radio manufacturer in Canton, Mass., who goes gunning after geese.



Fretted at the waste of time between shots, he thought out a plan to attract inquisitive geese within range; and the next time he went shooting he determined to take with him some loudspeakers and a record of

goose-talk and love chatter. Now, if geese are seen too far off to fire, this apparatus is switched on, and ten to one the birds will veer to find out what all the row is about.

Then the feathers fly, and another goose loses all interest in what loudspeakers are saying!

Farewell to Huizen.

ANOTHER famous long-wave station has thrown its hand in, and no more shall we hear it burbling away at the top of the dial. I refer to Huizen, the remarkable Dutch station, which worked on a fifty-fifty basis with Hilversum, and periodically announced itself on the other fellow's wavelength.

In place of Huizen we now have Kootwijk, a promising shouter who puts out 150 kilowatts on 1,875 metres, having quite recently produced another 30 kilowatts to bring his power to this figure. And since Brasov has the same power and same allotted wavelength as Kootwijk, announcements may sound a little jangled! To make matters more complicated, Kootwijk is following his predecessor's example and announcing himself as "Hilversum"—so if you want a mix-up, the top of the dial is the place to tune for it.

Mystery Music.

A FURTHER instance of "mystery music" has cropped up; this time at Hobol, in Denmark. It is of a roof apparently having pronounced Norwegian sympathies, for the Oslo programmes have been heard emanating from it, though Oslo is a goodly step away and there are much nearer broadcasting stations.



The classic case of the same kind was that of the Denver dustbin, which looked like an ordinary refuse-container, but acted like a "DX" fan and pulled in programmes from hither and yon, night after night. An investigation was decided upon.

When some scientists assembled to test it, there was not a sign of any jiggery-pokery; nor, indeed, of the mysterious programmes! But they do say the owner

of an adjacent peanut stand—who did good business with the crowd that collected—could have explained that dustbin's behaviour.

Paradise Near Bradford.

WHEN a weary householder answered a bang at his door, on a housing estate near Bradford, he found a radio canvasser on the doorstep. Holding out a nice-looking wireless set, this born orator convinced the reluctant owner of the house that he ought to give it a trial—"No obligation to buy," and all that line of talk.

The set was installed free, no deposit was required, and the salesman said he would return within the week to hear the verdict.

BROADCASTING BREVITIES

The "Air-do-Wells" are returning to the microphone on August 8th. Effie Atherton, the star of this concert party, has been holidaying in Spain with her husband, and others of the cast have been out of town, but on August 8th the same troupe will be back in St. George's Hall to serve up the popular mixture as before.

One of the interesting things about the "Air-do-Wells" programme is that the majority of material is made up from scripts and music submitted by listeners to Broadcasting House. Jack Clewes, one of the original members of the "Air-do-Wells," returns to the cast for this broadcast.

An old favourite returns to the programmes on August 10th in the safe hands of Gordon McConnel—"New Songs for Old." Gordon McConnel is an expert in this type of programme, choosing his artists with great care and writing excellent connecting material. In "New Songs for Old," listeners hear an early version of a popular favourite, and then how the same theme is treated to-day.

The third port to feature in the series "Quayside Nights" will be Plymouth, and a relay will be taken from the city on August 10th for Western listeners. The commercial and the fishing side of the port will be included, but as by history and tradition Plymouth is prominently a naval port, it was specially arranged that this broadcast should take place in Navy Week.

A. E. Lawton, former captain of Derbyshire, will broadcast a series of eye-witness accounts to Northern listeners of the Yorkshire v. Lancashire cricket match at Bradford (the famous Bank Holiday "Battle of the Roses") on August 5th.

Now comes the paradisaical part. For three months that set has been working perfectly, but nobody has called for it, and not a penny has been asked for it! And when other radio salesmen go to that house and talk about "easy terms," the fellow who lives there laughs himself hoarse trying to turn them away!

Radio Nations.

THE Prangins Station, official transmitter of the League of Nations, is going to give out weekly radio news bulletins in the autumn.

Commencing September 6th, the service for European countries will be radiated in Morse on 4,225 metres, between 9 and 10 a.m. B.S.T. The language used will be French.

At midnight on the same day the service to non-European countries will commence. It will be in English and Spanish, and the respective wavelengths will be 31.27 metres and 38.48 metres.

I don't suppose many readers will care about the 4,225-metre business, since it involves special coils and a knowledge of French. But the short-wave crowd will

certainly hear Prangins doing his stuff on their waveband.

Trade With China.

IN case any of my trade friends are wondering what the chances are of doing radio business with China, I should like to present for their consideration a curious fact about the radio set trade in that country.

The cabinet must be absolutely first class.

The well-to-do Chinese may or may not regard superlative quality of reproduction as essential, and he may not worry



about visual tuning or A.V.C. so much as some people; but when it comes to cabinet-work, he always puts on his most powerful specs, examines the colour, the grain, the texture, the polish, the design, the general effect, and the particular wood. He dusts it, wets it, rubs it, dries it, and smells it—and then produces a high-power magnifying glass and has a good look at it.

If he then buys the set, you can bet your life on one thing—that cabinet is one of the O.K. Toots type.

News in Brief.

THE Post Office announces that 256,138 radio licences were issued during June, bringing the half-yearly total number in force to 7,119,440. Twelve months before the total had been 6,371,812.

The novel mast at the new Northern Ireland Regional was manufactured at the works of the Glasgow Steel Roofing Co., Ltd.

Prague reports that the Czechoslovak Government has constructed new broadcasting stations at Draunter, Budweis, and Carlsbad.

Wireless Detective.

A BRAZILIAN planter who had suffered long from a thieving house-boy hit upon the coming of wireless as the perfect means for demonstrating to that

light-fingered nuisance that cheats never prosper. The planter assembled all his servants, showed them the new set and let them hear it talk and sing and play.

"Also," he said, "this set big policeman." He then gave each member of his audience two long pieces of wire to hold, and explained that the set could show who stole silver spoons and so forth when touched with the wires held by the culprit.

Aged butler and fat cook passed without incident, but when it came to the thief's turn the planter touched the wires on the H.T. terminals. Two hundred and fifty volts and a guilty conscience did the rest!



ARIEL.

The B.B.C.'s New STATIONS

WHENEVER I want a cure for brain fag I don't try to fill in crossword puzzles; I turn to the infinitely more intriguing puzzle of how the B.B.C. is going to find enough wavelengths for all the new stations it has decided to build.

I glance down a list of European wavelengths, discovering anew that from Droitwich National on 1,500 metres down to Bournemouth and Plymouth sharing 203.5 metres we have somehow or other managed to annex no less than 12 wavelengths for our broadcasting system.

The Regional Wavelengths.

In descending order we have six quite reasonable medium wavelengths for the Regionals—for North, Scottish, West, London, Belfast and Midland. The rest, being well below 300 metres, are not so useful. They are given over to the stations having fairly limited service areas to cover. And fairly low power into the bargain.

It will not always be so. Take Belfast, which I have included among the Regionals. Before the end of this year it is probable that the North Ireland Regional will be testing on the air—a full-blown 50-kilowatt transmitter. This will take the place of Belfast, and, so far as present indications go, it will take over Belfast's moderately good wavelength of 307.1 metres.

Early next year North Ireland Regional will be on full programme service, giving, of course, an infinitely better signal to those at present subscribing to Belfast's puny output. This is, as a matter of fact, the next of the big stations to take the air in the B.B.C.'s modified Regional Scheme.

What is particularly interesting about North Ireland Regional is its aerial, a radical change in technique from anything the B.B.C. has so far handled. As is well known, the B.B.C. engineers have until now retained an unswerving faith in the simpler types of aerial. It must be admitted that so far as range is concerned this policy has paid—in the daytime. At night, though, fading at the critical edge of the service area has tended to offset the glamour of high power. Indeed, many listeners have complained that our stations have faded much more than, say, the Germans.

An Unfair Complaint.

This is an unfair complaint, based on a certain amount of misconception as to the effect of the Kennelly-Heaviside layer. Had such listeners moved to, say, thirty or forty miles from the German stations they might have found fading much worse—paradoxically enough—than at their normal distance of some hundreds of miles.

Latterly, the Germans in particular have been adopting what are called anti-near-fading aerial masts, designed to give a low

angle radiation within the service area. The result has been to push back the critical area at which ground and sky waves inter-mingle and cause fading.

And now our B.B.C. is after the same

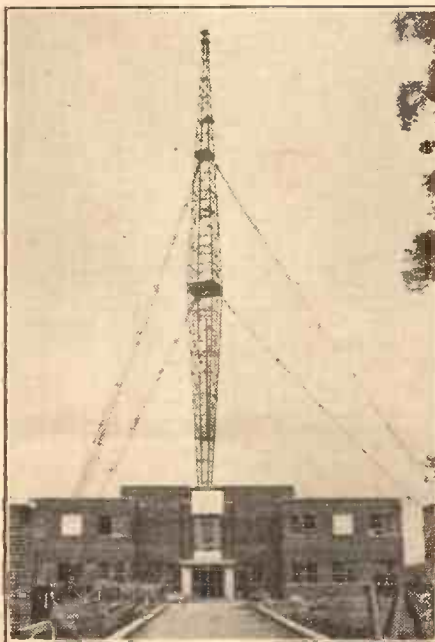
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The B.B.C. is making every effort to improve its service, and in consequence several new transmitters are in process of erection or are being planned. In this article Alan Hunter gives an interesting description of the B.B.C.'s activities in this direction.
.....

idea. At Lisburn, the site of the North Ireland Regional, an anti-near-fading aerial mast has been put up. Its basic height is 475 ft., but there is an adjustable top with a maximum extension of 75 ft. This means that the total height of the Lisburn mast can be 550 ft.—higher than Moorside Edge but not so high as Droitwich.

It will be most instructive to see how Lisburn acquits itself. We English listeners will have an excellent chance at night to see whether the special type of aerial mast has any appreciable effect on the counteracting of fading. Perhaps we shall be able to give our A.V.C. a rest!

Although no decision seems to have been

TO OVERCOME FADING



The anti-fading aerial at the new Northern Ireland B.B.C. Station. Its basic height is 475 feet. This height can be increased another 75 feet with the aid of an adjustable top, thus making a total of 550 feet.

taken yet, it is not unlikely that the North Scottish Regional will also have a special aerial. At Burghead, near Lossiemouth of illustrious connections, work is going on with the station building. North Scottish Regional will be the second of the new stations opened under the modified scheme.

At the moment the engineers—who believe in doing one thing at a time and doing it well—are not worrying overmuch about the technical side of Burghead. The builders have it, at the time of going to press! Already, though, the station building is beginning to take shape. My spies tell me that the walls have already reached a height of from 4 to 5 ft. No date can yet be given for the opening. Some time about the middle of next year, I imagine.

What is the Solution?

What it will do for a wavelength I cannot say. Aberdeen's shared channel of 233.5 metres is hardly good enough for a high-power station. North Scottish Regional will presumably take over Aberdeen's service area—although it is not certain that the present low-power outlet will be shut down.

Scottish National's wavelength is not too bad—285.7 metres. I have wondered for a long time why this National retains an exclusive B.B.C. wavelength. Could it not be synchronised with the other "little Nationals"? We shall see!

If that were done the 285.7 metres wavelength might be given to North Scottish Regional. Perhaps by the time the new station is ready to take the air the engineers will have solved this knotty problem. I don't envy them!

Well, that makes two new stations. There are plenty of others. By the time this article gets into print the B.B.C. may have seen fit to make an announcement about the settling of the site for North-Eastern Regional. I know they have had the right site in their mind's eye for many months, but various departmental snags have cropped up to delay a decision.

To Replace Newcastle.

North-Eastern Regional will, of course, take the place of Newcastle's low-power station on 267.4 metres. Situated some ten to fifteen miles inland from Newcastle, it ought to give the Tynesiders a really good signal, as well as providing something like an alternative for listeners in most parts of the north of England.

Meanwhile, polar diagrams are being prepared in the Plymouth area, where on the high ground in that vicinity the mobile transmitting van has been perambulating for the past few months. Eventually yet another new station is proposed for the

(Continued on page 560.)

BARRY KENT CALLING

News and Views from the "Big House"

I HAVE been hearing some interesting "inside" gossip about the proceedings of the Ullswater Committee which is trying to make up its joint mind on what to advise the Government to do with broadcasting in Britain when the licence of the B.B.C. expires at the end of next year. The main point is the degree of freedom which is to be allowed to the new B.B.C. The present B.B.C. naturally wants as much freedom and money as it can get. About the money there is no disagreement; but the freedom is quite another matter.

I am told that Lord Selson, vice-chairman of the Committee, is taking a strong line on behalf of the rights of listeners as distinct from the arbitrary wishes of the Broadcasting House bureaucracy. The Committee is suffering from the complete secrecy of its proceedings. One result will be that Parliament will probe its report much more carefully than would have been done otherwise.

New Sea Effects Records.

As a result of a good deal of criticism from listeners about the inadequacy of "sea effects" from Broadcasting House, it has been decided to make a new set. Recordings have been made at various suitable points round the coast, so as to get the sea in a variety of moods, calm to angry. The result will be on the air in September.

"Trans-Atlantic Bulletin."

The first experiment with the feature "Trans-Atlantic Bulletin" will come to an end shortly. This co-operation with the Columbia Network has been most successful on both sides of the Atlantic. Later in the year the same idea will be applied to Dominions, probably Canada and Australia. Also there will be further American broadcasts of the same kind, but not necessarily with Columbia. The B.B.C. is getting on with its plans for a North American branch office in New York, with a fully qualified representative.

B.B.C. and German Broadcasters.

As I was able to disclose some time ago, relations between the B.B.C. and the German broadcasters went through a difficult period when the heads of the German broadcasting organisation were imprisoned by the Nazi Government. These heads were personal friends of important people at Broadcasting House.

Lately, however, relations have improved, and there is now something of the old cordiality. B.B.C. officials are moving about in Germany with their old-time freedom. The Germans give the credit for this change to Lord Bridgeman, pointing

out that it began when he took over the chairmanship.

More Light Entertainment.

I hear there are bright prospects of more light entertainment in the programmes next autumn and winter. Eric Maschwitz is going strong with big schemes for expansion, and a good number of them will be approved. In particular there will be more "Songs from the Shows" and "Film Features."

This is all to the good, but I do wish they would hurry and let us have cheerful broadcasting early in the morning. As I have said so often before, breakfast time broadcasting is bound to come, and if the B.B.C. does not take the initiative and the credit in doing it voluntarily, then it will be forced into it, as it was forced to lighten the Sunday fare.

ON THE AIR



PERCIVAL MACKEY, whose band is featured in "One Band to Another" programme this week (August 2nd).

Gerald Cock on Top.

Gerald Cock is certainly getting away to a good start with his television job. He held out for authority and independence right to the bitter end, and he got both. He is now as independent as anyone can be in the B.B.C. He will rank with the Controllers, dealing direct with Sir John Reith. From the points of view of television and Mr. Cock himself, this is exactly right.

Sir Stephen Tallents' Plans.

Sir Stephen Tallents is busy settling the plans for the big campaign he will begin this

autumn to make the B.B.C. more popular than it is. He is seriously considering doing something like he did for the Empire Marketing Board and afterwards for the Post Office, that is, bill-posting and newspaper advertising on a large scale. It is also likely that he will embark on an ambitious exhibition scheme. All of this will cost money, but Sir Stephen is quietly confident that the new licences that will result will more than offset the added cost.

Engineers' Pay.

At a general meeting of the B.B.C. staff some weeks ago there were complaints about the rates of pay of certain grades of junior engineers and manual workers. Sir John Reith, who presided, at once took up the matter. There was a characteristically thorough investigation, and now all grievances have been generously removed. The grievances were not serious, but the fact that there were any upset the Director-General of the B.B.C. so much that I would not like to have been in the shoes of the administrative staff responsible.

"THE MULBERRY BUSH"

Candid comments by our broadcasting critic on recent programmes.

WHILE I enjoyed the story of "The Mulberry Bush," I would have enjoyed the broadcast of it better had it been carried out in a quieter vein. The story was good, just the sort to hold attention, but the players exhausted us with their garrulity. There would have been more point in one of Julian Palliser's remarks had it been applied to any one of the cast but Yarrow, the schoolmaster, to whom it actually was applied: "You schoolmasters never appear to be happy away from the sound of your own voices." Yet this was a typical Julian remark, and self-condemnatory withal. And, of course it was on this kind of observation that the comedy of "The Mulberry Bush" depended.

Julian Palliser, played by Deering Wells, sounded more like the conventional and irritable Colonel than a creative artist. I don't think, somehow, that the part called for quite so robust acting. This criticism may apply to some of the other parts as well. . . . It was a strange family to which we were introduced—realists running wild.

Fortunately, there were exceptions in Yarrow and Pauline (the perfect lovers) and Thelma Fountain, who, I suppose, were romantics at heart. But these three were overwhelmed by the opposition through sheer weight of numbers, or to be more exact, of volubility. Listeners must have felt the oppressive effect of the family's oratory.

Was it Too Vigorous.

I wonder whether the author intended quite this amount of vigour to be put into the comedy. Obviously the producer did. The music (the same two airs always) was most effective and soothing to the nerves. Some effects were good, Julian's studio was a very lofty attic, judging from the number of steps required to ascend the staircase, which Julian, I am bound to say, managed with surprising agility considering his age.

I also noticed that while doors were always heard to open, they were rarely heard to shut. While on this question of effects, may I ask why the family was made to play cards in a huge and empty baronial hall (for so it sounded) which couldn't have existed in the Mostyn's country home?

A Hard Worker.

Sandy Powell is a hard worker. The German statistician who has estimated that a man uses 4½ million words a year obviously doesn't know our Sandy. Sandy seems to use this number of words in every show of his. The general effect he produces is that of being a likeable old codger, and an amusing one.

The Radio Three do their harmonising with restraint. They do not play havoc with their tunes. I like them for this. I do not care for those harmonisers who convert a popular tune into an anthem

(Continued on page 557.)

Where CONSTRUCTORS Go Wrong

by JOHN SCOTT-TAGGART M.I.E.E., FINST. P., FEL. I.R.E.

THE greatest trouble in home construction is undoubtedly that constructors will be designers. They are quite prepared to give the original designer, say myself, credit for technical ability, inventive skill, and originality of approach to a problem. As regards the designer's judgment in connection with components the minority of constructors (and the minority may reach as much as 40 per cent) gives no credit at all. Likewise, little attention is paid to the designer's views on layout.

