WIRELESS & TELEVISION REVIEW

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All Star Contents

8 PAGES OF PHOTOGRAVURE

Contents

As some of the arrangements and specialties described in this Journal may be the subjects of Letters Patent the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

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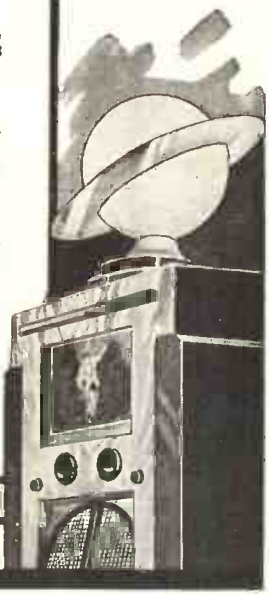


WIRELESS and TELEVISION REVIEW

The Roberts Four—A Sensitive Single-Valver—The "Speedy-Right" System

WHEN you have carefully examined this number of "Wireless and Television Review" you will be able to appreciate that, despite the great improvement of the paper on which it is printed, and the consequent superior reproduction of the text and illustrations, and the considerable increase in the number of pages, the original "Wireless," which so many tens of thousands of you have supported in the past, retains its essential character and individuality.

Bigger and Better

But we trust that you will be able to visualise the potentialities which these superior facilities provide for future developments. The previous space and printing restrictions have been removed, the scope of the magazine has been vastly widened, and we are determined to take full advantage of these facts.

This present number should serve to indicate the way in which we are going to work to make "Wireless and Television Review" increasingly better as well as bigger.

As will be seen, the constructor is offered a most interesting variety of designs. Dr. J. H. T. Roberts contributes his second great set. Dr. Roberts is to-day probably the most widely read of all radio physicists among trade and scientific circles. His practical and scientific electrical and radio training includes years of work (in the Cavendish Laboratory with Lord Rutherford), and he has also been employed in important executive positions by the British Admiralty, although he is still only forty years of age.

A New Short-Waver

Dr. Roberts designs sets exclusively for "Wireless and Television Review," but his national and international activities of necessity must render these expressions of his inventive and designing genius comparatively rare events. His Roberts Three was one of the two most popular designs of its period. His Roberts Four should prove even more successful.

Secondly, we have G. T. Kelsey, whose reputation for short-wave apparatus is world-wide. Since he invented the adaptor principle, probably several millions of short-wave and other adaptors have been built at home and abroad. He has produced a typically original set for this issue, a short-wave set incorporating really effective H.F. amplification and a marvellously smooth reaction control.

For the more experimentally inclined constructor we offer H. A. R. Baxter's super-regenerative set, which, although it employs only one valve, has an almost incredible sensitivity.

Special Survey of Commercial Sets

The world's most popular and highest paid radio engineer and writer is also to be found in our unrivalled team of contributors. Of course, we refer to John Scott-Taggart, who has weighed in with a brilliant article on the subject of Death Rays in addition to his usual features.

Our art photogravure supplement is devoted to a fascinating survey of the leading commercial sets, and complementary with this we have a special feature, "Looking Inside," in which outstanding sets are interestingly dissected and the intriguing secrets of their "innards" revealed.

As in all other aspects, we are able to claim that even in connection with the Italo-Abyssinian War we are uniquely placed and are able to provide exclusive information regarding radio "at the front," for we have our own correspondent actually on the spot!

HIS NEW MASCOT

Leonard Henry, the popular broadcaster, in a characteristic attitude. The microphone is a new mascot which he has had made for his car, and is an exact replica of a B.B.C. mike

Look Out for This

And what of the future? Obviously, we cannot disclose all our plans, and in any case to do so would remove that pleasurable element of surprise. However, we will conclude with a few words about just one of the special features of the December "Wireless and Television Review."

In that issue you will find full details of our new and quite original "Speedy-Right" system of fault-finding, which will be applicable to all types of sets both home-made and factory produced. Hitherto, fault-finding has been dealt with either somewhat superficially or in a manner comprehensible only to the advanced experimenter or professional service-man.

But two of the members of the "Wireless and Television Review" Research Staff have developed a method which enables every listener and constructor to become his own service-man. With the aid of the "Speedy-Right" system the quick location and remedy of faults become really simple. THE EDITOR.

Wireless & Warfare

REVELATIONS DRAWN FROM YEARS OF FIRST-HAND EXPERIENCE OF EAST AFRICA AND MILITARY RADIO

UNDERLYING the shattering explosions of bombs from the air and the thunder of guns which are booming through the Abyssinian ravines and valleys, an intangible, invisible force is continuously at work co-ordinating these terrifyingly potent machines of war.

Keeping in Touch

Silently and unseen the radio waves flash through the ether, linking field forces with headquarters, aeroplanes and tanks with battery commanders, supply depots with advanced units; a medley of thousands of communication channels all less tangible than the air itself and each as reliable as though an unbreakable wire ran from point to point.

Wireless is the most vital factor of any modern, mechanised army. It constitutes its nervous system and with its aid the whole of an expeditionary force, with its innumerable departments, becomes one entity, as manageable as a single unit and with the increased destructiveness which comes from scientific co-ordination. No section of it is isolated, the brains of the supreme command can operate through an uninterruptable network.

Wireless enables the generals to play their armies with the close contact that a draughts player has with his draughts. Before the introduction of wireless such a three-point attack on Abyssinia as has been made by the Italians would have been quite impossible. The three attacks could have been launched, but only by separate and independent armies, communication between them being by such uncertain means as pigeons and human messengers.

Cable connections could be used to some extent, and are in fact being widely employed in Abyssinia at this very moment. But cables can be cut and, in any case, the difficulties of laying them across hundreds of miles of mountainous country, much of it perhaps in the hands of the other side, would be colossal, and they could not keep pace with the mobility of a modern army campaigning in such terrain.

Planes and Tanks

The Italians are also making great use of wireless for artillery observation. In this way, aeroplanes are enabled to act as range correctors. Flying in a closed circuit immediately above the target the observer in the aeroplane can see exactly where the shells fall. By means of a simple code he wirelesses back the information to the batteries in action and the guns are then corrected until a direct hit is registered.

Aeroplanes on reconnaissance duty find wireless extremely useful, for messages regarding enemy troop movements and so on can be flashed back to headquarters immediately. And in the other direction, instructions can be wirelessed from the ground to aeroplanes in the air.

Tanks carry wireless installations, too, and so a line of these sinister engines of war can be commanded from a vantage point by an officer just as though he were giving instructions to a line of troops on parade. And just as the commander of a formation of 'planes can speak by wireless to the members of his formation and order their manœuvres, so can a team of tanks work together by wireless under the leadership of the one.

The Main Station

Wireless has even revolutinised guerrilla tactics, for separate small units can be spread over large areas and all be kept in close contact by means of compact portable wireless outfits.

Indeed, to catalogue all the uses to which wireless is put in a modern mechanised army such as that of the Italians would occupy a considerable amount of space.

The Abyssinians are not at all well equipped with radio. They have a

SELLING CLOTH IN AN OPEN-AIR MARKET

A typical peace-time scene in one of the open-air markets in Addis Ababa

in Abyssinia

A TOPICAL AND INTENSELY INTERESTING ARTICLE

By Our Special Correspondent

small number of ground stations which are being used purely for communication purposes and, of course, the moderately large station at Addis Ababa is the main channel of communication with the outer world. By the way, it is an interesting commentary on Ethiopian mentality that even though this station is simply snowed under with work it closes down every night at nine o'clock, just as it used to do!

The Blue Nile

Abyssinia is not a country as westerners understand it, but a dark-skinned and, in many ways, a darkly-mysterious empire embracing all manner of shades of civilisation from sheer savagery to high grades of culture.

I have taken coffee with an Abyssinian in Shepheard's Hotel, Cairo, and discussed art, literature and science with him and felt quite small beside such a wealth of polished learning; while, on the other hand——

One day a few years ago I crossed the frontier of Abyssinia in a motor-boat and followed the course of the Blue Nile almost as far as Lebu, where the river winds its tortuous way through mountainous, broken country. No greater contrast could be conceived than that which exists between this and the undulating desert regions of those parts of the Sudan which I had passed on my journey.

An Unknown Voice

As far as one could see in any direction there were great masses of hills, rugged and irregular as though the whole of the surrounding land had been thrown up into vast disorder by terrific earthquakes.

I was all alone; in the boat was a small radio outfit and I must say right away that the reception experiments I was going to carry out had nothing at all to do with the present international complications. It was purely and simply an exploration of the ether conditions of this strange and forbidding area.

Late in the afternoon, but while the sun was still fairly well up in the sky and the heat was still intense, I landed at a convenient point and erected a short mast. It was about twenty feet high, a rather cunningly devised collapsible affair.

I chose a spot where I could also camp. Three previous nights I had camped out solitarily and without seeing a single human being. It was a splendid site, a small sandy stretch like a tiny plateau standing well above the river.

Within an hour I had the radio outfit working, a simple three-valve arrangement with headphones. The atmospherics, as is nearly always the case in these regions, were extremely bad. There was such a crackling in the 'phones that I at first thought that all signals would be drowned.

However, the transmission which I had set out to pick up came through above the sullen roar and I was able to make all the required observations. But, later in the day, I heard another station not so very far away. A telephony station, but the quality of it was so poor that I could not distinguish the language in which the messages were spoken.

It was not Addis Ababa, of that I was fairly certain. Was it a secret Abyssinian outfit? Or a mobile Italian? I didn't know.