The Circuit Alone of Little Value.

As a matter of fact, a circuit alone is often of little value even to an extremely competent professional radio engineer; he needs to know much more if he is to produce an effective receiver without having to carry out all the innumerable experiments which have, no doubt, been performed by the original designer.

Let me now assure all home-constructors that although the circuit is of paramount importance a very great deal of experiment has been involved before the exact final embodiment of the circuit is offered to the public. Perhaps we designers have not made enough of a song about this phase of our work. Perhaps the reason is that we do not care to take the public into our laboratories, and to expose the various experiments which we have found to be necessary for evolving the best final arrangements. As a matter of fact, no conscientious designer ever designs a set "straight off" without making various changes as he goes along. He makes mistakes—if it is fair to call them mistakes—if something a little less than the best is achieved.

Important Considerations.

There are, of course, certain principles involved in the embodiment of a circuit into a set. It is important not to bring this wire close to that, or to have this component near that one. The orientation of a component is also of extreme importance in some cases, and failure to follow a designer's design may result in instability or excessive hum, to give but two examples.

Then there is the question of the capacity to earth or condenser effect between components carrying high-frequency currents. Instability may arise, while high-frequency chokes may have their efficiency enormously decreased by disregarding such a consideration. Wave-traps may be a complete failure if their positioning is not very carefully thought out and very carefully tested.

No. 2—LACK OF ADHERENCE TO DESIGN.

This is one of a special short series of articles by the world-famous set designer.

The mere circuit—and the circuit at this stage does become "mere"—may be closely followed, but unless the practical design is sound the circuit will be a failure.

Take another example: The constructor may feel that if he earths a coil it matters little where the earthing is done. In a mains set this is an extremely common source of hum, and both in battery and mains valve sets high-frequency instability is frequently due to earthing components in the wrong way. What very often happens is that the high-frequency currents in one tuned circuit pass through a conductor such as a wire or metal chassis which is also common to another high-frequency

to the grid terminal of the valve holder, and you could connect one side of the tuning condenser also to the grid terminal of the valve holder. Another way would be to connect one side of the condenser not to the terminal of the valve holder but to the appropriate terminal of the coil. The designer of a wireless set thinks all these things out, and what is far more important, tries them out. If you depart from his system, thinking it does not matter, you will simply be inviting trouble.

Those Chinese Copies!

Naturally, in nearly twenty-one years of experience in designing sets for the constructor, I have come across hundreds of receivers which their indignant owners protested were Chinese copies of my own original set. The sets, on examination, showed that this was a slander on the Chinese. In many cases the receivers revealed highly individualistic tendencies on the part of the constructor. These are highly commendable qualities which might bring glittering rewards in other fields, but failure in a home-made set.

The first requirement of a home constructor is modesty. If he thinks he can modify my designs he becomes a designer himself. He may be a good designer or a bad designer, but he must bear the consequences of his own enterprise. He must not squeal if he fails to get the results that I have got. If he wishes to experiment, let him do so after he has got the set working excellently.

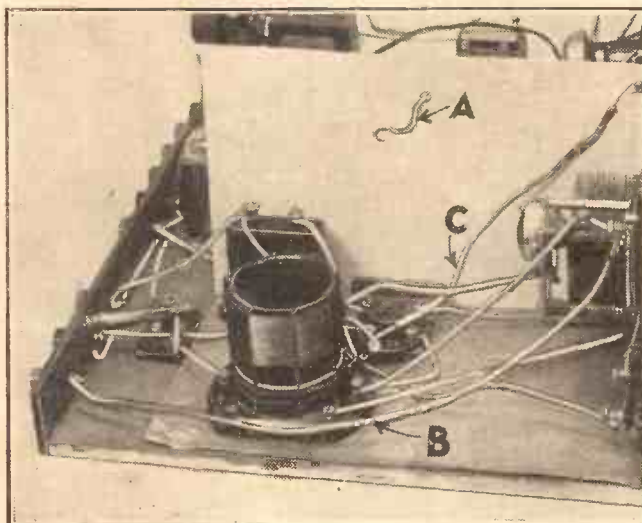
Don't Attempt Modifications.

A designer is paid—and very often paid very well indeed—to produce a complete model in which all the experimental work has already been accomplished. We feel no sympathy whatsoever with the constructor who, off his own bat, modifies the design and then complains of results. In practice, we find that it is more often the experienced constructor who experiences most trouble.

This apparent paradox is easily explained: The experienced constructor is just not sufficiently experienced. The little knowledge has proved a dangerous thing, while the completely ignorant and inexperienced amateur conscientiously repeats the author's design and gets the author's results.

Why do constructors "mess about" with a writer's design? One experienced constructor told me proudly, "I can't be bothered with blue-prints. I can never

NOT BUILT TO SPECIFICATION



The constructor of this receiver did not get satisfactory results, and there were three reasons: (A) He brought the S.G. valve's anode lead through the screen instead of using a screen with the valve passing through it as the designer did. (B) This lead should have stood up in the air well away from the coil. (C) This lead consisted of two pieces of wire lightly twisted together, the joint being covered by sleeving.

circuit. Such a conductor may provide a coupling between the two circuits and cause instability.

It might be thought that the order in which components are connected does not matter. For example, a tuning coil may be shunted by a tuning condenser, and the whole tuned circuit connected across the grid and filament of a valve. There are a variety of ways in which you can do this, all of which would look the same in a circuit. You could connect the top end of the coil

(Continued on page 558.)

THE "ANTI-STATIC" WAR

Interference with broadcast reception by electrical apparatus such as nearby motors, electric signs, and household equipment is a serious problem, and drastic steps are required to check its growth. In this article our Legal Correspondent briefly reviews the situation in this country.

ALTHOUGH it is over two years since the committee appointed by the Institution of Electrical Engineers first sat to consider the problem of man-made static, as it affects—or rather afflicts—the Broadcast listener, no legal steps have yet been taken to remove the source of the trouble.

There are no doubt difficulties in compelling the makers and users of violet-ray machines, flashing-light signs, hairdressing appliances, vacuum cleaners, passenger lifts, and all the other varieties of "spark-jing" motors to respect the peace and quietness of the ether, but when all is said and done the listener is in the majority, and sooner or later will see to it that he gets fair play.

No Legal Action.

Meanwhile the Post Office is doing its best to tackle particularly bad cases, here and there, but until the P.M.G. is given legal power to compel an offender to mend his ways he can only rely upon cajolery or persuasion.

Not long ago one of the P.O. officials whose duty it is to attend to these matters tracked down a particularly bad centre of disturbance to an electric motor used by the proprietor of a certain fish-shop. Persuasion and argument proved useless. The owner of the offending motor stubbornly refused to allow it to be touched.

Bitter complaints were made by his neighbours—who naturally were mostly customers of the shop. The P.O. official, in explaining that the P.M.G.'s hands were tied, threw out the suggestion that he, personally, would not deal with any trader who deliberately spoiled the Broadcast programmes. The hint went home, and a few days later the P.O. engineer received a wire: "My trade is being ruined. Send your men to fix the motor—regardless of cost."

There is force and logic behind this story, though it is seldom that listeners will take combined action—even in their own interests.

Criminal Offence in Germany.

It is quite a different matter in Germany. There the law recognises what is called "Hörer-recht," that is, the right of the listener to hear the Broadcast programmes free from interference. Like any other right, it will be protected by the courts of law, if and when the "trespasser" can be identified. If he is an innocent offender—i.e. is unaware that he is the cause of the disturbance—then the law simply compels him to put matters right. But deliberate interference is a criminal offence.

The difficulty is, of course, to find the culprit. Here the Germans show a definitely united front. From the first they organised a body, known as the "Funkhilfe" or Radio-aid Society, which consisted of semi-official groups of individuals

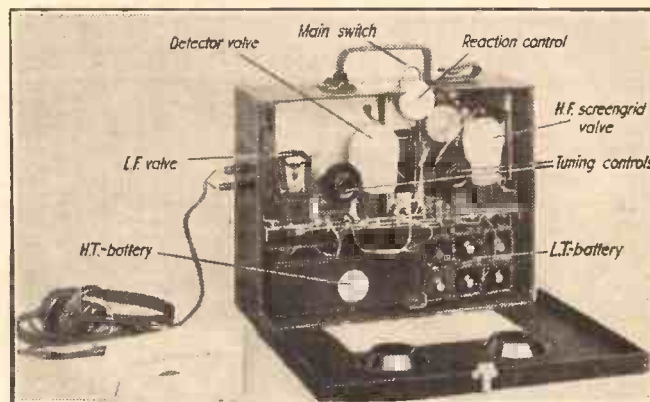
who gave willing and enthusiastic help in tracing down various forms of interference. Once the offending plant was discovered, the owner was instructed and assisted in the process of making it harmless. Usually he was only too glad to fall into line, knowing that he could be compelled to do so by force of law if necessary. If, however, he was there first, i.e. had his plant in operation before the beginning of broadcasting, then he could not be compelled to do anything by law, but the Radio-aid Society saw to it that strong "moral persuasion" was applied.

The Question of Cost.

The German Post Office has recently taken over this duty from the original organisation, so that the entire control is now in official hands, where it functions promptly and effectively in keeping the ether clear of "man-made" trouble.

In France, too, a Parliamentary Decree has recently been issued which throws the

FOR TRACKING DOWN INTERFERENCE



A portable device for locating "man-made" static, made by Siemens of Germany. With an apparatus such as this it is comparatively easy to locate the source of interference.

responsibility for creating static disturbance upon the manufacturers of the offending appliances. It is recognised, however, that in certain circumstances the cost of conversion may be excessive, and in such cases the whole matter is referred to a special committee appointed by the Post Office, and is there decided on its merits.

Post Office Comparatively Powerless.

In this country the responsibility of keeping the ether as free as possible from artificial static rests upon the Postmaster-General, who issues the Broadcast listener's licence and has a general "monopoly" over the use of the ether. As already stated, he has no statutory powers to enforce the right of listeners to enjoy their wireless free from interference, but the fleet of Post Office Radio-Service vans which now patrol both London and the provinces show that he is doing his best in a good cause.

Any listener who is a victim can obtain a form from the local post office in which he is asked to set out in detail the nature of the trouble. The Engineering Department then takes the matter in hand. In each district there is a Wireless Investigation Officer, who has passed through a special course of training at the Dollis Hill School in the theory and practice of radio, and in the causes and detection of the various forms of interference.

Figures for Recent Years.

In addition, nearly 100 radio vans are now in operation, completely fitted with up-to-date testing equipment, including a portable heterodyne interference-locator with a special search-coil aerial. Although under 30 lb. in weight, the sensitivity of this set is such that it gives full loud-speaker response on an input as low as 50 micro-volts per metre. The van carries a full range of suppressor and filter units, so that the offending plant can be "doctored" on the spot.

Although the augmented Post Office service has not yet had time to become fully effective, the results are definitely beginning to make themselves felt. Ninety per cent of the complaints are cleared up in under two months, and in some cases within a few days, including negotiating and fitting the necessary suppressors.

In 1931 there were 4,300,000 broadcast licences and 12,700 complaints of electrical

interference, of which some 4,000 were found to be due to self-oscillation. In 1933 the number of licences had grown to 6,000,000 and the number of complaints to 21,000, of which only 3,000 were traceable to "oscillating" sets. Last year, when licences numbered just under 7,000,000, the complaints jumped to 37,000—or nearly double the previous year—although the "oscillation" cases fell to 2,500.

These figures speak eloquently of the constant growth in man-made static and of the necessity for taking drastic steps to reduce it. The work now being done by the new Post Office staff undoubtedly holds out some hope that the nuisance may be held in check.

POLICE RADIO FORECAST TWELVE YEARS AGO

The Editor, POPULAR WIRELESS.

Sir,—In your issue of September 1st, 1923, you published an article by me entitled "A Hue and Cry by Wireless—By a Barrister-at-Law" (which I then was) suggesting methods of connecting central police stations by wireless.

One reads in the Press that a meeting was held recently to prepare a scheme whereby central police stations would be linked with Scotland Yard.

It would seem to be no longer a vision that the "Wireless Court of Justice" should exist. It is now almost practical politics. I wrote an article on that in your issue of December 22nd, 1923.

Yours truly,
I. GWYNNE-JONES.

Hastings House, Norfolk Street, Strand. W.C.2.

ON THE SHORT WAVES



"SOME POINTS ABOUT H.F."

This week W. L. S. gives some valuable advice on getting the best results from the H.F. side of a short-wave receiver.

THE use of H.F. amplification on short waves has changed considerably during the last few years. The height of one's ambition used to be to employ an untuned S.G. valve, giving the well-known "buffer" effect between the aerial and the detector. If one could get this going without actual loss of signal strength, one was tolerably satisfied.

Nowadays one expects to be able to use a tuned stage, or even two, and to get quite a lot of gain from them. The H.F. pentode has helped things along quite a bit, and it really is possible to-day, thanks to standardised coils and condensers, to use a set with an H.F. stage ganged with

constantly varying as the tuning of the set is altered.

For this reason it is well worth one's while to decouple it from the detector—hence the popularity of buffer stages. The one important point to note is that the two chokes H.F.C.1 and H.F.C.2 must *not* be similar. If they are, then the S.G. valve may easily start up as a perfectly good tuned-plate, tuned-grid oscillator, which is extremely trying for the detector!

H.F.C.1, in my own sets, is usually a home-wound affair with 60 turns or so on an ebonite rod; while H.F.C.2 is a commercial choke with a considerably greater number of turns.

The neutralising condenser coupling the stage to the detector must be played with until the best adjustment is found. Too small a value will limit the transference of energy from the first valve to the second; too large a value will introduce too much damping into the detector grid circuit, raising the minimum wavelength to which each coil will tune, and flattening out the tuning.

Thus we may lay out the receiver in such a way that the detector is nearest to the panel with the H.F. stage behind it; use a two-gang .00015 condenser; and mount the two coils as near as possible to their appropriate halves of the condenser.

Note that the coupling from the anode of the H.F. valve to the primary winding is now a fixed condenser of .0001, instead of the neutralising condenser that we use when ordinary tuned-grid coupling is employed.

Not Necessary for C.W. Reception.

In case you are at all dubious about the advantages of H.F., let me talk about them for a little. If you are an amateur-band C.W. enthusiast, I candidly don't advise you to bother about it. I have never found it worth while except in a superhet, when it becomes a necessity nowadays.

For the reception of broadcast, however, the chief advantage is that one no longer has to treat the reaction control as if it were a pound of high explosive. That awful hairsbreadth that used to make all

A POPULAR SCHEME

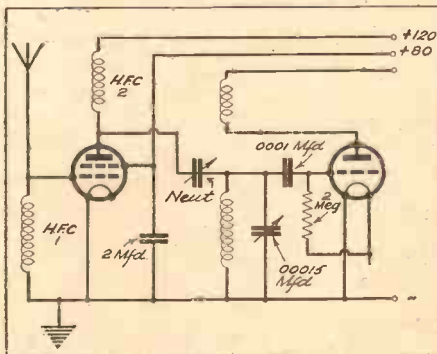


Fig. 1. A circuit using a "buffer" stage, the aerial being untuned. The scheme is useful in cases of hand capacity, dead spots, and poor reaction.

the detector, giving *real* single-dial tuning and many advantages over the H.F.-less receiver.

Fig. 1 shows the conventional "buffer" stage which must be in use in thousands of sets. My feelings on the subject, briefly, are these—that it isn't worth using if one can get really comfortable operation *without* it. If, however, you are one of those unfortunates who habitually suffer from hand capacity, dead spots, bad reaction, and all the other what-nots, then you will probably cure them all in one stroke by installing a buffer stage.

Acts as a Decoupler.

Its whole point, of course, is that it is definitely a decoupler between the aerial and the receiver. Tap the aerial straight on to the detector's tuned circuit, and it will have different effects on different frequencies, according to its length. A 20-foot aerial, naturally, behaves as a half-wave aerial at one wavelength, and a quarter-wave at twice that wavelength, and its damping effect upon the detector is

Increasing the Efficiency.

Now, the usual way in which to convert this buffer stage into a real H.F. stage is simply to substitute a tuned circuit for the first choke, H.F.C.1. Very often the aerial is left on the top end of the new coil, which means to say that the efficiency of this first tuned circuit is extremely poor.

Since we all use four-pin coils nowadays, I want to suggest the use of such a coil for the input circuit, the grid winding being connected as usual, and the reaction winding used as a separate aerial coil. Fig. 2 shows the arrangement—the aerial is inductively coupled to the input circuit, and we may regard the arrangement as tight, untuned coupling.

I have also gone one better with the coupling from the H.F. stage to the detector by using, this time, a six-pin coil to provide transformer coupling. This means that the detector grid coil doesn't have to be damped down by the attachment of a coupling condenser to its top end. The conventional six-pin coil is provided with grid, reaction and aerial windings; the grid and reaction coils are used as such, while the aerial winding now becomes the primary of an H.F. transformer.

One big advantage of this combined arrangement is that if the two grid coils contain the same number of turns, ganging presents no difficulties whatever. Neither grid coil has any external attachments, and the damping effects of the two primary windings will probably be fairly similar.

FULLY TUNED

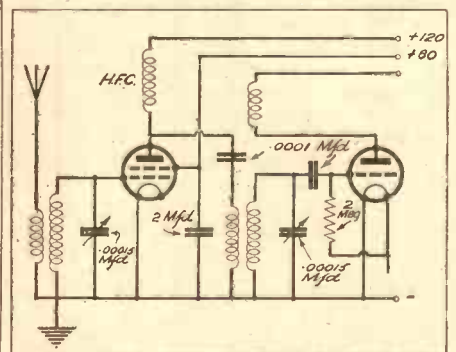


Fig. 2. The untuned aerial circuit of Fig. 1 has been replaced by a fully-tuned arrangement. Note also the alteration to the detector-tuned circuit.

the difference between intelligibility and nothing will now be absent, and, since the H.F. stage takes away most of the dead spots in the tuning, it should be possible to cover quite a big band without touching the reaction control at all, which is a very definite advantage.

Amplification is definitely possible down to 16 metres or even below. When some of the new midget valves are obtainable we shall be able to provide real gain right down to 5 or even 2½ metres.

I have never experienced any real trouble in stabilising a stage like that shown in Fig. 2, and I don't usually use any screening if the coils are of small diameter.

ON THE SHORT WAVES—Page 2.