A Visitor Arrives

My period of listening concluded, I opened my box of food supplies and after a jolly good meal I lit a cigarette and once again, this time quite idly, put on the telephones and swung the dial round.

Suddenly I became conscious that I was being watched. Perhaps I had heard a slight sound. Anyway, I knew that there was danger stealing up from behind and the short hairs on my neck bristled as I broke out in a cold sweat.

THE ETHIOPIAN EMPEROR'S PICKED MEN

Soldiers of the Abyssinian Imperial Guard watching and waiting for an attack. The Imperial Guard is the only body of paid regular soldiers in the country and normally has a strength of about 7,000.

I was all alone in a strange, wild part of Africa, and to this day I shiver when I remember the tense moments which elapsed before, finally, I plucked up enough courage to shift my position and turn round. And then my heart bumped right into my mouth.

Almost standing over me was a huge black man wearing a dirty white robe and carrying a long spear. I felt just as a mouse might be supposed to feel when a huge tom cat suddenly materialises above it.

Some Nasty Moments

If this were one of the dreaded Danakils, I knew I should be lucky not to "vanish without trace."

For about five minutes the giant, or so he appeared to me from my sitting position, stood there silently just watching, and you can imagine my feelings. You know how they say that if you are caught by a lion the animal will make no move so long as you keep absolutely still. That was the principle on which I was operating! Unfortunately, my right leg, which was twisted rather uncomfortably, developed cramp, and so I had to chance it and move my position. And as the black stepped back as though politely to give me more room, the situation then lost some of its strain.

"Lil-tak, Saida!" I said boldly, and as the man accidentally kicked over a tin of peaches as he backed farther away, "Malaach ia habibi," I added, which is a somewhat affectionate way of saying "never mind" in Arabic.

A Surprise

But, apparently, he could not understand. He merely shook his head, but to my terrific relief revealed that his intentions were quite friendly by grinning broadly. And he grinned still broader when I gave him a cigarette which he carefully tucked away somewhere under his robe.

Laying down his spear he squatted beside me and inquiringly tapped the headphones, which were now hanging round my neck. I lifted them on to my ears and made the sort of grimace I thought might convey the impression to him that I was hearing things.

NATIVE'S FIRST TASTE OF RADIO

The mystery station was working, but I couldn't make anything out of it. I took off the phones and held them out to the black man. He looked at them very closely and suspiciously, but eventually tried to put them on. I had to help him to do that.

And then his eyes goggled and his great mouth opened in astonishment. For about half an hour he sat there listening intently. To this very day I am not sure whether his amazement was due mainly to the mere fact of hearing sounds coming from out of space or whether he could actually understand what was being said by that station.

The conclusion of the adventure is quickly told. When he had taken off the phones he made signs for me to stay where I was, and it was obviously his intention to fetch others to listen in.

But I did not stay. As soon as he was out of sight I quietly gathered all my gear together, packed it on to the boat, and made my way down river just as fast as the vessel would carry me!

The Second Visit

About a year elapsed before I again penetrated into Abyssinia. This time it was in no unorthodox or clandestine manner. I took the train from Duanle, close to the frontier of British Somaliland, to the Ethiopian capital Addis Ababa. But I presume all my readers will already have read as much as they want to read about that particular place.

Even then, and that is a year or two ago, there was a great deal of discussion in the town about the possibility of trouble with Italy. There was also talk about trouble with Great Britain—and that will surprise you, I expect.

This was what I heard in the native cafés, it must be noted, and there were only veiled hints on the part of any of the officials I met. Apparently there had been considerable trouble between certain of the tribes in the East and British subjects on the British Somaliland borders.

Seemingly the tribes concerned included the Danakils, which mostly people the north-eastern deserts and are an unsubdued, intractable, and altogether rather nasty bunch. I even heard talk of really hard and prolonged fighting in those areas in which both armoured cars and bombing aeroplanes had been used by the British. In reality they may have been only skirmishes, but as they were recounted to me by Abyssinians, one could have assumed them to have been slices of first-class warfare.

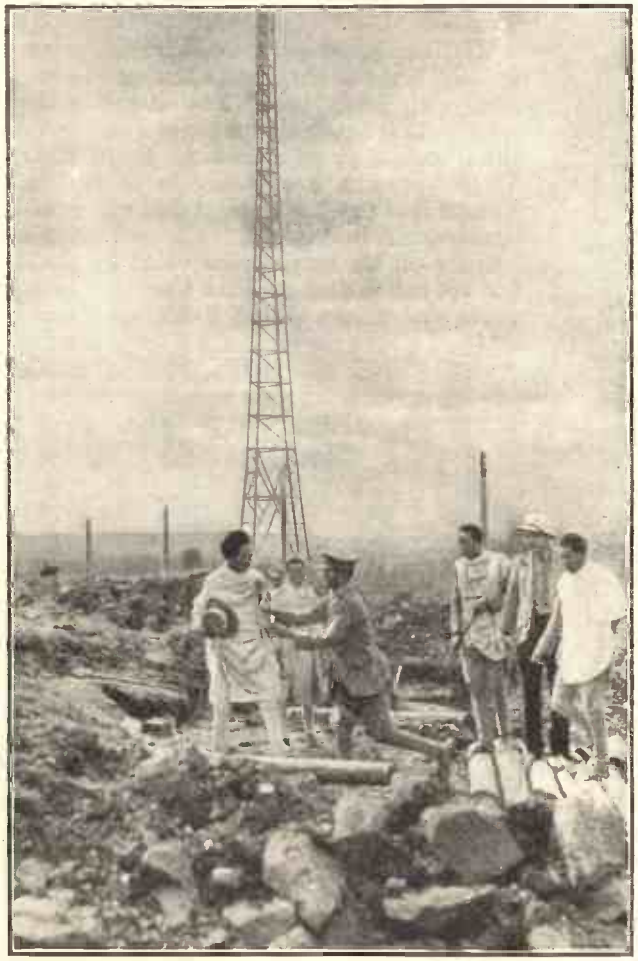
The War Drums

But rumours fly round the Ethiopian Empire as quickly as the drum-beats are relayed. In my opinion, the drum telegraph is somewhat over-rated. That is, judged as a line of communication.

I once heard the drums west of Sasa Baneh. They make the blood tingle, I can tell you. Dub! Dub! Dub a-dub! Dub! Dub! Dub!

(*Please turn to page* 287.)

PREPARING FOR AN AIR ATTACK



Abyssinians making a start on building a bomb-proof shelter near the Addis Ababa wireless station. Great secrecy was observed in the work, and a photographer who attempted to take pictures was stoned by the natives and seriously injured. In this photograph a native is being warned off by one of the soldiers. Note the wireless mast in the background.

How I Became "STAINLESS" by STEPHEN

The popular broadcaster who writes the special article on this page.

In this article you are told something about Stainless Stephen, the comic broadcaster, by himself. He tells you in an entertaining manner about his early career, his real name, and how he came to choose his microphone title.

TOWARDS the end of last summer I was motoring up to London for Radiolympia. It was an all-night drive and I started from Lynton, in Devonshire, where I had been holidaying. At Andover I came across the scene of an accident. The road was smothered with splintered glass, and a mangled motor-cycle was entangled with the hedge at the side of the road. It all looked pretty grim and, curious to know what had happened, I got out of my car and asked a policeman for details.

Recognised!

I was relieved when he assured me that no one had been hurt.

"Miraculous escape!" he muttered. "Most miraculous escape. You see——" And he proceeded to describe the accident in the tedious but familiar "he-was-trying-to-overtake-and-the-other-fellow-came-out-of-a-side-turning" manner that generally leaves the hearer more bewildered and less enlightened than before.

"But," he added significantly, "'e didn't stop! Would you believe it now? 'E didn't stop—and there was the other pore feller picking hisself up orf the road. But I saw 'im clear as anything, and I'd know 'is face agen——"

Suddenly he broke off and stared at me with great intensity. Did he think I had been mixed up in it? I made some comment and a look of recognition lit on the policeman's face at once.

"You're from Sheffield!" he told me unnecessarily.

"How did you know that?" I asked.

"Your accent!" he vouchsafed tersely. "And," he added, with some emphasis, "I'll tell you another thing."

"Oh! What's that?"

"You're Stainless Stephen, aren't you?"

Exclamation mark.

Well, it is certainly very pleasing to be recognised by one's voice, during the excitement of a road smash, at dead of night and miles from anywhere! It is gratifying chiefly because it confirms my long-held belief that radio humour can be put across successfully if the artist distinguishes himself by some peculiar quality of voice.

Many artists, like Bobby Howes, perhaps, and Jack Buchanan depend very largely upon their visible personalities; the broadcaster, however, is obliged to compensate for this loss by lending a very definite distinctive quality to his expression. But I also believe that a humorist can gag most effectively only when his personality is being observed; that is why, in my opinion, it is advantageous for a broadcaster to have a studio audience in addition to his vast unseen one.

A moderate degree of common sense will immediately suggest to you that, despite the hereditary nature of lunacy (and the very strong evidence of parental insanity in myself), my parents did not actually christen me "Stainless Stephen."

My real name is quite prosaic—Arthur Clifford. But I have also been called Brainless Stephen, Seedless Raisin, Painless Measles, Shameless Satan and Senseless Reason—in addition to various unprintable designations.

"My Voice Broke"

When I was a small boy I sang in the choir until my voice broke—an event received with much appreciation by the congregation; but the process of breaking has been sustained indefinitely and I have not yet emerged with a normal, hundred per cent voice.