WHAT READERS ARE SAYING

A. W. (Cape Town), after reading one of my "tidiness" articles, brings up a point that is worth mentioning, and I may as well quote his actual words. "Every set owner that I know," he writes, "is in the habit of having an H.T. negative terminal as well as an L.T. negative on the terminal strip. I have seen set after set with two nice big negative terminals and the corresponding battery leads to them well separated, and then there is a bit of nice, shiny wire inside the set connecting the two together!"

Just a Convention.

As A. W. remarks, later on, it's rather like walking a mile there and a mile back to visit a friend in the next street. I do it myself—convention, I suppose. Possibly there's a thought at the back of my head that if only one negative terminal was provided readers couldn't be trusted to connect the right ones together on the batteries.

I did once meet a man who thought that any common connection between the batteries was O.K., whether the two negatives or the two positives were joined. He soon learnt better!

A. W. also remarks about the awful effects of dust on a set. After leaving his own for a while, he put on the 'phones and heard an awful crackling before the set was

WAVELENGTH OR FREQUENCY?

I HAVE always thought it a great pity that we ever started thinking of radio in terms of wavelengths. Frequencies may work out at very odd numbers and sound very strange, but they certainly are more logical than wavelengths, and definitely more helpful where the very high frequencies are concerned.

Ten kilocycles are 10 kilocycles the whole world over, but who knows what .25 of a metre represents? In the region of 45 metres two stations separated by .25 of a metre are, roughly, 40 kilocycles apart; by the time we get down to 16 metres the same difference represents something more like 300 kc.

The Only Real Guide.

Since it is only the frequency-band between two stations that gives us a real picture of the distance by which they are separated, it is terribly confusing to continue to think in metres.

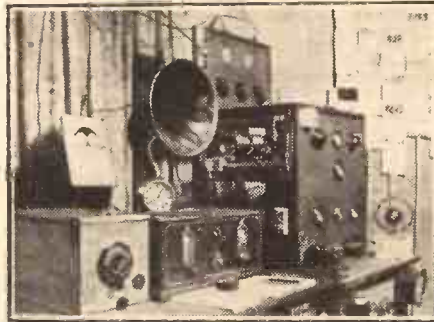
Many of the short-wave stations are now announcing their frequency first, with the wavelength in parentheses afterwards; e.g. W2XAD on a frequency of 15,330 kilocycles, equivalent to 19.56 metres.

Since the kilocycles are apt to run into rather large figures at these short wavelengths, I suggest a more general adoption of the term "megacycles." The amateur transmitters have been using them now for years, and have quite cultivated

switched on. When it was switched on the noise was terrific.

L. G. J. (Canvey Island) writes at considerable length about his own receiver, which is the "Two-Pentode" Two which I described in lay-out form some time back. He built this receiver, the only new component included in it being a grid-leak, and within a few minutes was "touring the whole wide world." He has taken a

A SOUTH AFRICAN STATION



This neat equipment is owned by a South African amateur, ZS6Y, and his transmissions have often been heard over here.

solemn vow never to use a triode detector again.

He would like to get into touch with other short-wavers in the vicinity, and his full address, for the information of such people, is L. G. James, "Sunrise," Beach Road, Canvey Island, Essex.

While we're on this subject, another reader who wants to get into touch with fellow-enthusiasts, or with a local club, is Eric T. Prior, 15, Lower Chestnut Street,

Arboretum, Worcester. I hope local club secretaries are in the habit of reading these notes and following up all these inquiries. I can't put readers in touch with them because they don't generally trouble to write and tell me of their existence!

C. M., a reader in Gibraltar, sends in an interesting letter and log. Using one of the "standard baseboard" series of lay-outs, he says that he has spent many hours globe-trotting, although that was his first attempt at handling the short waves for himself.

His log from Gibraltar doesn't seem to include many stations that we don't get here, although he naturally receives the Empire stations with more punch than we do at home. It must be rather nice, from the radio point of view, to live in a spot in which some of the Europeans can be called "DX"!

Inductive Coupling the Remedy.

R. C. S. (Anerley) remarks upon the discharges which take place across pre-set and aerial-coupling condensers when there's thunder about. Yes, R. C. S., I've got a big aerial myself, and I've had some! I've also caught one or two "packets" that way. When thundery conditions prevail, a short-wave receiving aerial can slowly build up quite a nice charge without any particular sign of atmospheric or crackles in the speaker, and it will suddenly let fly through the series condenser. Use inductive coupling, with a coil straight down to earth, and you won't notice it at all.

Regarding your valve problem, R. C. S., I can't solve it. Sorry!

the habit of thinking in "mc's." You seldom hear an amateur talking about the 20-metre or 40-metre bands; it is always 14 mc. and 7 mc. The latter, incidentally, represent the real figures, whereas the terms 20-metre and 40-metre are only rough approximations, the actual bands centring round 21 and 42 metres.

Think, too, of the matter of calibration. Fig. 3 shows a purely imaginary curve for a receiver with real straight-line-frequency tuning. The two scales on the left show frequencies and wavelengths. Note the

EASIER CALIBRATION

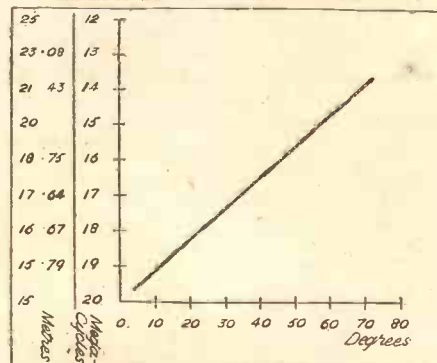


Fig. 3: This is the curve referred to by W. L. S. Note how the use of megacycles simplifies matters as compared with the odd figures of wavelengths.

perfectly equal spacing in megacycles, and compare it with the odd figures of wavelengths!

Notice, too, that the space between 15 and 20 metres is nearly twice as great as that between 20 and 25 metres, and that

the space between 12 and 13 megacycles is nearly 2 metres, whereas that between 19 and 20 megacycles is only .79 metre.

Some short-wave enthusiasts, when planning out their tuning ranges for a new set, seem to think that if they cover 15-30 metres on one coil, and 30-60 metres on the next, they are doing quite well. I wonder how many of them realise that the 15-30 range, though only half the width of the other in terms of wavelength, is exactly twice the width when we think in frequencies?

Fifteen-thirty metres represents 20-10 megacycles, while 30-60 metres represents 10-5 megacycles. Tuning on the lower range will therefore be just twice as sharp as on the upper. Suitable choice of coils and condensers should make it possible to cover ranges that are more alike in width, such as 20-12 megacycles and 12-5 megacycles (respectively, 15-25 metres and 25-60 metres).

Think in Megacycles.

I don't want to be arbitrary—even if I were allowed to be by the Editor!—but it would be nice if I could drop all references to wavelengths and talk in terms of megacycles in future. The title of this section, logically, would have to be altered to "On the High-Frequencies," although I doubt whether we should be such sticklers as that.

Please let me know how you feel about it, though, if you feel at all; and, by way of preliminary practice, think about the short-wave broadcast bands as 6 mc., 9 mc., 12 mc., 15 mc. and 17 mc. It's just as easy as 49, 31, 25, 19 and 16 metres.

W. L. S.

Cathode-Ray Circuits

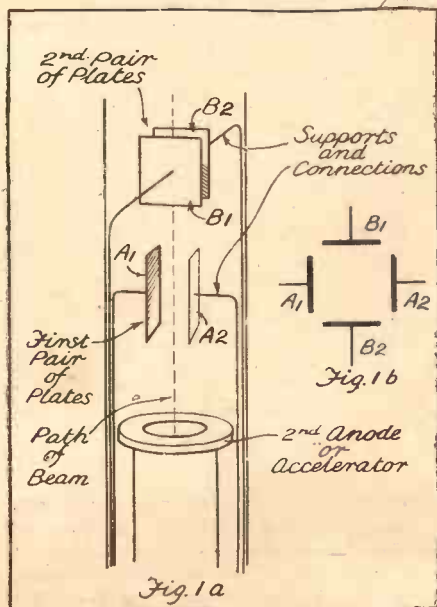
No. 2 The Television Time Base

IN the last article I showed how the spot of light on the screen of the cathode-ray tube was obtained. That is the simplest part of the cathode-ray television receiver; the spot is not hard to obtain, but it is sometimes difficult to make it do what is required when we have produced it. Not that it is difficult to move the spot; it is merely a matter of speed and position control that causes the trouble, as we shall see later when we get to more advanced circuits. For the time being, however, we will consider the means that we use to cause the spot to shift across the screen, as it must do to trace a television picture.

Four Deflectors.

In the cathode-ray tube are four deflector plates (that is in the English tubes; some German ones have coil deflection instead of plates), and these plates are fixed in pairs: the first two pairs not far from the second anode and then another pair a little farther on, nearer the screen. The pairs of plates have their surfaces parallel with the axis of the tube, or slightly diverging from that axis but while the two plates of one pair are roughly parallel to one another they

THE ELECTRODES



A typical cathode-tube internal "layout." Fig. 1b shows a plan view of the deflectors.

This second article on the practical aspects of cathode-ray television explains the fundamental principles of the time base used for forming the luminous "frame" or "raster" on the screen.
By K. D. ROGERS.

are at right angles to the next pair. Figure 1a will help you to realise this arrangement.

We usually show the plates in circuit form like Fig. 1b; and that is how they would look could you gaze down the tube from the centre of the screen towards the cathode.

Now we have got our tube with its deflectors and the exciter unit for producing the power to produce the

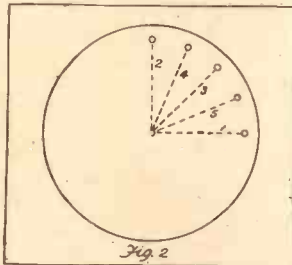


Fig. 2

TRACING THE PATH

Above we see how the spot may be deflected in various directions by using deflector plates, and on the right we see how a zig-zag path may be traced on the screen.

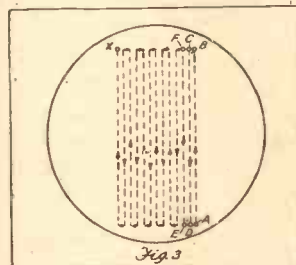


Fig. 3

spot. We will assume that we have the spot already on the screen (which we could achieve by anchoring all the deflectors together and taking them to the accelerator). Incidentally, to have the spot stationary would mean a burnt screen, but that fact does not matter for the purpose of this article.

Shifting the Spot.

How are we going to shift that spot, say, to the right as we look at the screen? By the simple process of applying a positive potential in relation to the anode to the right-hand deflector; see Fig. 2, No. 1 (A₁ in Figs. 1a and 1b). To raise the spot upwards across the screen we apply potential to deflector B₁ (Fig. 2, No. 2). And we can do both movements together if we like, getting with equal potentials a diagonal tracing of light (Fig. 2, No. 3). Increase B₁ voltage a little more and the spot travels in a steeper vertical (Fig. 2, No. 4), increase A₁ voltage more and it

tends to flatten out in its travel upwards (Fig. 2, No. 5).

Now imagine that by some ingenious mechanism we could do this. Start with the spot at A in Fig. 3. That position is obtained by positive voltages on plates A₁ and B₂ (A₂ and B₁ being still connected to the anode), the voltages being so arranged that the spot is towards the

THE SAW-TOOTH

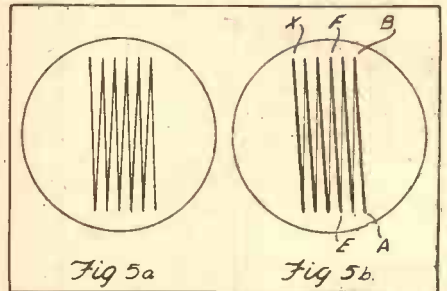


Fig. 5a

Fig. 5b

The saw-tooth path traced by the spot when operated by a time-base. The letters on 5b correspond to the spot positions shown on Fig. 3.

bottom right-hand "corner" of the screen. Now keep these potentials on A₁ and B₂ and increase B₁ above that of either of the two mentioned. The spot goes to B. Now slightly increase the voltage on A₂ and the spot goes to C. Remove the voltage from B₁ and the spot flies down to D. Slightly increase again the voltage on A₂ and the spot goes to E. Repeat the voltage on B₁ and it goes to F. Thus it

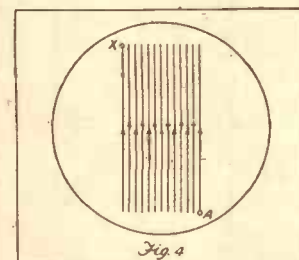


Fig. 4

What we want to get on the screen is a series of lines, all traced in the same direction. Here they are shown in a vertical manner as used in the present low-definition television scanning.

can be seen that by alternately increasing the voltage on A₂ and applying and removing a strong voltage on B₁, we can trace a "rectangular zigzag" on the screen, ending with the spot at X.

We have traced a sort of television frame on the screen, and if we could only do it quickly enough we would be able to see the whole area as a light patch of rectangular shape. It would be a rough television "frame" or "raster."

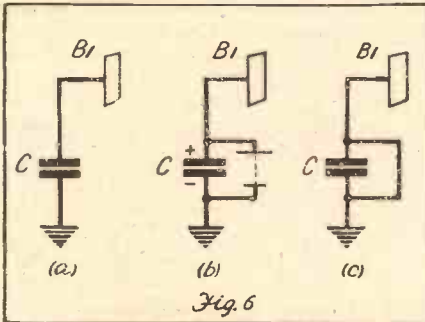
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THE TELEVISION TIME BASE

(Continued from previous page.)

It would not do for television actually, however, for the tracing of the pattern is carried out by the spot moving in a zigzag, while the transmissions are carried out by a spot of light travelling in separate unconnected sweeps, forming lines made in

DEFLECTING VOLTAGE



This diagram illustrates the use of the charging condenser in the line time-base, a battery being used to charge it as in (b). Fig. 6c shows the condenser shorted to provide sudden discharge.

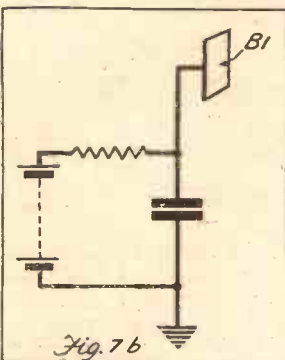
one direction only. Fig. 4 will help you to realise this.

So in our cathode-ray spot travel we have to make the spot go upwards (we are going to discuss the present low-definition television first) and trace a line of light, then start at the bottom again and trace another such line alongside, repeating them until we have reached X again.

The Effect of Speed

Now the tracing of a line of light on the cathode-ray screen depends not only on the path taken by the ray causing the spot, but also on the speed with which it travels. If it goes slowly the spot is very bright and the actual movement can be seen. If it goes quickly the actual movement will not be seen, but the spot will trace a line of light, the line being due partly to persistence of vision and partly to the lag in the fluorescent material of the tube, which tends to glow for a short time after the ray has passed on.

RESISTANCE-FED



Obtaining gradual charging of the deflector (or charging) condenser by means of a resistance.

matters are not seconds, however, but millionth parts of seconds, i.e. micro-seconds, so the whole process is pretty quick.

If we still further increase the speed of the ray we can get it across the screen so fast that it does not leave any light mark

at all, and nothing is seen. That is where the television time-base comes in, as you will see.

We start at A again with our spot and we quickly cause it to run up to B (Fig. 5b), then we rush it down again and at the same time increase our voltage on the A_2 deflector so that the spot is pulled to the left a little. As a matter of fact the increase in potential on A_2 is continuously carried out all the time the spot is being travelled across the screen up and down so that the path is as shown in Fig. 5a.

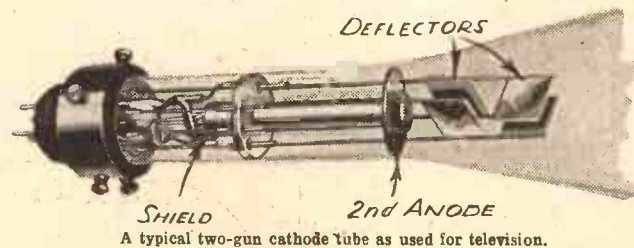
When the Spot is Invisible

But to return to Fig. 5b. The spot having reached B is rushed back much faster than it came up, so fast that it does not trace any light path and is invisible. The path is shown by the light line in the diagram, and the thick lines show the upward paths. A repeated performance results in a series of sloping white lines, the "returns" being invisible, so that we really get what we require, namely the effect of Fig. 4.

Now how is it done? With A_1 and B_2 strongly positive and holding the spot at A (Fig. 5b) consider the deflector B_1 connected to the second anode by the condenser C in Fig. 6. No voltage effect would be exerted on B_1 and it would not pull the beam at all.

In studying all this it is essential to regard the anode of the tube as the "fixed" potential about which all voltage fluctua-

CATHODE-TUBE CONSTRUCTION



A typical two-gun cathode tube as used for television.

tions occur. Though the anode is positive with regard to the cathode of the tube it is regarded as earth where the deflectors are concerned, and indeed is connected to true earth. Therefore if I refer to the "earthing" of the deflectors or any part of the television apparatus it must be remembered that it is at the same potential with regard to the cathode of the tube as is the second anode or accelerator. It is, in fact, connected to the second anode. This may be confusing at first, but it is essential to get it straight or all television aspects of the cathode tube will be difficult to understand.

Varying the Condenser Voltage

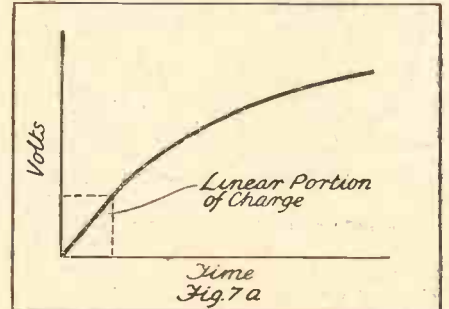
To resume. The deflector B_1 is to all intents and purposes devoid of potential; as regards earth, there is no potential across the condenser C (Fig. 6) (a). Now apply a positive potential across C with the positive on the deflector side (b). Immediately the plate begins to pull the beam. Increase the potential at a steady rate and the pull increases at the same rate, and the spot moves towards the deflector.

Now suddenly release the potential and at the same time short the condenser C. The plate becomes neutral and the spot flies back instantaneously. We have moved the spot upwards to B and let it fly back to A. We can keep on doing that regularly if

we arrange an automatic method. And that is quite easy.

We need not go into the theory of the business deeply, but suffice it for the moment to say that when a condenser is charged through a resistance it starts "filling" at a steady rate, the rate falling

THE CHARGE CURVE



Resistance-charging is linear during the early part of the charge, as shown here.

off as the voltage rises (Fig. 7a). Quite a proportion of the charging time is spent, however, in linear charging, and it is this fact we use in television. Thus Fig. 7b gives a steady charge of the condenser at first and a steady increase of voltage on B_1 .

Before the condenser reaches the point of charge where the linearity begins to fall off we discharge it, and the spot that has been steadily drawn over towards B_1 (that is up the screen) will fly back.

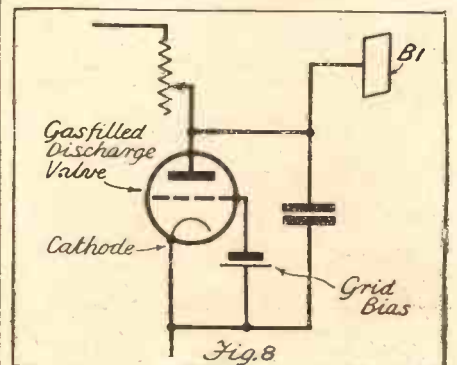
Automatic Discharge

The automatic discharge of the condenser can be obtained by a special type of valve called a "gas-filled" discharge tube, which is "filled" with mercury vapour or with argon or helium gas. This is connected together with a source of

potential as in Fig. 8.

We have now discarded the H.T. battery that has been used in the diagrams for illustrative purposes, and are obtaining the voltage from a special power pack that

THE "SOFT" VALVE



How the gas discharge valve is used.

we shall describe later in this series. The resistance is variable so that the speed of the condenser charging can be regulated, and thus the movement of the spot towards B in the figures can be regulated.

(Continued on page 554.)

The B.B.C. at the TRIBUNAL By GARRY ALLIGHAN

THE SPIRIT OF AMATEURISM

IN surveying the first ten years of the B.B.C. it must not be forgotten that they had to be, to a varying extent, experimental years. They were as formative as the adolescent years of any man—and, therefore, as vitally important. Progress by trial and error has been accepted, by Wisdom and Experience, as the most rapid method of development. For ten years a new art has had to progress by that method. There was no precedent and no tradition by which to be guided. For ten years Sir John Reith has piloted the good ship B.B.C. on a voyage of discovery, sailing uncharted seas, negotiating dangerous currents that could not be anticipated, facing unexpected typhoons and avoiding hidden rocks.

An Entirely New Technique.

One of the troubles with most critics of the B.B.C. is that they adopt as their criteria of judgment the traditions and standards of such well-established arts as the theatre, literature and the cinematograph. That is palpably unfair because the B.B.C. have had to devise an entirely new technique—as strange to them as to everyone else—and by experimentation and research, create a new science, a new art, a new entertainment. To attempt to judge the new by the old is as unwise as to attempt to estimate the reactions of the modern girl by the etiquette of the crinoline period.

That fact, however, does not prevent the constructive critic from attempting an analysis of B.B.C. failure and success, deducing from both the reasons for each. Should someone ask me what defect more than any other has disfigured the B.B.C. programmes I should, for want of a more accurately descriptive term, say: "Amateurism."

It is no conceit on my part to say that I probably know the "B.B.C. boys" as well as any. That adds to my embarrassment, because they are all such delightful fellows personally. And it's hard to tell a fellow what you really think about his work when he's breaking your bread or you his. But it's no friendly act to "kid 'em along," as our American friends say; it's best to give them "the low down" on themselves. So here goes.

Impossible to Know the Truth.

The system that obtains at Broadcasting House makes it almost impossible for any programme producer to know the truth about his work. So soon as his show is over he is surrounded by sycophantic artists who clap him on the back and explain what a schoolboy Cochran is in comparison. As he passes along the ecclesiastic corridors of the "Big House" he meets first one and then another fellow worker. Now what can one producer say to another in such circumstances? If he says "Your show was on the dud side, old man," he

immediately lays himself open to a charge of sour-grapeful jealousy. So he congratulates the producer who he knows, in his heart of hearts, has attempted valiantly and valiantly failed.

This goes on all the time. There is no supreme chief who listens to all the pro-

.....
 "Banish It Into Outer Darkness," says our Candid Commentator.

grammes and is in a position of such authority—even if competent to judge—as to be able to send for the producer and after giving him an expert lecture on where his show fell flat, examining it in detail, sternly tells him that any more such flops and there will be another ex-B.B.C. producer haunting Wardour Street.

Add to the serious disadvantage of there being no box-office judgment on broadcast shows, the fact that there is no constant competent supervision of the actual broadcasts. The programme chiefs have far too much desk-work to do to be able to listen to

A FEARLESS CRITIC



The author of these outspoken comments who is a prominent figure in radio and journalistic circles.

the programmes during the day, and by night they are conscious that their critical faculties have been debauched by eight hours of incessant application to the prosaic details of administration. Programme chiefs appoint their producers, approve their plans and then go home to

dig the garden or go out to the opera. Imagine, if you dare, Cochran being absent from a first night of one of his new shows. And remember that with the overwhelming majority of radio shows there's only a first night.

These domestic circumstances encourage the spirit of amateurism which, in my opinion, is the programme's chief defect. If the B.B.C. producers were not in a "firm" who possessed a ready-made, State-guaranteed public, they would have to adopt the policy of self-criticism that is an ever-present essential in the professional show-world. As it is, a show can be good, bad or worse—there is, so far as anyone can tell, a public listening to it. The fact that the whole 30,000,000 listeners might have switched off never occurs to the producer—if it did, he'd still go on with his Band of Hope entertainment, sublimely content with his own approbation and the back-slapping of the staff and the back-scratching of the artists.

A Very Important Point.

Note another important point: a B.B.C. producer never hears his own show as his public hears it. He either hears it in rehearsal, in the listening room, or via the Blattnerphone record. In every case he hears it far more favourably than the public. If it is in rehearsal, his aural reception is aided by seeing the artists; their movements, grimaces and stage "business" aid the ear. If it is in the listening room, he hears it either with headphones or loudspeakers, both of which are specially made by the B.B.C. and transmit from reception apparatus made at the B.B.C. research stations.

It is impossible to ignore the human equation in this, as in all other matters. Producers, whether they be of the film, stage or radio, are human and subject to human frailties as well as human virtues.

The Producer's Dilemma.

So with B.B.C. producers. In several cases they are men of no stage experience, having to "produce" celebrated stage and music-hall stars of long experience and high public reputation. Is it anything but human for such a producer to hesitate to enforce his will and wish, when the stage celebrity, conforming splendidly to his theatrical technique, fails to "come over" through the microphone with his usual perfection? How can the youthful B.B.C. producer tell the Great One that his diction is crippled and his "lines" need crutches? Is not the producer, compared with the Great One, an amateur, and are they not both conscious of that fact?

What guide can the poor B.B.C. producer possibly have as to his work? Most of the press critics, if they say anything at all about a broadcast show, dip their pens

(Continued on page 558.)

TUNING BY REMOTE CONTROL

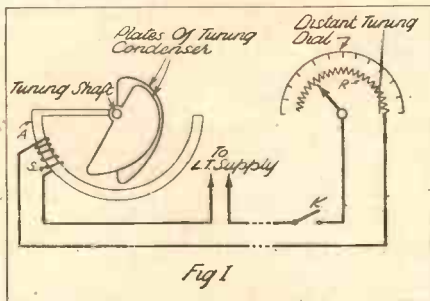
Some interesting information concerning different methods of operating receivers from a distance.

By J. C. JEVONS

THERE are different degrees of remote control, ranging from the luxury of being able to command the set completely from one's favourite armchair in any room—to the lesser advantage of regulating tone and volume at the speaker, even though the set is in another room—down to the mere convenience of being able to switch the set off at night without having to get out of bed.

The simplest system, i.e. remote control of the filament circuit alone—or of the power supply in the case of an all-mains set—depends upon the use of a small relay inserted in the circuit to be made and

SIMPLICITY A FEATURE



A simple form of remote tuning control. "R" is the control potentiometer.

broken, and wired up to each loud-speaker point. The insertion of any speaker plug then automatically energises the relay to bring the set into action, whilst the withdrawal of the last remaining plug open-circuits the relay and so shuts the set down.

Another inexpensive plan is to drive the filament relay through an old alarm-clock movement, costing a shilling or so, and a cheap "drop relay" of the kind used for electric bells. The latter is used as an escapement for the clock-train, which, in turn, drives a two-position cam. One touch of the control button then serves to energise the set, whilst the next touch breaks the supply circuit.

Adjusting the Volume.

Independent control of volume at each loudspeaker point seems, at first sight, quite a simple problem. One rather too-obvious solution is to connect a variable resistance across the speaker terminals, and to hope for the best. Within limits this can be quite satisfactory, when using variable- μ valves which do not easily overload, particularly if matters are so arranged that the insertion of the plug connecting the set to the distant speaker automatically cuts out the ordinary potentiometer control on the set, and inserts the local speaker-control in its place.

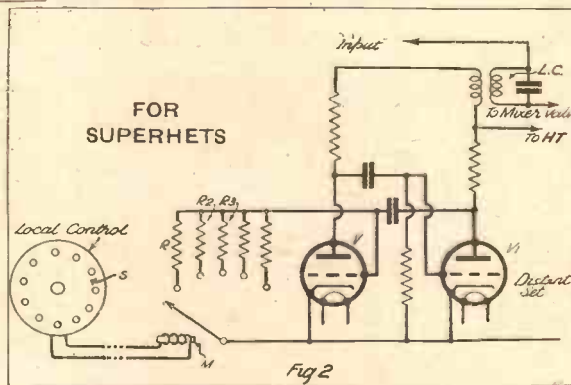
The most troublesome problem is, of course, that of tuning from a distance.

A complete installation of this type also includes on-and-off switching and volume and tone control, whilst in some cases provision is also made for switching the set over from broadcast to radiogram. A further refinement includes means for changing selected records in a given sequence, and even for summarily rejecting one record in favour of another more in sympathy with the mood of the moment.

Use of Synchronised Motors.

Such systems are almost always based upon the use of synchronised motors, fitted with special devices for breaking the motor circuit at the exact setting required, at the same time taking care to prevent any tendency for the driven part to over-run or lag behind the control. In addition, there must be some arrangement for re-setting the moving parts at the end of each tuning operation, so as to leave the set ready for the next selection. Not unnaturally, such arrangements cost a good deal of money to install, though there is a growing demand for them in quarters where convenience and even luxury are not too closely weighed against expense.

UTILISES A DIALING SWITCH



In this scheme stations corresponding to definitely fixed wavelengths are selected by using the dialing switch, "S."

There are, however, less costly methods which are well worth consideration, even if they fall somewhat short of the performance just mentioned.

Fig. 1, for instance, illustrates a comparatively simple form of remote control designed to give "free" tuning over the whole dial. The local control potentiometer R is inserted in the L.T. supply circuit, in series with a solenoid winding S, which surrounds an armature A pivoted to the shaft of the main tuning condenser on the distant set. The position of the armature within the solenoid is determined by the strength of current flowing in the

windings, so that it advances or recedes as the control resistance R is cut in or out. As the armature moves to and fro it rotates the tuning condenser accordingly.

In order to prevent accidental displacement, the moving condenser plates are normally held in position by a small spring-controlled clamp or relay (not shown), which is automatically released by the L.T. current as soon as the on-and-off switch K is closed.

Varying the Oscillator.

A second method of "distant" tuning control which does not involve the use of synchronised motors is shown in Fig. 2. Here the signal-input circuit L.C. of the receiver, which is of the superhet type, is tuned to a fixed frequency, preferably selected so as not to overlap the frequency of any station to be received. The set is then tuned to any required station by altering the frequency of the local oscillator valve.

In the arrangement shown the local oscillator actually consists of two cross-coupled valves, V, V₁. It is of the so-called multi-vibrator type, in which the frequency generated depends upon the effective resistance in circuit.

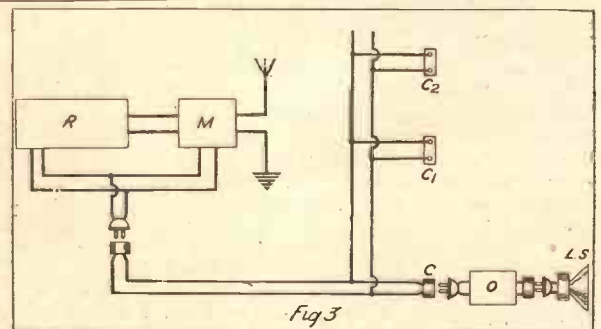
A series of resistances R₁, R₂, R₃, etc., graded to correspond to definite wavelengths, are then selected by using a distant dialing switch S of the automatic-telephone type to control a relay M.

The arrangement shown in Fig. 3 is based on somewhat the same principle, though it can be applied to a "straight" type of receiver. The tuning of the distant set R is kept fixed, and the selection of different stations is effected by means of a distant "adaptor" or oscillator O, combined with a "mixer" unit M, which is interposed between a "straight" set and the aerial. The entire installation is run from the electric supply mains, so that no other connecting wires are required between the receiver and the various loudspeaker points, as shown at C, C₁, C₂.

A Local Generator.

Oscillations generated by the local oscillator O, say at the control C, are fed back through the leads to the

MORE ELABORATE



This arrangement, although based on somewhat the same principle as Fig. 2, is applicable to "straight" sets.

mixer M. The local frequency is then varied until it "beats" with the required signal to produce a frequency which corresponds with the "fixed" H.F. circuits of the receiver R.

(Continued on page 557.)

The New "UNIVERSAL THREE"

FULL CONSTRUCTIONAL DETAILS OF A HANDSOME RECEIVER

ALL-MAINS OPERATION WITH FULL SELECTIVITY AND A POWERFUL OUTPUT



LAST WEEK we introduced to you the chief features of the New "Universal Three," the all-mains set that has been designed specially to make the most use of the latest universal valves, and to enable a mains receiver to be constructed with the minimum of cost.

As can be seen in the heading photograph, the set is a very handsome piece of furniture and compares very favourably with up-to-date commercial sets of the table variety.

The construction of the New "Universal Three" has been simplified as far as possible by the use of the popular "Metaplex" wooden chassis on which the set itself has been built.

Bonding the Chassis.

It is made from ordinary sheet "Metaplex" cut to the dimensions given in the list of components. The baseboard is supported on strips of plywood (which can also be of the same "Metaplex") to a height of 1½ inches. It is important that the two surfaces of the baseboard—and if "Metaplex" is used, also the surfaces of the runners, or supports—be bonded. The best plan is to run a threaded bolt through the baseboard, clamping the two surfaces by washers under the bolt head and the nut on the other end, and screwing the latter up hard.

As regards the runner surfaces, if these are of "Metaplex" these can be clamped in the same way if desired, and then connected to one surface of the baseboard, but it is probably easier to connect both surfaces of the baseboard by means of wood screws and washers, using short lengths of wire for the connections. Better still, of course,

DESIGNED AND DESCRIBED BY THE "P.W." RESEARCH DEPT.

is to use ordinary plywood for the runners and not a metallised wood, for there is no real necessity to use this type of wood, though if you have a few odd bits of "Metaplex" you may like to use them up.

The loudspeaker and power pack portion of the set is made of ordinary wood

for the baseboard with a baffle on the front edge for the loudspeaker. The dimensions are given in a separate diagram.

This section of the receiver is fitted into the cabinet above the set portion. As a matter of fact, if desired, it can be obtained together with the cabinet, as can the chassis. Incidentally, it is a good plan to specify the chassis when ordering the cabinet, for in that case the whole chassis can be obtained ready assembled and metallised all over, so that there should be no need for the bonding process.

Fitting the Speaker.

It should be noted that the speaker, a W.B. "Stentorian," is fitted on the baffle in a sideways position. It does not rest on its chassis stand, but is supported by the screws through the rim into the baffle. This latter, of course, must be of fairly substantial wood or nasty resonances may occur.

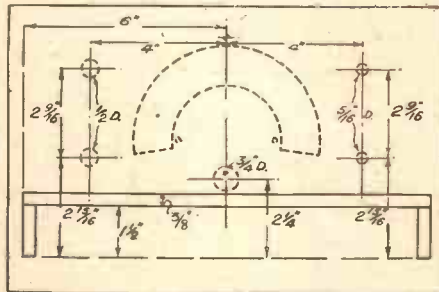
It does not matter which part of the set is constructed first, the chassis or the power pack. They are both separate in their conception and just have to be linked by a few wires when the receiver is being placed in the cabinet.

Let us start with the speaker and power pack. As with the rest of the set we recommend that it be wired up with some good insulated wire, and every connection must be well and truly made, the terminals being tightened up with pliers or a suitable spanner.

The two electrolytic condensers are mounted on the special strip and wires are attached to the positive terminals before the strips are fixed in position. Unless this

(Continued on next page.)

THE CABINET FRONT



The relative positions of the escutcheon and spindle holes are shown here.

THE PARTS EMPLOYED IN THIS UP-TO-DATE RECEIVER

- 1 Varley iron-cored 3-gang coil unit, type B.P. 57
- 1 Polar Midget 3-gang .0005-mfd. tuning condenser.
- 1 Polar semicircular drive for above, with scale marked in degrees.
- 3 Clix 7-pin chassis-mounting valve holders, with screw terminals.
- 1 Varley "Ni-Core" II. L.F. transformer.
- 1 Bulgin screened H.F. choke, type H.F. 9.
- 1 Bulgin toggle on-off switch, type S.80.
- 1 B.T.S. .00015-mfd. differential reaction condenser, with insulated bush and spindle.
- 1 Erie 10,000-ohm potentiometer.
- 1 Peto-Scott component mounting brackets, type 23.
- 1 Dubilier 50-mfd. electrolytic condenser, type 3003.
- 1 Dubilier 8-mfd. dry electrolytic condenser, 500-v. working.
- 1 T.M.C.—Hydra 1-mfd. tubular fixed condenser.
- 2 T.M.C.—Hydra 1-mfd. tubular fixed condensers.
- 1 Dubilier .001-mfd. fixed condenser, type 610.
- 1 Dubilier .0001-mfd. fixed condenser, type 670.
- 1 Erie 1-meg. grid leak, 1-watt type.
- 1 Graham Farish ¼-meg. 1½-watt "Ohmite" grid leak in horizontal holder.
- 1 Graham Farish 50,000-ohm. 1½-watt "Ohmite" resistance, in horizontal holder.
- 2 Graham Farish 25,000-ohm 1½-watt "Ohmite" resistances, in horizontal holders.
- 1 Graham Farish 10,000-ohm 1½-watt "Ohmite" resistance, in horizontal holder.