In 1914 I enlisted with the Yorks and Lancs Regiment and was twice wounded; after demobilisation, in 1917, I toured the music-halls as Arthur Clifford—as Arthur Clifford comma, comedian, question mark, deriving this "punctuation" style of humour, which has since become so popular, from my experiences as signaller during the war, when I was obliged to articulate these signs while transmitting messages.

This brand of humour with which I am now identified has been copied by a famous team of American humourists, various British variety actors, and, unconsciously, by a distinguished naval historian, who, at his first broadcast, became nervous and began to say "full stop" at the end of his sentences.

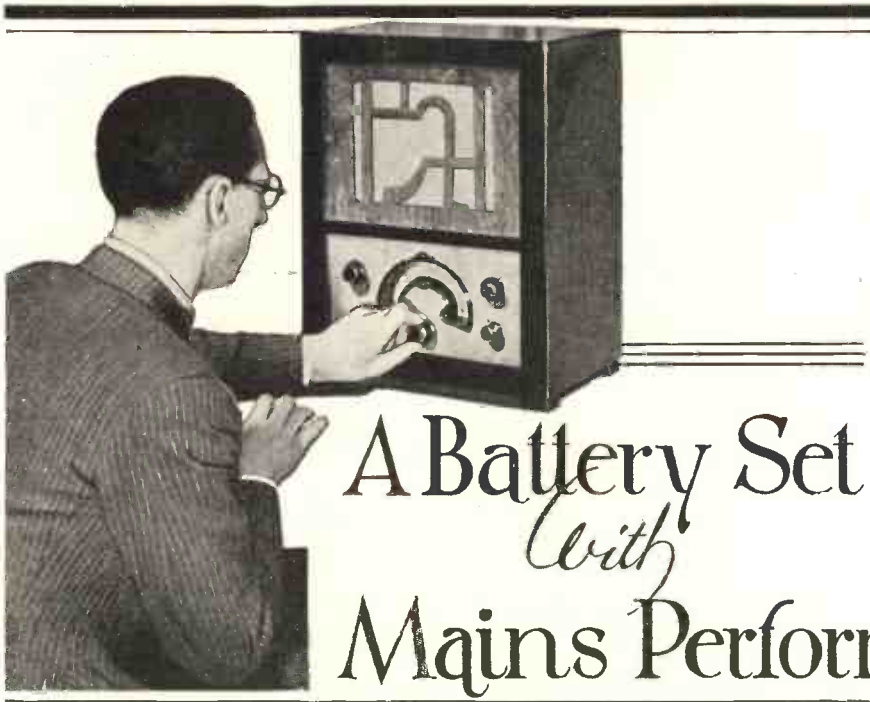
An Early Broadcaster

A good deal of my patter is spontaneous and unpremeditated; I like to be left quietly alone for a minute or two before my act. That enables me to prepare the opening remarks, and the rest flows on automatically.

I first broadcast in the very early days of radio—in January, 1924, soon after Norman Long and the late John Henry had established themselves as

(*Please turn to page* 236.)

The ROBERTS



A Battery Set with Mains Performance

SOME months ago, as many of you will remember, I was asked by the Editor of WIRELESS AND TELEVISION REVIEW to design a three-valve receiver; in this every known device, or artifice, if you like, was applied so as to get the absolute maximum possible out of three valves. The reason that no more than three valves were allowed me was that the set was to be primarily *inexpensive;* that was the first and paramount consideration. You might have thought that, by the same token, I should have been limited to *less* than three valves; but I think, with all respect, that three valves was the minimum with which a really first-class and up-to-date set could be produced.

Wonderful Results

The set which was then brought out was called after me and I had the gratification of receiving a large number of letters from readers of this journal, from all parts of the country, and quite a number from other parts of the world, telling me of the wonderful results which they had obtained with it.

Those of you who have ever set to work to design a radio receiver will, I am sure, appreciate my feelings on this point. There are so many different ways in which almost every part of the circuit can be arranged and such a multitude of components available, that it is a matter of great difficulty to make decisions. On top of all this, the radio public, and particularly the army of radio constructors, are by now so well up in the science, so expert, in fact, that one has a very critical audience to cater for.

★

"A WONDERFUL DEGREE OF SELECTIVITY CAN BE OBTAINED, WHILST ON POWERFUL STATIONS THE OUTPUT VOLUME OF THE SET IS VERY LARGE. SOMETHING LIKE 2,000 MILLIWATTS IS AVAILABLE WITHOUT DISTORTION, WHILST THE AVERAGE ANODE CURRENT IS A MERE 10-12 MILLIAMPS AND THE STATIC CURRENT ONLY 7 MILLIAMPS."