- 1 Graham Farish 800-ohm 1½-watt "Ohmite" resistance, in horizontal holder.
- 1 Graham Farish 300-ohm 1½-watt "Ohmite" resistance, in horizontal holder.
- 1 Peto-Scott "Metaplex" (both sides) 12 in. × 10 in. baseboard, with 10 in. × 1½ in. wood runners.
- 1 Peto-Scott terminal strip, 2½ in. × 1½ in.
- 2 "Clix" indicating terminals, type B.
- 1 Bulgin mains resistance, type M.R.36.
- 1 Wearite smoothing choke; type H.T.12.
- 1 Wearite twin mains H.F. choke, type H.F.11.
- 1 Bulgin combined mains plug and fuses, type F.15.
- 2 T.C.C. 8-mfd. dry electrolytic condensers, type 902.
- 2 T.M.C.—Hydra 1-mfd. fixed condensers, type 30.
- 1 Peto-Scott twin electrolytic condenser bracket.
- 1 W.B. 5-pin valve holder, A.C. type.
- 1 W.B. Senior "Stentorian" loudspeaker.
- 1 Peto-Scott "Fitzall" cabinet with shelf and L.S. baffle.
- 2 Coils B.R.G. "Quikon" connecting wire.
- Screws, flex, etc.

VALVES.

Cossov:	H.F. 13V.P.A. metallised.	Det. 13S.P.A.	Output 402P.	Rectifier. 40S.U.A.
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THE NEW "UNIVERSAL THREE"

(Continued from previous page.)

is done you will find it difficult to make the connection.

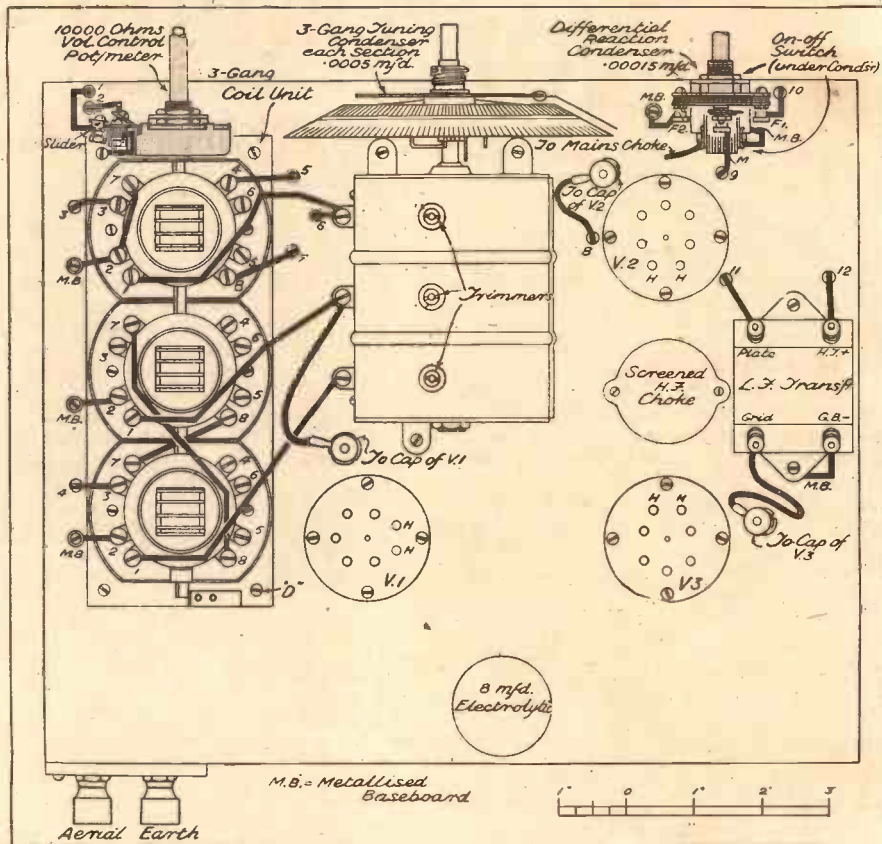
Most of the set can be built without soldering, but it is necessary to solder the leads to the double H.F. choke. One of these leads should preferably be of flex, a length of high-tension cable will do well, and it should be clamped down to the speaker platform by means of an insulated staple. This is not shown because it was actually done in the set in question where the lead passes under the loudspeaker, but it does not matter much where the staple is placed as long as it ensures that no strain shall be placed on the lead, and therefore that there is no danger of it being dragged off the soldering tag of the choke.

Connecting the Twin Choke.

This choke is a double component, consisting of two separate chokes on one former. The top winding is connected to the leads from the .1-mfd. condenser, and from the right-hand side of the mains plug and fuse (looking from the back of the set). The other winding of the choke is connected to the other side of the mains plug and to the long, flexible lead that we have already discussed.

There are other flexible leads in the set, attached to the speaker platform. These go to the heater terminal of V1, to the point "D," to the earth terminal, to the terminal marked "X" on the chassis, and from the

THE TOP OF THE "METAPLEX" CHASSIS



The coil cans have been removed in this diagram so that the connections to the coils can be seen. The screw marked "D" shows where a connection from the power pack is taken.

speaker "A" terminal to the terminal on V3. The rectifier valve holder is of the

ordinary baseboard mounting type with only five pins. Of these four only are used, the grid terminal of the holder being unconnected, for the valve is a half-wave rectifier of the indirectly-heated cathode type.

There is one other point that we should like to stress, and that is the need for making the connections to the mains resistance not only really tight, but also correct. It is very easy to slip up unless you bear in mind the voltage of your mains and make absolutely certain that the lead that goes to the top series of terminals on the resistance is connected to the right one. The voltages are clearly marked, but even so it is not unknown for a constructor to make a mistake.

The Low-Voltage Tapping.

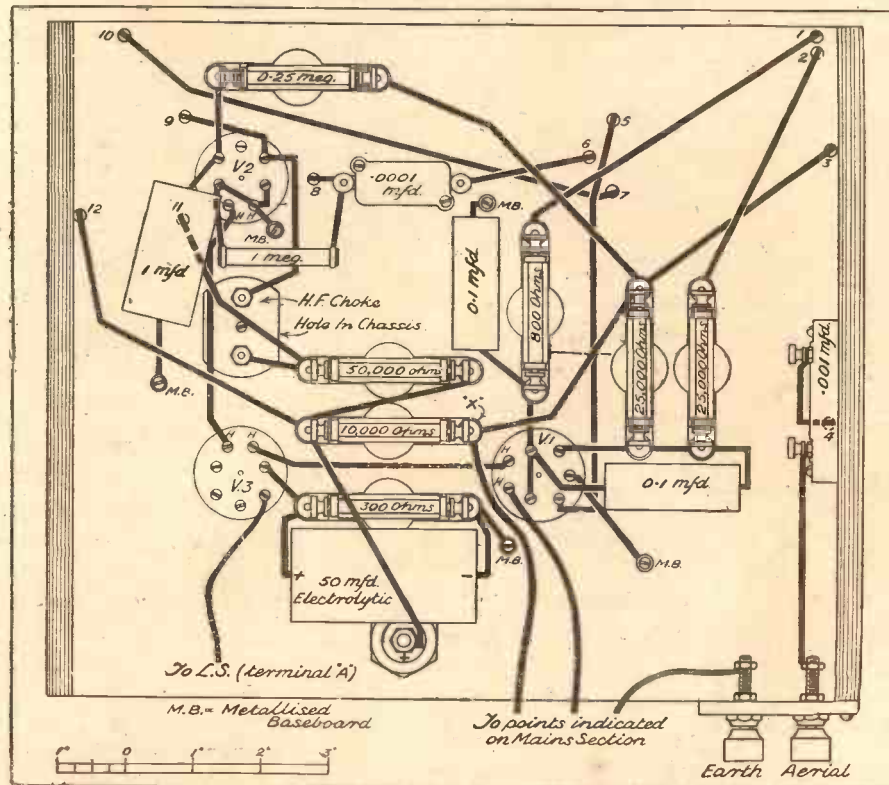
The other connection will not have to be taken into account, for it can go only on to the 6-volt terminal in the case of this receiver. The terminal marked 100-110 is not likely to be required, for it is very improbable that the set will be used on mains below 200 volts. If it is wished to use it for such a low voltage there is no reason why the change-over in voltage tap should not be carried out as indicated by the resistance, but the results obtained with the set will, of course, be very greatly reduced.

The chief result of the low voltage is that the H.T. volts of the whole receiver are cut down to an absolute maximum of 110 volts, which, as you will realise, is not very conducive to sensitivity or high-power output.

And now for a glance at the chassis part of the set. This is quite straightforward in construction, as we have already

(Continued on next page.)

THE WIRING BELOW THE BASEBOARD



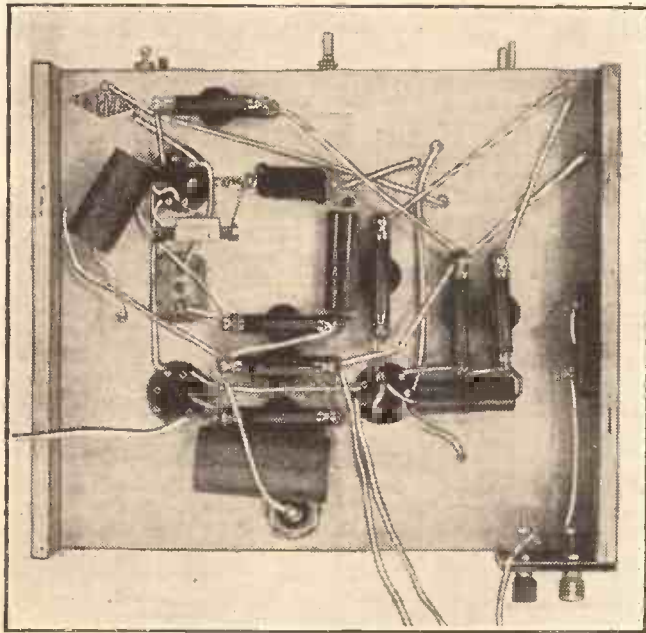
Note that the chassis is cut away to allow the connections to be taken to the screened H.F. choke, which is mounted above the chassis upside down.

THE NEW "UNIVERSAL THREE"

(Continued from previous page.)

indicated, but there are one or two points that should be mentioned.

AN UNDERNEATH VIEW



If you use this photograph in conjunction with the lower diagram on the previous page it will greatly assist in the wiring of the set.

One of the most noteworthy is the fact that the screened H.F. choke is mounted upside down so that the terminals come at the bottom. In order to enable these to be got at it is necessary to cut a hole in the chassis baseboard so that leads from the under part of the set may be connected to the choke terminals.

Holes also have to be cut for the three chassis-mounting valve holders, and these holes should be about $1\frac{1}{4}$ in. in diameter, so that the pins of the valve holders shall be clear of the edges of the "Metaplex."

Special Points to Note.

The tuning condenser is fixed in the usual way on the baseboard, but the other "panel" controls are mounted differently. But note that the points of the condenser scale are cut off to avoid fouling the chassis. The coil unit is fixed on the baseboard, but the spindle protrudes through a bracket which is fixed in front of it to carry the potentiometer. The wiring of the volume control will be quite clear from the wiring diagram if it is remembered that this component is shown shaded. The only connection to the coil unit at that end is that to the screw holding the unit to the baseboard, and to this screw is taken one of the leads from the potentiometer—that from the one end of the resistance (an "outside" terminal). At the other end of the coil unit is the screw marked "D," to which a lead from the power pack is taken.

The other set of panel controls are the on-off switch and the reaction condenser. This latter is of the differential type, and

is mounted above the switch. Here we have again employed shading to distinguish on the diagram the two components, the reaction condenser being the shaded one.

Mounting the Electrolytic Condenser.

The drilling diagram shown on the first page of this week's account of the set shows the relative positions of the components and controls, so that the front of the cabinet can be drilled without difficulty.

So much for the upper surface of the chassis; now let us have a look at the diagram of the under side. Here at once we notice that the electrolytic condenser that protrudes through from the top must have a pretty big hole cut in the chassis to accommodate it. This hole must not be so big as to prevent good contact between the case and the upper surface of the baseboard being obtained, but it must be big enough to allow the positive terminal nut to be clear of the under side of the "Metaplex." The hole must also be cut into so that the nut for fixing the condenser can be used. This nut has to be recessed

into the wood, for the threaded spindle of the condenser is not long enough to clear the three-eighths of an inch thick baseboard.

Note that the heater terminals of the valve holders have been marked by us. These are not marked actually on the valve holders. But a close scrutiny will reveal that there are two terminals set closer together than any other pair, and these are the heater terminals.

As usual, the holes through the baseboard have been numbered so that the wires through may be followed as they go from one component to another.

On this diagram can be seen the terminal which we have labelled "X." It is at one end of the 10,000 Ohmite resistance, and from this comes a flexible lead out at the back of the chassis and up to the power pack as already indicated.

Isolating the Set from D.C.

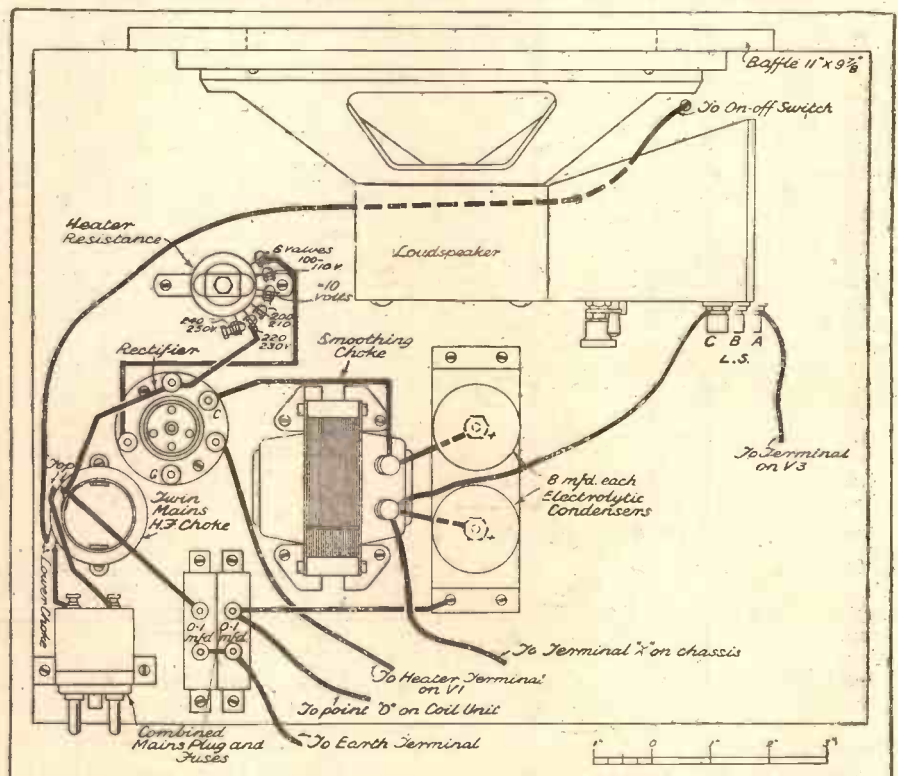
Note also that the earth terminal is not connected to the "Metaplex" as it is in most sets. It must be taken by a well-insulated flexible lead to the top deck of the set, the power pack, where it makes contact with the two .1-mfd. condensers. In this way the actual earth is isolated in a D.C. sense from the mains. In the case of the aerial the D.C. isolation is accomplished by the .001-mfd. condenser fixed on the runner underneath the chassis.

That is all we need say about the actual construction of the New "Universal Three." Remember always to use good insulated wire and to make the connections secure, for you do not want any loose leads in a mains set.

The assembly of the set in the cabinet will be clear from the foregoing, but for the

(Continued on page 558.)

THE LOUDSPEAKER AND "MAINS" PLATFORM



The loudspeaker and power pack section is wired as shown here and is fitted in the cabinet above the receiver chassis. The speaker is mounted on the baffle in a horizontal position. (See text.)

WHAT READERS WRITE

SOME LETTERS OF SPECIAL INTEREST SELECTED FROM THE
HUGE CORRESPONDENCE SENT TO US BY ENTHUSIASTIC
"POPULAR WIRELESS" READERS.

"ON THE SHORT WAVES."

Sir,—You want our experiences; you want readers to tell of their triumphs and their failures, and as the fountain of your own "experience" was the source from which, in earlier days, I derived the nourishment that helped the growth and development of my interest in the delightful hobby of radio construction, I take up your invitation with pleasure, and yet with some diffidence because of my own inexpert knowledge.

In the week ending July 6th, your attractive "Short-Wave" articles should stir the sluggish blood of many of the old stagers and stimulate the curiosity of the new.

There was a time when I was filled with a deep and abiding admiration, almost reverence, of the supermen among your readers who could make Short-Wave receiving sets work. My own had all been model sets; but, alas, none of them could ever have been described as "working models."

AN EARLY PRODIGY

I remember one of my early prodigies, a two-valver, that would have made a name for itself as a fog-horn. It had a note I had never heard in the musical scale. My wife used to say that the only station it would bring in was the police station! She threatened to leave home if I didn't chuck the thing out, and as I still needed her to boil my morning egg I "chucked it out"—the set, not the egg.

My next "Short-Waver" produced a perfect imitation of a wind-storm, with a rising note like the whistling hiss of a Cape Horn hurricane through the shrouds of a wind-jammer. It was so realistic that I involuntarily turned up my jacket-collar to keep the draught out. Its end was like that of "The Fog-Horn."

Then followed a real beauty made up from the diagram of a little circuit in "P.W." It was simple—and so was I. Tied up with bits of string, hairpins, and wire taken from the bundles of firewood my wife used to buy in those days. I spent about three nights sandpapering the rust off that wire—but it was worth it. That weird contraption would probably have made "W.L.S." die of apoplexy if he had seen it, but here is the marvel—it gave me the first foreign station reception I had had.

FIRST TASTE OF AMERICA

That night I listened to a broadcast from America! It was an account of the very first east to west flight of two French airmen. It ended just after 1 a.m., British time, and the time in New York was given as 8.10 p.m. I shall never forget the thrill of satisfaction I experienced that night.

I have constructed many short-wave receivers since that time with gratifying results, but I will not weary your readers with a dry account of the many foreign

stations I have brought in. My object is to encourage those who have suffered failure and disappointment to persist in their efforts, for success is certain to follow. And they have in your fine short-wave articles a mine of knowledge from which they can dig gems of information to help them in the pursuit of this alluring hobby.

And now for the lumber-room to see how many old and well-tried components I can dig out of my junk-box to build that "Simplex" Short-Wave Two with which "W.L.S." has increased my "circulation." May it also increase yours.

Yours truly,
W. Sayers,

1, Tolnes Road, Chorlton-cum-Hardy,
Manchester.

[This letter wins the Guinea prize offered by the Editor in accordance with the details on this page.]

INSIDE OR OUTSIDE AERIAL.

Sir,—I was interested in a reply to W.A. (Redditch) in POPULAR WIRELESS for July 13th.

ONE GUINEA FOR A LETTER!

AN INVITATION
FROM THE EDITOR
TO "P.W." READERS

I WANT readers of "P.W." to help each other. I want them to use the columns of this paper to express their views on all and every aspect of the great hobby of radio; I want them to "swap" experiences; I want them to tell about their triumphs—and their failures—with the various sets they have built. I want, in short, to encourage an exchange of views, opinions, likes and dislikes.

Send me letters for publication, in order that "P.W." can become, more than ever, the best medium for imparting all kinds of knowledge about radio.

YOU must have had, many and many a time, interesting experiences when building or operating your set. Tell other readers about your radio experiences. And, incidentally, get to know each other through the medium of "P.W."

For the best letter in each batch published I am offering a prize of one guinea. Send your letters to the Editor, "Popular Wireless," Tallis House, Tallis Street, London, E.C.4.

It is generally assumed that an outside aerial must be more efficient than one fixed inside the house; but a good inside aerial can be not only more efficient than the average outside aerial, but also free from trouble and out of sight.

In the early days of broadcasting I tried various types of outside aerials, in order to receive the strongest signals. My best effort I had until recently was 100 feet long (including the lead-in), the far end attached to the top of a pole 30 ft. high, good insulation, and clear of ironwork:

It was a good aerial, and I was proud of it.

Then came improved valves and the need for better selectivity. So I tried a shorter aerial fixed inside the loft.

Well, greatly to my surprise the volume was just as good and selectivity greatly improved.

I would tune in a weak station on the long waves, say Moscow, then change from one aerial to the other without noticing any loss of strength.

Height is most important, and if the aerial is taken straight up to the ridge of the house, it will be higher than most outside aerials slung from poles.

About 60 ft. of covered aerial wire is required. Keep about 6 inches off each wall. In going through the ceiling be careful to avoid floor-joists; no special insulating is necessary here.

Only one horizontal run is required as high as possible—a lot of wire in the loft causes flat tuning.

Even the users of small two-valve battery sets need not hesitate to use such an aerial.

Yours truly,
John Lovekin,

3, Eldon Road, Lemington,
Northumberland.

HARKING BACK TO WRITTLE.

Sir,—I have been a keen wireless experimenter since the early days of wireless, and have read "P.W." from the very first issue. Occasionally, in a vain endeavour to secure more knowledge on the subject, I have wandered from the fold, but have always returned to "P.W." as no others ever give such first-hand news and up-to-date circuits.

My first set was a modest crystal, the tuner consisting of a round former 12 ins. long by 4 ins. diameter, wound by hand with enamelled copper wire, with a slider to vary the wavelength. This sufficed for some months till 2 L O commenced operations; then a variometer was constructed which gave "sharper" tuning. Incidentally it was with this set that I received my first amateur transmitter on about 450 metres.

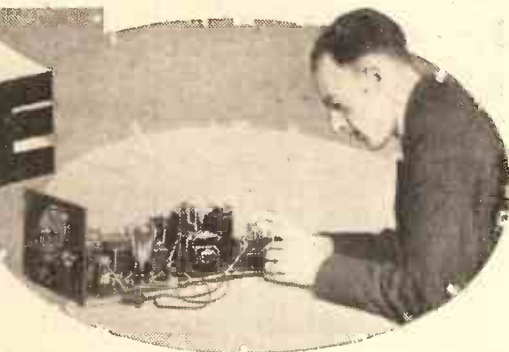
Then came one, two, and three-valve amplifiers. Then a single-valve detector set, which even in those days was capable of receiving the Continental stations. A two-valve amplifier was then added to this set, which did good service until the advent of the "Comet Three." When this was built it was a truly wonderful set, and gave some hundreds of hours of pleasure, as have several other "P.W." sets; the latest one under construction being the last short-waver of "W. L. S."

If some of the present-day listeners could realise the thrill that we used to get, when, after sitting with the headphones on our ears for perhaps an hour or more we heard the voice of Captain Eckersley announce "This is Writtle calling" and switching off for a few minutes, they would not be so quick to call the broadcasting services all the names they do. They certainly have a lot to be thankful for. We had to pay the same amount of licence for the small amount of transmitted matter then as they do to-day.

Yours truly,
E. J. Walker,

Standon, near Ware, Herts.
(Continued on page 560.)

D.C. DIALOGUE



By C. J. DARK

Written in the form of a conversation between a radio constructor and an inexperienced listener, this article contains valuable information on the installation of a D.C. mains unit.

DESPAIRING CONSTRUCTOR (bursting upon the writer): Look here, old man, I must get this D.C. business straightened out! I've talked about it umpteen times to umpteen people, and all I get is "hum-m-m"; "rather dangerous: better stick to batteries." "If you've got rough mains it's—!"

Now, I ask you, how do I know if my mains are rough? Am I supposed to stroke the wretched things? And if you mention Q.P.P. or Class B I shall run round smashing things.

The Writer (concerned to soothe this friendly avalanche): A cigarette is indicated, I think, before I attempt to reply to your questions.

"Niagaras of Power."

Now, in the first place, to play with D.C. mains without some understanding of the possibilities that lurk in the main lines is asking for trouble. But I know quite well what's biting you. You can see Niagaras of power at your domestic D.C. plug points, and the idea of buying battery after battery is breaking your heart.

But you must remember that, in spite of the disarming simplicity of a D.C. eliminator, quite a number of difficulties may lurk in the background to bite the unwary.

If I didn't know that nothing on earth would induce you to give up your pet diode arrangement, I might say "buy a complete D.C. set." I have one set in mind which is a model for all constructors, and, I suspect, for quite a number of other manufacturers as well.

But I won't tell you the name of the maker because to do so might be unfair to others who may be producing stuff just as conscientiously designed.

The D.C.: Thanks, but we'll take your conscience and your counsel of perfection as read, if you don't mind. I'm interested in getting juice from my mains—smooth, oily juice—even if they are as rough as the back of a hedgehog.

The W.: Well, we will cover the subject systematically: there is the question of noisy reception, otherwise hum-m-m, and the possibility of dangerous shock.

Getting Down to It.

The D.C.: Yes, those are the two chief headings. And I intend to drink your whisky and smoke your cigarettes until I feel that I can command the D.C. to eat out of my hand.

The W.: Then, in the interest of my "thirty under proof," I'll get down to it. Noisy reception is not only a matter of

constant, steady note—the hum note—penetrating every programme, but includes every imaginable splutter, pop and bang that can go for a ride on your mains.

So long, however, as you are willing to provide adequate smoothing chokes and condensers, hum-free reception should be possible. That is not to say that the simple choke-in-the-positive-and-a-2-mfd. will always be satisfactory. It won't.

But a studied distribution of chokes and condensers, as dictated by the good and bad qualities of your mains, will solve the hum problem. The splutter-and-bang type of interference is another matter. On the whole, the best thing to do is to wait until it turns up, and then try to trace the source of it before making any attempt to remedy it.

danger is present, in some degree, with any electrical gadget which is incorrectly used or fitted—a vacuum cleaner, electric iron, table lamp and so on.

It is not difficult to construct a set of conditions which would make their operation dangerous should any one of these possess a defective part. So it is with a D.C. wireless set; if you add together carelessness, defective part and abnormal conditions, an unpleasant shock, to say the least, is certainly possible. But, recollect, an unwary hand in a humble battery set may come out quicker than it went in.

The D.C.: That's reasonable enough, but what I want to know is: is it possible to construct an H.T. eliminator that can be added to a battery set without being a source of danger?

Examine for Suitability.

The W.: Well, the answer is this: a D.C. eliminator should not be used until the set has been examined in regard to its suitability, and, if necessary, certain changes made in the connections and controls.

The D.C.: If sets can be suitable and unsuitable, suppose you imagine that mine belongs to the latter type, and let me hear what you would do about it!

The W.: Now we are coming to the essence of the thing. While it is not necessary to go to the length that the firm I mentioned a few minutes ago have gone—their set is a complete D.C. set and was naturally designed as a unit—at the same time the principles behind the job are universal.

Take such a simple and easily forgotten thing as the filament on-and-off switch on your panel: I suppose it is the usual shillings-worth of push and go?

The D.C.: Yes, quite an ordinary thing, but you are not going to tell me that it becomes "live" in use?

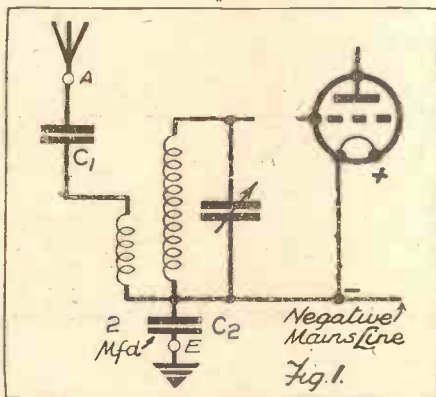
The W.: I am going to tell you that it may be "live" and a source of danger if the positive side of your main is earthed.

The D.C.: But if the positive side is earthed, how in creation can the set work?

The W.: Not so fast. Think a moment! If the common negative line of your set is at 150 volts negative in relation to an earthed positive side, your set will still work because the relationship you always have in mind is not really changed.

(Continued on next page.)

CONDENSER SAFEGUARDS



C₁ and C₂ of Fig. 1 are necessary items when a set is run from D.C. mains, in case the positive main happens to be the earthed lead.

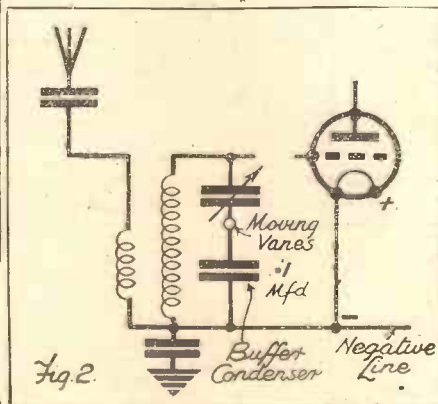


Fig. 2 shows how all possibility of shock from the tuning condenser panel control may be eliminated by means of a large fixed condenser in series with it.

The D.C.: Yes, I think that's good enough, as far as it goes. But get on to the danger side of the business—there seem to be quite a lot of nasty possibilities. After all, I'm a family man, and if there is serious danger from the mere handling of exposed parts the D.C. mains will remain unused, so far as I'm concerned.

The W.: This question of danger exercises the minds of a lot of wireless people who have D.C. mains. But, remember,

A D.C. DIALOGUE

(Continued from previous page.)

There is still a high potential difference between the anode and the filament, and it is this condition that makes operation possible.

The D.C.: I see, "all is relative," as our Mr. Einstein would say.

The W.: But let us get back to the switch. I don't want to make a mountain out of this mole hill; it is only necessary to replace an unsuitable switch with one having an insulated operating mechanism.

The D.C.: I'm getting the idea now. I take it that all controls must be insulated from the negative mains line in case that side of the mains is "in the air" and at high voltage in relation to the true earth point.

A Vital Point to Remember.

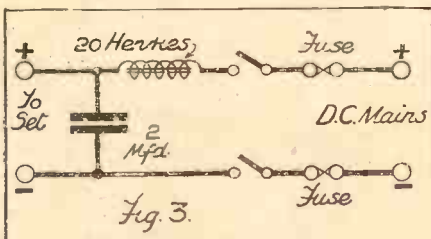
The W.: Yes. That's a vital point. In a D.C. set you must always keep in mind that the "common negative line" of the set and the "true earth" are quite different things. Once that is appreciated most of your difficulties will solve themselves. Now examine the position of the aerial and earth terminals in this diagram (Fig. 1).

The terminal E is a "true earth" point, and the isolating condenser C_2 —which, by the way, is compulsory—should be placed within the set, and all the common negative connections taken to the other side.

All wiring should be carried out with properly insulated wire and be, as far as possible, out of reach of the casual hand. The same precautions should be taken with regard to aerial connections, and the condenser C_1 should be placed inside the set.

The D.C.: I'm getting quite confident about this business now. I must, it seems, consider all points connected to either main

SIMPLE SMOOTHING



This smoothing circuit contains the bare minimum of components necessary for smoothing purposes.

line as suspect, and these points, and the leads to them, must be within the set or adequately shielded.

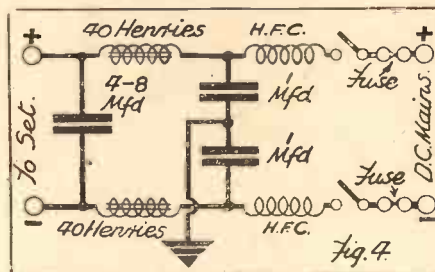
The W.: Exactly. The open-backed, wiring-all-over-the-place set must be cleaned up on the lines I have indicated. The double-pole mains switch on the eliminator section should be accessible and be used. "Switch off the mains!" must be your slogan and your confirmed habit before the slightest adjustment is attempted.

The D.C.: There's one other point: you have said that the filament switch must have an insulated control, but what of the tuning and reaction condensers? These are invariably connected to the common negative line.

The W.: All I have said regarding the switch applies equally to the condensers. As, however, the variety of condenser controls must run into hundreds, I am going to suggest a precaution which I consider advisable in every case.

Look at this sketch (Fig. 2): you will see that I have inserted a large condenser in series with the tuning condenser. This condenser—if of the size indicated—will have a negligible effect upon tuning, but will act as a buffer between the condenser control and the common negative line. It is obvious that the moving vanes are completely insulated from the mains—on the one side by the buffer condenser and on the other by the dielectric of the tuning condenser. These remarks apply, naturally, to a reaction condenser.

FOR BAD MAINS



When the mains are "rough" and the simple circuit of Fig. 3 proves ineffective, this scheme should be adequate to deal with all mains hum and noises.

The D.C.: Thanks. I think that covers all my difficulties in regard to the set, but I should like to go back to the question of smoothing. You suggested early in this talk that smoothing circuits varied considerably in effectiveness in different districts. Perhaps, then, you will give me an example of a simple circuit and an elaborate affair.

The W.: Well, then, here is the simplest circuit possible (Fig. 3). It is unfortunate that, in this matter, simplicity and success don't always go together. The sketch shows a bare minimum of smoothing, and in many cases it may be all that is necessary to give a silent background.

In other districts it may be hopeless. Now, here is something a great deal more elaborate (Fig. 4), and it may be made up with every confidence of success in all but the very worst districts.

High-Frequency Chokes.

The high-frequency chokes should be of low D.C. resistance—50-80 turns of 22 or 24 D.C.C. on a 3-inch former will be near enough. The two 1-mfd. condensers are associated with the chokes and form a preliminary filter for high-frequency interference.

This type of interference is occasionally serious, but it generally yields to treatment of this kind. The inductance of the low-frequency chokes should be close to the value shown, and the condensers may be of foil or the electrolytic type.

The D.C.: Well, thanks for all this information. You've knocked down quite a number of bogies, but, at the same time, you've shown me that the conversion of a battery set to D.C. feed needs serious consideration—at least, as serious attention as I've given to your excellent whisky.

THE TELEVISION TIME BASE

(Continued from page 546.)

By grid-bias adjustment of the valve the voltage at which the discharge (by the ionisation of the gas in the valve) takes place can be regulated so that the length of the travel of the spot can be adjusted. When the valve "fires" the voltage across the condenser is destroyed almost instantaneously and the spot flies back, to be followed by automatic charging again as the valve is released from the potential across it and becomes de-ionised again. All very simple, isn't it?

The Up and Down Movements.

Thus it can be seen that it is easy to waggle the spot up and down, with the upward movement being comparatively slow, and the return, or flyback, as it is called, extremely quick. We therefore get a line of light traced in an upwards direction but no visible path downwards.

What about the movement to the left? That is carried out by another deflector and another condenser and discharge valve, the condenser so regulated that it will charge up comparatively slowly, and the valve will not flash over until the spot has been pulled right across the screen. This pulling is done in our diagram examples by the plate A_2 .

So while B_1 is pulling and releasing the beam A_2 is pulling the beam steadily across the screen. The result is the tracing of Fig. 5b. We get a slanting upwards line (not noticeably slanting in practice) and a vertical flyback, because the effect of A_2 on the flyback is almost nil, the time period is so small.

Linking the Time Bases.

At the end of the traverse, that is at X, the valve in conjunction with the condenser being charged for the operation of A_2 fires and the spot flies back to A on the screen. In practice the two time bases, as these devices are called, are linked together so that they act in step with one another, and A_2 releases the spot exactly as B_1 gets it to X on the screen.

The adjustments of values of resistances and condensers are somewhat critical in practice, for it is obviously the combined values of voltage, condenser capacity and resistance, to say nothing of grid bias, that determine exactly when the discharge of any particular condenser takes place. But I do not want to go into deep theoretical details; I want to give an idea of what happens without technicalities as far as possible.

Concerning Actual Circuits.

Next time we shall go into the actual circuit used for television scanning. It is based directly on the type of control of deflector voltages explained here. If it is remembered that in the simplest time bases two of the deflectors in the tube are "earthed" and the scanning is done by "working" the other two the whole process will be easy to grasp.

There is nothing really complicated about the fundamentals of the normal cathode-ray tube or its television time base, though the practical applications are sometimes somewhat tricky in adjustment to get going properly.

How Much Does Your Set Cost to Run?

AT one time, in fact only two or three years ago, the deciding point as to whether one changed to the domestic tariff rate of electricity charge from the ordinary flat rate per unit was certainly not the consumption of the wireless set. It depended on the extent to which some other domestic electric appliance was used in the home, consuming more energy.

To-day, however, it is different; the electrical energy consumed by a modern all-electric set is sufficient in most cases to make this change in method of payment an economical one, providing, of course, one is not already on a light and power basis. When electricity from the mains was first used for operating wireless sets, with the use of eliminators for high-tension supply, the actual consumption of power by the eliminator was certainly not sufficient to concern the listener about its running costs—they were rated at about a shilling or so per year.