★

They have all kinds of different opinions as to different points in the design of the receiver, and it is a matter of no small anxiety for the designer trying to estimate what will be likely to please, or even to satisfy, the majority of his followers. He may as well recognise at the outset that it will be quite impossible to satisfy them *all*, and he must use his judgment and his experience of their views (gained, in my case, from a considerable correspondence over a number of years) to guide him in estimating the wishes of the majority.

I confess that when the three-valve set was launched I had misgivings as to how it would be received by some sections of radio constructors—and it was, therefore, with great pleasure that I learned, very soon after publication, how well it had been received.

Evidence was soon forthcoming that a large number of constructors had been so intrigued with the points of the design as to go to the trouble of making the set. In due course, reports came in that amazing results had been received on the set and quite a number of readers praised it in terms which even I found it hard to believe. One reader, I recollect, told me that his wife was going to divorce him if he didn't come away from the set and take more notice of her!

Well, now I have designed another set, this time with four valves. I feel that when this new set is launched it will meet with the same approval as the last: I earnestly hope it will not lead to any domestic discord or separate husbands from wives!

Already Proved

It is no harm to say that the new set is better than the old one, because obviously one can do much more with four valves than with three. I believe that this new set will prove extremely popular. It has already passed unscathed through the hands of the technical staff of WIRELESS—probably the most critical set of radio technicians in the country. Not only that, but by reason of their long experience they have their finger on the pulse of their readers to an almost uncanny degree. *They* have O.K.'d this new four-valve set and so I feel sure that *you* will do likewise.

FOUR

Readers will remember the famous "Roberts 3" designed by our Scientific Adviser and published in "Wireless" some months ago. A large number in all parts of the world made that set and wrote in praise of its wonderful performance.

Dr. Roberts has now designed a 4-valve set which far surpasses that remarkable three-valver, and in these pages he tells you all about it.

THIS SET MAKES RADIO HISTORY. YOU WILL WANT TO BUILD IT!

Dr. Joseph Harrison Roberts, F.Inst.P.

Now that I have made my apologies for adding yet another receiver to the list, and for inviting you to build it, let me give you a very brief idea of the technicalities of the set; the detailed technical description follows later on.

The Valve Sequence

You will see from the circuit diagram that it uses one high-frequency amplifier, detector, and two low-frequency amplifiers. One of the first considerations is to give the maximum of *selectivity* and yet at the same time to preserve the *quality*, and for this reason I decided to use a band-pass input to the first valve, which is an H.F. pentode. For the same reason, that is, to obtain selectivity and also to aid stability, I have used high-frequency transformer-coupling between the H.F. pentode valve and the detector.

Whilst still dealing with the high-frequency stage, I should also mention that I have taken special precautions to avoid the overloading of the detector on strong signals, which is often such a drawback with relatively small sets. The screen-grid is of the variable-mu type and so permits of pre-detector volume control. Another point which makes for stability is the metallised baseboard, which I used in the previous set, and also the shielding of the coils.

For the coils I have chosen air-cored Wearite coils which I have found to be very efficient. These coils contribute greatly to the selectivity and also to the sensitivity of the set.

H.F. Filtering

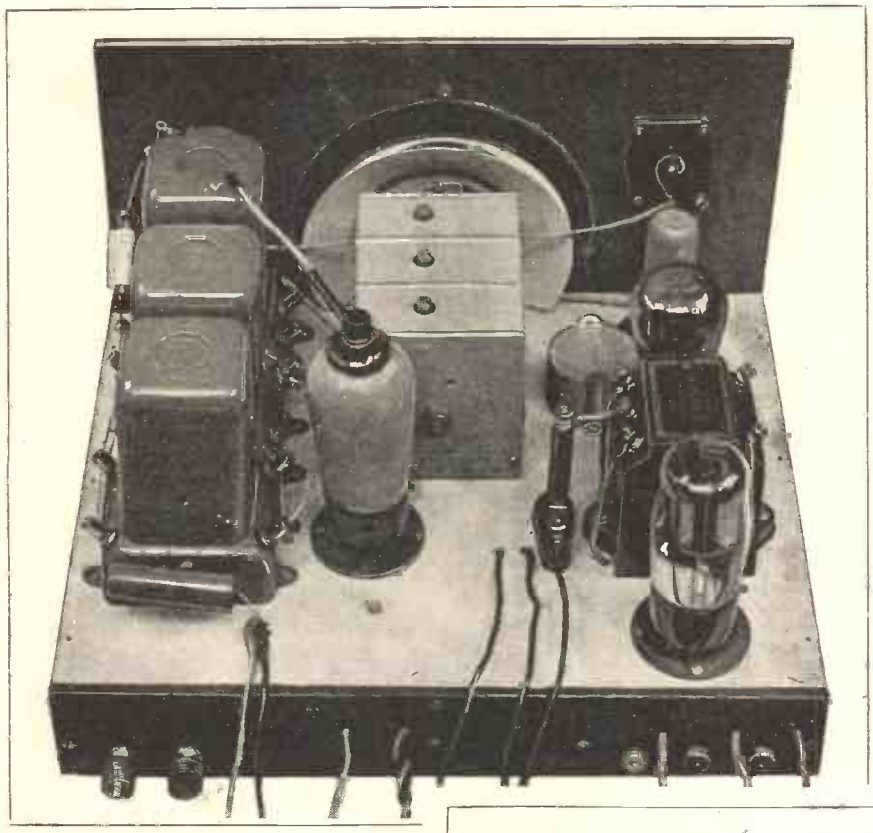
As regards reaction, most of you know the complications which are apt to arise unless it is used with discretion. In this set I have avoided the use of a differential reaction condenser by connecting a suitable fixed condenser from the detector anode to earth. High-efficiency H.F. filtering and rectification are obtained throughout a considerable waveband, irrespective of whether the reaction is used or not.

The next question which had to be decided was the type of detection to be used. Anode-bend rectification was, of course, considered. It has, as you know, the advantage of smaller damping on the grid circuit. But as the set is so extremely sensitive, this is not really necessary, and I decided for leaky-grid detection.

The coupling between the detector and the first low-frequency amplifier was the next step and here, as you see,

TWELVE OUTSTANDING POINTS

1. Perfect Tone
2. Finest Selectivity
3. Amazing Sensitivity and Range
4. Tremendous Power
5. Single-Knob Tuning
6. Distortionless Volume Regulation
7. Small Current Consumption
8. Inexpensive
9. Easy to Build
10. Easy to Operate
11. Handsome Appearance
12. Accurate Wavelength Calibration



I use resistance-capacity-coupling with a grid-stopper in the lead to the grid of the first low-frequency amplifier.

Double-Pentode Output

The output valve is a double pentode, a Q.P.P. valve which, whilst only consuming a relatively small amount of H.T., gives a very large undistorted output. This valve is a great improvement on the earlier Q.P.P. valves. The earlier ones needed a good deal of trouble spent upon them in the way of matching, whereas these latest ones are already matched by the makers. This is a very great advantage and is one of the reasons why I chose this particular valve for the output stage. I enlarge on this point in the technical description following later on in this article.

" THE OUTPUT VALVE IS A DOUBLE PENTODE, ONE OF THOSE Q.P.P. VALVES WHICH PROVIDE SUCH A LARGE OUTPUT POWER WITH SO LITTLE AVERAGE CONSUMPTION OF H.T."

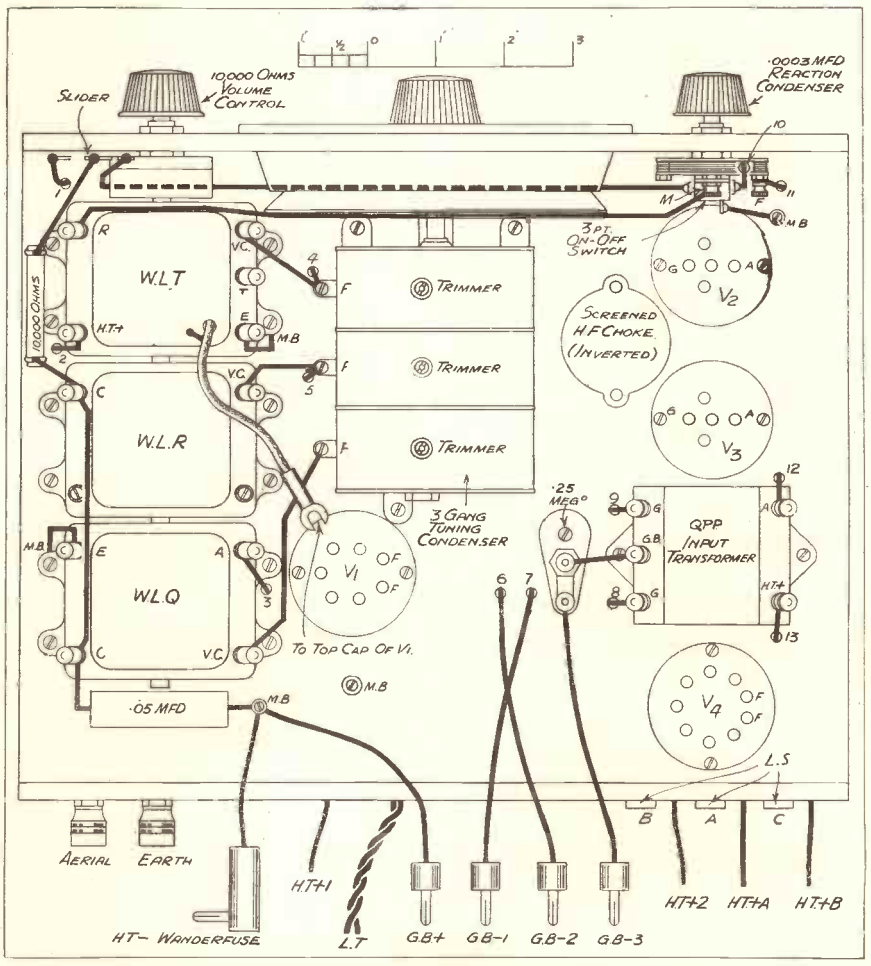
The set is built, as already mentioned, on a metallised baseboard, and this is supported on runners, everything being done to make the whole chassis as simple as possible in construction. The whole of the " works " can be slipped quite easily into the cabinet in one lump and the batteries are very conveniently placed out of the way behind the loudspeaker.