Even when the first mains valves were introduced, taking low tension also from the mains, the cost of operating the average three-valve set did not seriously disturb one's mind concerning the running cost, the total wattage consumed being somewhere round 20 or 30 watts, which, at 4d. per unit, would give approximately 12 hours running for 1d.

Fours Hours a Penny.

Now, however, and the price per unit has not been reduced much, listeners cannot obtain much above 4 hours for 1d. with modern mains sets. Why is this?

Without going into details, it is largely the outcome of the progress made by our designers and manufacturers in obtaining better quality, output and selectivity. Broadcasting conditions to-day demand a set with clear-cut station separation and long range, these factors dictating the call for new valves with multi-grids and new circuits requiring more power for operation than the early three or four electrode valves and circuits.

Consequently the average modern set, commercial or otherwise, to meet these conditions concerning selectivity and the providing of real quality response, usually consists of a five-valve (including rectifier)

A thoroughly practical article which will prove extremely useful to everyone who uses or contemplates using his electric light mains for running his radio.

By L. A. HODGES, Grad.I.E.E.

superhet automatic volume control type of circuit, employing new and necessary valves in the various circuit stages, with a large triode or pentode output valve, and supplied with current by a heavy duty rectifier valve. This new and popular type of set takes anything from 50 to 70 watts from the mains.

What Radio Sets Consume.

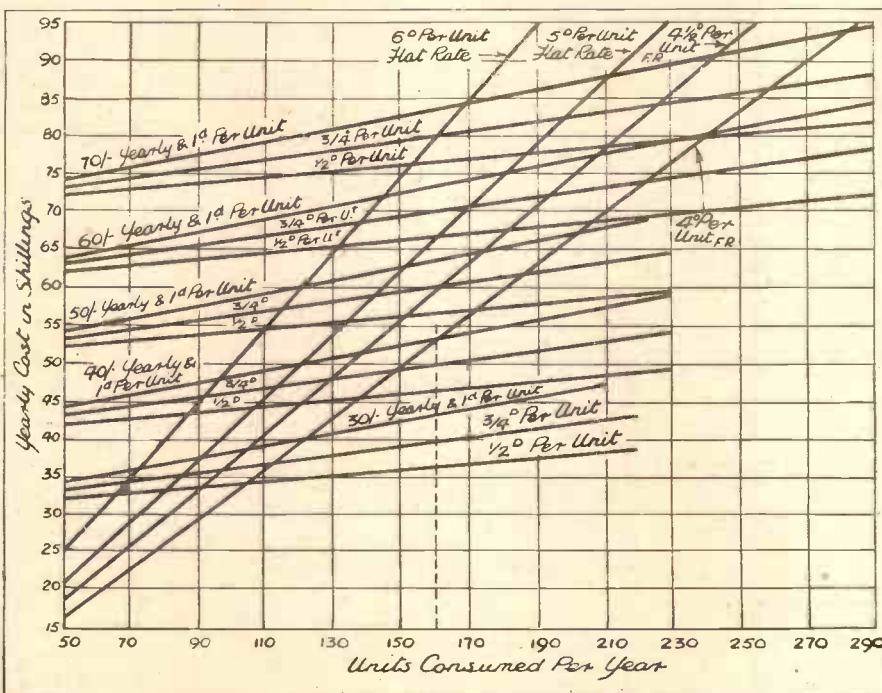
To mention one or two examples of 1935 popular all-electric sets, the G.E.C. five-valve superhet A.V.C. is listed with a

four valves and the rectifying valve. With the radiogram addition, an extra 15 to 25 watts must be added to these figures.

It will be observed, therefore, from these figures that one of these sets consumes as much electricity as the ordinary 60-watt electric lamp used in the home, and as an expense it is now an item to be reckoned with, for with ordinary use, say two or three hours per day, it can amount to doubling the electric light bill. When observed in this light it may cause many listeners in the medium type of house to sit up and take notice if he is paying a flat rate of 4d. or 5d. for the electricity consumed.

To enable us to get at these expenses, let us revert for a few moments to the cost of electric lighting in the ordinary six-roomed house where electricity would be used for little else besides lighting, at a flat rate of, say, 4d. per unit. You would find, either by rough calculation or by looking up the electric light bills for four consecutive quarters, that somewhere between 80 and 100 units have been consumed, this amount costing about 30/-.

CHECK YOUR COSTS AGAINST THIS CHART



A simple chart which tells the yearly cost of running a set from almost any electricity supply and compares the flat rate and contract systems of charge.

power consumption of 70 watts and a similarly designed H.M.V. set is rated at the same, whilst an Ekco five-valve, seven-stage superhet takes 60 watts.

And the Marconiphone "Jubilee" models, also of similar design, consume 60 watts: in fact all sets with these distinguished characteristics, commercially built or home constructed, absorb about the same power.

Of these input wattages it is interesting to note that practically half the watts consumed are taken by the heaters of the

therefore, under these general circumstances, that the wireless pleasures (not forgetting the wireless licence) cost something, and it is essential that electricity should be bought at the most economical rate, and this is where the domestic tariff comes in.

Before coming to the application of the graph to these charges, some listeners with home-constructed sets may not know the actual consumption of their set. This can be easily measured without borrowing or (Continued on next page.)

Worth Consideration.

This consumption is based upon the ordinary use of a 60-watt lamp in the living-room for week-night use, and a 100-watt lamp in the drawing-room for the indulgent Sunday evenings. Now if one of the new all-electric sets is installed and in use, say, on average two and a half hours per day, that is about eighteen hours per week throughout the year, this gives an added consumption of nearly 60 units costing £1 to go on top of the electric light charges.

HOW MUCH DOES YOUR SET COST TO RUN?

(Continued from previous page.)

buying any indicating instruments. By looking through the glass windows of the electricity meter, installed in the house, a disc can be seen which rotates slowly whenever current is being used anywhere in the house.

Somewhere on the edge of this disc will be seen a coloured marking by which the revolutions of the disc can be counted. All that has to be done to measure the consumption of any wireless set is to switch on the set, making quite certain that no lights or anything else are switched on, count the number of seconds by your watch that the disc takes to complete one revolution, and substitute this number of seconds in the following equation which is easy to work out.

$$\text{Watts consumed} = \frac{3,600,000}{\text{Revs per kw.h.} \times \text{secs for 1 rev.}}$$

The revolutions of the disc per kw.h. is usually stamped on the name-plate of the electric supply meter, and for the ordinary 5-amp. house meter this is usually 1,500.

Which is Cheaper?

We can now proceed with the example of the electric light and wireless taking 160 units per year, or, in the case of a different wattage consumption for the wireless set, determined by the above equation, it will be 100 units for light plus this different consumption for wireless worked out for an annual amount.

The graph shown is to enable the reader, in the medium-sized house which has not two separate circuits for light and power, to determine the cheaper way of buying his electricity.

It is only necessary to approximate the number of units used per year and to obtain from the local supply authorities the amount of the fixed charge per year, together with price per unit, should a change-over be made to domestic rate.

Assuming the 160 units per year in the example, project up as shown in the dotted line from 160 units on the base until you come to the steep angle line marked with your ordinary flat rate, which in the example is 4d. per unit. Assuming a domestic tariff rate of 40/- per year and 3d. per unit, it will be observed that the dotted line passes through this particularly marked curve before coming to the flat rate curve, and in all cases where this occurs it denotes that the domestic tariff rate is cheaper.

The Maximum Number of Units.

It will be seen that the graph covers most general flat-rate charges and domestic tariff quotations, but where curves are not shown to indicate some readers' particular cases, they can easily be pencilled in if necessary.

Another general way of reading the graph is to project a vertical line down to the units base from the point where the flat rate curve crosses the domestic tariff curve. The number of units so indicated by the projection represents the maximum number of units that can be used on the flat rate system to be profitable, as compared with the domestic tariff system.



The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return M.S.S. not accepted for publication. A stamped, addressed envelope must be sent with every article.

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

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

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

QUESTIONS AND ANSWERS

LOUDSPEAKER RESULTS FROM A SINGLE VALVE.

P. S. (High Barnet).—"I want to use a mains pentode as the only valve in a set to work a moving-coil speaker. From Captain Eckersley's writing in "P.W.," I know this is possible, provided one can put up a really perfect aerial within ten miles of the station to be received.

"Well, I shall only need the Brookmans Park stations, and my aerial is going to be a peach. The second essential—plenty of H.T. at 250 volts—I can also manage. But can you clear up the following points.

"Should there be any provision in the aerial circuit for selectivity—series condenser, or tapping? Is the screen voltage very critical? And would a low-capacity choke in the anode circuit be impaired if I use a really big capacity, say 4-mfd., across the loudspeaker primary and the H.T. supply?"

You will probably need some form of selectivity control, which can take the shape of a variable condenser, variable tappings, or a combination of both of these.

Screen voltage on the pentode does not need to be adjusted very finely, but it must be really high for such a circuit—probably nothing less than 200 volts would be of use.

The self-capacity effect of the choke will not be affected by the condenser unless the latter is placed or connected wrongly. Any capacity connected across the choke, of course, would have the same effect as a high self-capacity in the windings. But the normal connection of one side of a large capacity condenser to a choke does not cause any rise in its apparent self-capacity.

From your description we are not quite clear as to how the circuit will be arranged, but if you avoid reaction and stick to normal output connections you should be successful, since yours is one of the few cases in which such a circuit could be employed.

HUM-TRACING WITH 'PHONES ON A MAINS SET.

G. G. S. (Belfast).—"I was trying out a short-wave adaptor and had my 'phones connected up to the extension-speaker terminals of my broadcast set (all mains). I got no results on the adaptor, so I put it to the one side, saying a lot of things to myself about Mr. Kelsey. I kept the 'phones on, and contented myself with the broadcast programmes.

"My little boy, being a bit experimental, asked to try these 'phones, so I handed them over to him. When adjusting them on his head he shouted 'Oh!' I said 'What's the matter?' He replied 'I got a shock.'

"I said, 'You couldn't get a shock,' but he maintained that he did.

"So I touched the 'phone terminals and, sure enough, they were alive.

"But the following day I got a greater shock, for as I sat listening through the 'phones, I had a desire for reading, and so I

switched off, with the 'phones on my ears, and I heard a buzz.

"So I switched off the room light-switch. Still the buzz.

"So, I thought, there's something not right somewhere. I disconnected the set's plug from the lamp-holder, and the buzz stopped. But that didn't satisfy me.

"I took the 'phones from my set and commenced to investigate. First I started at that lamp-holder, and, on touching the pins with the 'phones, I heard that buzz again. So off I go to the kitchen, over to the supply meter, and unscrewed the cap of the house fuse-box.

"Taking up the 'phones, I touched the leads that connect to my house wiring, which happen to be our Corporation's. I had traced that buzz—stray current! So now I am having one of our Corporation's men up to see to this.

"(1) If when I got this trouble fixed up and those 'phones are still alive, should I try a .0001 condenser from the plate of the output valve to earth, or should I need a different value for mains? I don't want any of the rest of the family getting a shock.

"(2) Is it not possible to receive short waves on an all-mains short-waver? I hate the idea of going back to that little glass jar and batteries, and, as I am at present collecting the parts for a set, and my intention is to buy an eliminator for H.T. and run L.T. from a connection on my own broadcast set, will that be O.K.?"

Precautions to be Taken.

You do not say whether your mains are A.C. or D.C., both of which types are used in Belfast, we understand. But in neither case should the 'phones be "alive", when connected to the set's "extra loudspeaker" terminals.

If they are "alive" and tingling when no loud programme is being received, this is an indication that the set's output filter is faulty. It should be put right before the 'phones are used again in this way, since such a fault should be regarded as dangerous, especially where children are concerned.

(A slight tingle accompanying loud signals and absent when they are absent, is nothing to worry about; it is due to programme voltages, and not to mains leakage.)

In addition to the above warning, we must caution you about your method of looking for a fault with 'phones, for we should be afraid to investigate the house-wiring in the way that you appear to have done. It is dangerous.

When 'phones are used to listen to wiring that may be "alive", they must always be connected either to the secondary of a suitable transformer; or by means of a high-test voltage-condenser in each lead (and sometimes, in the case of A.C. mains, a high resistance as well), the mains wiring thus coming into contact either with the primary of the transformer or with the other sides of the condensers—never with the 'phone-leads themselves.

When the condensers or the transformer are used the arrangement forms a safety filter—and that is the only way in which 'phones should be joined to mains wiring. Without a filter, we repeat, there is danger.

With regard to your questions: (1) Those 'phones must not be worn if they are "alive", unless the tingle is, as explained above, the "programme tingle" (which can easily be recognised because it only accompanies loud music, etc.).

(Continued on next page.)

RADIOTORIAL QUESTIONS & ANSWERS

(Continued from previous page.)

(2) Preferably the short-wave set should be properly designed as an all mains set, when it should be quite satisfactory. Your scheme might work all right, but it will depend on the design of the set. You would use A.C. valves, of course.

CUTTING OUT THE S.G. VALVE.

The question of whether or not it is advisable to arrange by means of a switch for cutting out an S.G. valve, when listening to the programme from the local station, is one in which a great many readers are interested.

It was recently stated in "Radiotorial" that, in certain circumstances, it was not worth while. Circumstances, however, alter cases—and in a great many instances it is worth arranging for when alteration to the set's lay-out is comparatively small.

The advantages are: saving of the S.G.'s L.T. current; saving of the S.G.'s H.T. current.

The disadvantage is that disturbance of the wiring to fit the switch may do more harm than the good done by current saving.

It will be appreciated that sometimes the advantages disappear—as, for example, when a mains unit is employed, or an accumulator too large for the set; similarly, the disadvantage disappears when the set is certain not to be adversely affected by the switching.

Appreciation of these points will solve most of the questions raised on these matters by correspondents. We should like to thank the many readers who wrote giving their experiences of S.G. switching.

One typical query—answered by the above—is quoted below and will be specially interesting to those who built the "Double X" Three. Writing from Hale, Altrincham, Cheshire, BM-GBG4 says:

"In your reply to C. C. H. (Tollington Park) you say it is not worth while to cut out the S.G. valve; but what about the 'Double X' Three, the first set to use the Contra-Phase system, and the star set for 1934?"

"Among the many sets I have made up the 'Double X' Three is certainly the best and gives very much more volume than is required, in fact, besides having a .0003 variable condenser in the aerial, I have also a Clarostat variable resistance across the secondary of the Ferranti A.F.5 transformer to control volume.

"This transformer is the only component part that is different from those recommended, and the layout is altered to fit an old baseboard. Very many stations without the S.G. valve!

CAUSE OF FREQUENT H.T. REPLACEMENTS.

W. V. B. (Burntisland).—"The only trouble is the way that the H.T. batteries run down too quickly. What is the cause—or what are the causes—of this?"

If the battery is a good one to start with, the too-frequent replacements are due to the fact that it is overworked.

This may happen owing to a fault in the set, or to the choice of the wrong battery.

The likeliest set fault is a broken-down condenser. Such a component, connected between H.T. + and earth—as a great many condensers are—is not a D.C. insulator, as it should be; but by virtue of its defective insulation acts as a more or less high resistance, passing a certain amount of H.T. current even when the set is switched off.

This current, continuing for 24 hours a day, exhausts the battery, which consequently shows signs of overwork.

Less easy to identify, but also likely to shorten battery-life considerably, is under-biasing. Wrong voltage on a grid bias battery may cause this, but sometimes it is due to a coupling condenser becoming defective, and putting H.T. on the grid, thus reducing or cancelling the applied negative grid bias.

A faulty valve or valve holder might also cause the trouble; and a new valve which takes more current than its predecessor is another possible culprit. Obviously, you must watch insulation at all points, in particular where wires pass through earthed screens, or where other possibilities of leakage may occur.

These are the chief faults to look out for in the set, but equally important is to choose a battery capable of standing up to the set's demands on it. Even if insulation is perfect, a too-small battery will soon show signs of overwork if the current required by the valves is considerably in excess of the correct discharge rating for that type of battery.

It is cheaper to work a battery well within its discharge rating, so if you have any doubts on this head get the larger type of battery which can supply the set without risk of overwork.

TUNING BY REMOTE CONTROL

(Continued from page 548.)

Volume is regulated by varying the amplitude of the local oscillations, whilst on-and-off switching is effected by a relay in the output circuit of the mixer valve M. The latter is biased so that the set is normally switched off, but is automatically switched on as soon as oscillations come on from any of the control points.

Another type of remote control is based on the use of so-called switch tuning. In practice, it is found that a listener seldom demands a choice of more than half a dozen different stations, and the set itself is designed from this point of view. That is to say, instead of being continuously variable, the H.F. circuits are built up around a series of fixed condensers, which can be switched in succession across a fixed inductance. Each of the fixed condensers is designed to tune the circuits to a particular wavelength, so that the selection of one station or another is reduced to the mere operation of a marked tumbler-switch or push-button.

Under such circumstances it is a comparatively simple matter to parallel the "selector" switch circuits, and to locate remote-control panels wherever they may be required.

"THE MULBERRY BUSH"

(Continued from page 540.)

or a fugue. That very good tune "Lullaby on Broadway" was recently rendered by a famous trio of harmonisers in a way that would have come much better from "quires and places where they sing."

If you like yodelling you must listen for Van Dusen. In Sandy Powell's show he yodelled a good tune called "It's Holiday-Time Again."

"The Music of Men's Lives" was another of the variety of ways of presenting a decade or so of popular songs. I find there is nothing like an old song for recalling a particular year of the past with its peculiar associations. The difference between "The Music of Men's Lives" and most of those memory-stirring programmes to which the B.B.C. usually treats us was that, besides our own recollections, we had those of the pair of lovers, Margaret and Richard, as well. It was interesting to see where the two recollections coincided. In my case, they did fairly frequently.

I liked, for instance, that dig at "tom-cat scrending." And also the following lines appealed:—Richard: "You were extremely cross with me for talking while Caruso was singing." Margaret: "Yes, but I am not cross with you for talking while that is going on." (At the time, there is a background of jazz-music.)

Compton Mackenzie wrote the libretto for this show. It was a meaty libretto, full of good things, and was certainly very crisp. The songs selected, too, were good.

The Paris Programme.

The programme of music from Paris, played by the band of the Garde Républicaine was in striking contrast to that from Italy the previous week. It approximated more closely to our own, I thought. The music was less hilarious than the Italians'. There was nothing of the military march about it. On the contrary, it was weird music, in which wood wind was prominent. The clarinets were specially good. The guardsmen sounded what indeed they really are, a band of highly trained musicians. The programme was announced, first in French, then in English, but I am doubtful whether the French lady's English was understandable where it was most necessary it should be.

All butcher boys should know that story of "Alec Nelson and the Squire's kidneys." It is a lesson in speedy delivery. Alec told it himself as a preliminary to his talk on "Athletics at Fenner's." But for the incident of which the story relates, Alec might now be an obscure butcher's assistant instead of the famous coach that he is. As was only to be expected, Nelson's talk was full of interesting reminiscences and athletic statistics. Also the suggestions he made must have been invaluable to those in authority who are anxious to see England supreme in the world of athletics. C. B.

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WHERE CONSTRUCTORS GO WRONG

(Continued from page 541.)

follow them. I always make up my sets from the circuit." This attitude has obviously impressed his friends, but it merely depressed me. Other constructors disregard all dimensions because they happen to have a cabinet of different size. If the cabinet is too large the design is blown out to fit. If the cabinet is too small the components and wiring are concertina-ed into dangerous proximity.

A Constructor's Alteration.

Some constructors have bees in their bonnets, and these bees frequently are not of the breed which inhabit my own bonnet. A case of this kind was recently brought to my notice. The constructor was an ardent convert to my principle of having all controls on the front panel. When he found the Extractor tuning condenser on the terminal strip at the back, he came to the conclusion that even if my nerve had failed there was no reason why his should. The result was that the Extractor tuning condenser displayed itself defiantly on the front panel. Now it so happens that the Extractor circuit should be well clear of the rest of the apparatus, and should have a high efficiency. The reader's set produced all kinds of weird symptoms traceable to interference being pumped into one of the main tuning circuits. Incidentally, the set was unstable because the Extractor tuning condenser was brought very close to a point of the anode circuit of the first high-frequency valve.

Sometimes the layout is completely altered because the constructor wishes to use components other than those originally recommended. Even if the components themselves are satisfactory, the layout is altered and trouble may arise.

Effects of Stray Capacities.

A high-frequency choke, for example, when merely placed in the approximate position occupied by a much smaller choke in the author's own set, may result in poor reaction. This may be due to the large choke being placed too near earthed metal canisters (e.g. those surrounding coils). Sometimes a designer will use a small tubular fixed condenser and the constructor may promptly use a large mica condenser. In receivers of the gang condenser type, stray capacities are extremely important and changing of components or alteration of layout or failure to carry out the designer's instructions may result in an inability to gang the circuit. For example, a grid leak instead of being supported a short distance above a metallised baseboard may, by a careless constructor, be screwed down on to the metal. This may throw an added capacity across one section of the tuning condenser and prevent proper trimming.

There is nothing to be ashamed about in carrying out a competent designer's instructions. You cannot do better than follow these instructions even to the letter. An example of a constructor's originality is given in the following experience: A metal eyelet was provided on a screened H.F. choke for the purpose of earthing the can containing the choke. The component was to be mounted on a "Metaplex" baseboard,

and when the component rested on the baseboard there would be no contact between the "Metaplex" and the eyelet. The eyelet hole was intended to pass a fixing screw to hold down the whole component, and the constructor thought that the can would be properly earthed by simply screwing the component down on to the "Metaplex" board. Actually when the set was examined there was found to be no earth connection at all. A little thought will show that the screw would make a very uncertain contact with the thin skin of metal on the board, and quite possibly make no contact at all. If the fixing hole were made with a gimlet or bradawl, the metal surface would probably be cleared away in the vicinity of the screw. What the original designer had done was to fit a small piece of bare wire under the head of the fixing screw and to tuck it underneath the component; but the constructor knew better!

JEAN MELVILLE



Miss Jean Melville, the popular B.B.C. pianist, was one of the earliest broadcasters from Marconi House. She has a special aptitude for accompanying in vaudeville programmes and putting nervous artists at their ease.

THE SPIRIT OF AMATEURISM

(Continued from page 547.)

in treacle. Listeners' letters to the B.B.C. are the worst possible index. They represent a misleading minority—only a few who are profoundly stirred, either in favour or against, are enthusiastic enough to write about a show that died as soon as it was born and will never live again. And the producers tell me that if they get a hundred letters after a show it is phenomenal—100 letters from a potential public of 30,000,000!

Specially Trained Producers?

It may be, of course, that the B.B.C. are training a race of programme-producers who, in time to come, will be as professionally proficient as all the Cochranes and Kordas put together. Maybe. In that case, listeners must suffer for the sake of posterity. But if there is a School of Producers at Broadcasting House, who are

the Professors, and what are their qualifications?

I personally incline to another policy. I disbelieve in amateurism in anything but amateur pursuits. Broadcasting is not such. Broadcasting is a professional art: the supply of entertainment in return for payment. And in professional matters I am opposed to amateurism: the gifted amateur usually depreciates the standard of quality and depresses the level of payment—joint evils. For broadcasting I recommend the abolition of the policy and atmosphere of amateurism and the introduction of professional efficiency. Men experienced in producing entertainment good enough to stand the acid-test of the box-office should be introduced into the newer entertainment of broadcasting. And they should hold their jobs on a "get on or get out" basis.

The Listeners' Best Friend.

It is notorious in this country that the customer doesn't count, so there is nothing unusual in the disregard that is paid to listener-desire. It is my profound belief that the best friend listeners have is Sir John Reith, and that if his particular brand of intelligence, efficiency and conscientiousness was partaken of by all ranks of the programme staff, the spirit and standard of amateurism would vanish and B.B.C. programmes would be as excellent as B.B.C. organisation. It is because Sir John is never made fully acquainted with the voice of his democracy that the amateurs are able to "play theatres." I believe that it is possible for Jove, one day, to throw his thunder-bolts: for Sir John suddenly to descend in judgment on the spirit of amateurism and banish it into outer darkness for ever and ever. Amen!

THE NEW "UNIVERSAL THREE"

(Continued from page 551.)

first test place the speaker part in the cabinet and connect up with the chassis outside. It remains now to trim and get the set going. An ordinary mains power plug or electric light adaptor plug is fitted to the end of a double flex, the other end of which is connected to the plug which fits on the fuse box.

Then with aerial and earth connected and valves in position you can place the plug in the electric light point and switch on the set. If you are on A.C. mains you will hear some signs of life in about half a minute, but if on D.C. you may hear nothing at all, not even when you operate the on-off switch up and down.

Adjusting the Trimmers.

In such a case reverse the plug in the wall or the lamp-socket so as to get the polarity right. The set should now show signs of "life."

Having decided that things are "alive," switch off again and set the trimmers on the variable condenser so that they are about one turn "out." Then with a low wavelength station tune in, and trim so that the maximum strength is obtained. Check up the trimming on the long waves in the same way and then the set can be switched off again and assembled finally in the cabinet.

ELECTROLYTIC CONDENSERS

Jottings of interest to all.

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

ELECTROLYTIC condensers have increased in popularity and use very greatly in the past two or three years. They were first introduced about seven or eight years ago, but did not seem to "catch on" very much just then, partly because they were in rather a crude state, and partly because there was not the same requirement for them as there has been since all- mains sets became so general. Nowadays they have been improved out of all recognition, and can be said to be really reliable components.

They generally consist of a kind of dry cell, not unlike the single cell of a high-tension battery in general construction, the outer tubular case and also the central rod being made, however, of aluminium.

Wet and Dry Cells.

In one form of the "wet" electrolytic condenser the aluminium rod is connected to a spiral of aluminium foil, and this is immersed in the liquid electrolyte, this electrode being then "formed." This "forming" is somewhat similar to that which takes place in a lead storage cell, and consists in the formation of a layer of oxide on the surface of the electrode.

The result is that when a voltage is applied to the condenser, current is unable to pass one way, but a very high electrostatic capacity is built up. The secret of the very high capacity of an electrolytic condenser is the extremely small distance of separation of the conducting surfaces forming the condenser. One of the conducting surfaces is formed automatically against the aluminium foil and the distance separating them is far smaller than we could ever achieve in a normal mechanical construction. The condenser is sealed up to prevent the liquid from escaping, except for a small valve which enables any gases, given off during the operation of the condenser, to escape. The liquid condenser must be used in an upright position.

Importance of Polarity.

But just as we have a "dry" cell for battery use, so we can make up the wet electrolytic cell above mentioned into a "dry" form by the use of a pasty electrolyte instead of a liquid one. The "dry" electrolytic condenser can be used in any position.

A great point to note about the electrolytic condenser, and in which it differs fundamentally from ordinary paper or mica condensers, is that it must be used with a definite polarity. D.C. voltage must not be applied to it the wrong way round, nor is it suitable for alternating voltages.

The electrolytic condenser is an immense help to us where large capacity condensers are required for smoothing or other purposes, as it gives us a capacity which may be dozens, if not hundreds, of times as great as that of an ordinary type condenser of the same size.

Radio Guides Aircraft.

An interesting and important use of wireless in connection with aircraft has been

made at the new aerodrome outside Liverpool. Beacon equipment has been installed by the Marconi Company, operating on a medium wavelength, so that an aeroplane approaching the aerodrome will be able to make use of the radio beacons so as to be guided along the proper approach to the 'drome even at night or in a thick fog.

Overhauling the Aerial.

This is a good time of the year to overhaul the aerial and earth. The earth, as a matter of fact, is more likely to need overhauling in the summer because the ground gets dry. If you find that reception on your set is getting a bit "far away," it is quite possible that it is due to the efficiency of the earth diminishing owing to bad contact with the dry ground.

You can very easily tell if this is the case by digging a slight hollow around where the earth goes into the ground and pouring two or three buckets of water into this. You can do this whilst reception is actually taking place in the evening, and note if the loudness of reception is increased. If you like to put a pound or two of calcium chloride around the earth, it will be a good thing, as it will help to attract and retain moisture for a long period. This, in fact, is the principle of the various so-called chemical earths which are now so popularly used. Different kinds of deliquescent (water-attracting) salts are used, but the principle remains the same.

Clean the Insulators.

As regards the aerial, this should be lowered to the ground and then the various insulators examined and cleaned. Before an aerial has been up very long the insulators generally get covered with grime and soot and various other things which act as quite fair conductors, sufficiently good conductors to reduce the signal strength quite a bit. You may find a porcelain insulator cracked; if so, it should be replaced with a new one.

Corroded Wires.

Another point to look for in the aerial is any broken or partly broken wires. It may be that the weather has corroded the wires, or in some cases the aerial may swing against the corner of a wall, or something of that kind, and the wires will be chafed. If the wire is really badly corroded and has become "rotten" (which you can easily tell by giving it a few slight bends), it is better to replace it with an altogether new wire. In fact, many amateurs adopt the plan of replacing the aerial wire completely once a year, and a very good plan it is.

Finally, if you have an outdoor earthing switch or lightning protector, this should be carefully examined, and any dirt or soot should be removed from it, otherwise it acts as a partial path to earth for the incoming signal energy.

Handy Measuring Instruments.

The proper way to measure resistances is, by means of a bridge, but a simple,

(Continued on next page.)

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ELECTROLYTIC CONDENSERS

(Continued from previous page.)

rough-and-ready way to measure them is to apply a known voltage and to read the current which it produces. This is sometimes useful when you want to check up the value of a high resistance—say, 100,000 ohms. If you have a fairly accurate-reading milliammeter, all you have to do is to put the meter in series with the resistance and with a battery of, say, 100 volts, and then read the current. The internal resistance of the milliammeter can be neglected in comparison with the resistance which is being measured. If 100 volts gives a reading of 1 milliamp, then the resistance is obviously 100,000 ohms. If 100 volts gives a reading of 10 milliamps, the resistance is 10,000 ohms, and so on.

A point to watch, however, is that the current should not be kept on for more than a few seconds, because it is quite possible that the resistance is not intended to carry that amount of current; in other words, it is not intended to have such a high voltage applied to it. But it will not take you more than about a couple of seconds to notice the reading.

Battery Voltages.

In a similar way, if you want to tell the voltage, say, of a high-tension battery, and you have no suitable voltmeter, but have a milliammeter and a known high resistance, you can find out the voltage by connecting the three in series and reading the current. In the above-mentioned case, if you happen to know that the resistance is 10,000 ohms and the battery (of unknown voltage) connected to this gives a reading of 7 milliamps, then obviously the voltage of the battery is 70 volts. Again, you should connect only for a very short time, just as long as is necessary to take the reading.

Visual Tuning.

Visual tuning indicators seem to be getting quite the fashion. For a long time past manufacturers have made efforts to improve the tuning scale, which is a very good scheme. After all, the tuning arrangement is the "face" of the receiver, and is its most conspicuous feature. Not only this, but it is probably the most important feature so far as the ordinary user is concerned. It is only natural, therefore, that it should be made as good-looking and efficient as possible.

It is curious how opinion has varied during the few years of broadcast reception on the question of the number of controls that ought to be included on the front of the set. In the early days the set was plastered with controls of one kind and another. Then there came a swing of the pendulum, and the thing was to have practically no controls. Now there is a tendency for things to turn the other way again, and for more controls to be made available to the operator.

The Question of Controls.

Personally, I think that it is a good thing to have some of the controls on the front of the set, because I think the technical sacrifices which have to be made to reduce the whole thing to the minimum of "on-and-off knob" are too great.

Anyway, the visual tuning indicator, to show when the set is accurately tuned, seems to have taken on with the public and has come to stay.

WHAT READERS WRITE

(Continued from page 552.)

MY FIRST HOME-MADE SET.

Sir,—The biggest thrill I had was when I built my first set. It was a "one-knob" set, designed by Mr. Scott-Taggart, and called the "Solodyne." I had in use at the time a four-valve set with moving-coil reaction plus bright emitters, the valves being the only things bright about the set. So I resolved to make *my own*.

Bit by bit I began to buy the parts for my do-or-die set, wiring them up as I bought them, until the last part was fixed in its position. The old set was on the second floor, my workshop at the top of the house. It was getting late at night; I wanted to get the new set working that

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night—who has not had that feeling? I had finished the set as required, extended the aerial up to my workshop, using an old iron bedstead for the earth, connected all batteries up, turned dial, and lo! out of the speaker came sweet music! And was it so to me? Why, I did a dance around my workshop with joy. Called everyone up to hear it; they were as thrilled as I was. I have been in the game ever since that memorable night when *my first set worked*. My present set is a superhet, which I intend to alter after the lines of K. D. Rogers' "All-Wave" superhet.

Yours truly,

W. H. Williams,

Happy Valley Lodge, Marmi Drive,
Llandudno, Carnarvonshire.

HOW A READER STARTED.

Sir,—You'll have to increase your staff to deal with the correspondence you are going to receive on this subject of Radio!

I lived in a small village when broadcasting began as we know it. I didn't believe half the yarns then told until a friend happened along and with him a copy of POPULAR WIRELESS, and what appeared to me to be a very puzzling assortment of components. Well, that was Christmas, 1923, I believe. The receiver—a single valver—can't think of the name. Anyway, I was invited to help knock it together and fathom out "which was which" among the gear before us.

It took us quite a time, for we sort of had to decipher what things were. Anyway, we got the set finished after working days and nights on it. Then the "big" moment. Would it work? It did. And after my friend had got over the shock we had to invest in a fresh valve and square the thing

up generally. What was the shock? Well, reaction was on at its peak and the ear-splitting noise that set made caused my partner to leave his chair very hurriedly, and being hitched up, as it were, by the headphones, the whole contraption went with him.

This receiver later brought in K D K A, Pittsburgh, and my friend still has the sheet of programmes, for one year, sent to him by the director of that station.

I've built scores of "P.W." receivers, not for myself so much as for others. I've enjoyed every moment spent on my hobby.

Yours truly,

William Townhill,

58, Derbyshire Avenue, Stretford,
Manchester.

THE B.B.C.'s NEW STATIONS

(Continued from page 539.)

West. I have mentioned this in a preceding article.

The idea is, in brief, to turn West Regional over to Welsh, and to give the West Country folk a whole-time English programme from Plymouth Regional—a station having a power of perhaps 20 kilowatts or more. With an additional relay on the same wavelength at Bristol to serve the parts outside Plymouth's service range.

THE NORTH WALES RELAY.

Filtering through International Broadcasting Union's reports, we discover that a site has also been practically settled for the North Wales relay. It will be somewhere around Beaumaris, Anglesey. An odd choice, at first sight, yet when one looks at a map and remembers that wireless waves travel much better over sea than land, the choice is very sensible.

Signals will radiate right along the North Wales coast, serving the densely populated areas such as Llandudno, Colwyn Bay, and Rhyl. The B.B.C. aims, in fact, to cover the waterfront up there!

Only a 5-kilowatt transmitter will be put up, because it will have to work on the same wavelength as West Regional.

Fortunately, the Snowdonia range comes between Washford and Anglesey, effectively blanketing the higher power signals from the area it is proposed to serve with the new low-power station. Indeed, it is partly because of this mountainous range that another Welsh station is so essential.

FURTHER SITES UNDER CONSIDERATION.

At the moment that about exhausts the new stations in hand or on the *tapis* at Broadcasting House. But, looking only a little way ahead, we may expect decisions to be taken on still more sites. One for East Anglia—somewhere around the Norwich district. Another for the South, to take the place of Bournemouth. Suggestions have been made that Southampton would be about the right point—but it may be farther east.

Why, it may be asked, do these new stations have to wait upon each other? Why not go ahead simultaneously? The answer is twofold: the engineers are only human, not robots; and the B.B.C.'s money bags simply would not stand the strain of multilateral development.

Patience, my masters, is still a virtue.

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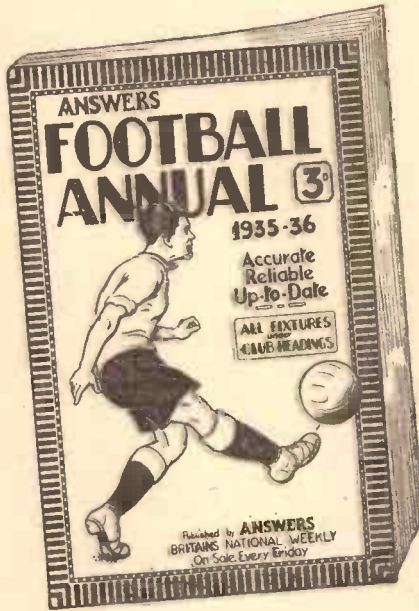
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