The cabinet is of the consolette type with the loudspeaker above the radio chassis. The Q.P.P. output which I mentioned is very important in that it conserves high-tension current and so adds greatly to the life of the H.T. battery.

" THERE IS NO NEED TO MATCH THE OUTPUT VALVE AS IT IS ALREADY MATCHED BY THE MAKERS."

As, however, I give full technical details and directions for the making of the set at every stage later in this article, I will not further anticipate those details here.

The loudspeaker is a W.B. Stentorian Senior type 36 S. I have chosen this because I do not know of any better loudspeaker for the purpose. It gives a marvellous tone and is compact and inexpensive.



The illustrations on this page are of the upper surface of the chassis and clearly show the lay-out and the wiring. Note the lead taken between the scale of the condenser and the panel, from the reaction condenser to the volume control.

THE COMPONENTS EMPLOYED.

1 Wearite 3-gang coil unit types WLQ-WLR-WLT.
1 Polar 3-gang "Midget" tuning condenser.
1 Polar Semi-circular drive for above.
1 Clix 9-pin chassis mounting valve holder with screw terminals.
1 Clix 7-pin chassis mounting valve holder with screw terminals.
2 Clix 4-pin chassis mounting valve holders with screw terminals.
1 Varley Q.P.P. Input L.F. transformer.
2 Dubilier 2-mfd. fixed condensers, type BB.
1 T.M.C.-Hydra ·1-mfd. tubular fixed condenser.
1 T.M.C.-Hydra ·05-mfd. tubular fixed condenser.
1 Dubilier ·01-mfd. fixed condenser, type 620 with insulated grid-leak clips.
1 Dubilier ·0002-mfd. fixed condenser, type 620.
1 Dubilier ·0001-mfd. fixed condenser, type 620
1 B.T.S. ·0003-mfd. reaction condenser.
1 Polar N.S.F. 10,000-ohm volume control for variable-mu.
1 Erie 2-meg. 1-watt grid leak.
1 Erie 500,000-ohm 1-watt grid leak.
1 Erie 250,000-ohm 1-watt resistance.
1 Erie 30,000-ohm 1-watt resistance.
2 Erie 25,000-ohm 1-watt resistances.
1 Graham Farish ½-meg. "Ohmite" resistance in vertical holder.
1 Bulgin screened H.F. choke type H.F.8.
1 Erie 10,000 ohm 1 watt resistance.
1 Bulgin 3-pt. toggle, switch type S.87.
2 Clix terminals, type B.
3 Clix parallel sockets with insulated shoulders.
11 Clix wander plugs.
2 Belling Lee Accumulator spades.
1 Belling Lee wanderfuse.
1 Peto-Scott Special Roberts Cabinet.
1 Peto-Scott wood panel, 12 in. × 7½ in. × ¼ in. to match cabinet.
1 Peto-Scott "metaplex" (both sides) baseboard, 12 in. × 9½ in. × ⅜ in., with wood runners, 9½ in. × 1½ in. × ⅜ in.
2 Coils B.R.G. "Quikon" connecting wire.
Screws, flex, etc.

The wiring of the set you will find very simple; indeed, everything has been carefully worked out to make this as easy as possible.

I hope that all of you who make up the set will stick absolutely to the specified components and will not try parts which are not set out in the list of approved components. If you will keep strictly to the lay-out and components given you will get, I venture to say, amazingly good results with this receiver.

Astonishing Selectivity

The set has been thoroughly tested out in all kinds of conditions and the opinion of those qualified to judge is that it gives better results than any four-valve set that has hitherto been produced.

"ONE THING THAT HAS BEEN FOUND MOST CONVENIENT IN USING THE SET IS THE WAVE-LENGTH CALIBRATION, WHICH IS REMARKABLY ACCURATE."

I need hardly say that it will give you a very large number of foreign stations, the dial being positively packed with stations. This is no drawback, however, because the set has, as I have already mentioned, astonishingly fine selectivity and it is perfectly easy to separate stations which come very close together on the dial. There is plenty of volume on all stations, whilst on many B.B.C. stations the volume is tremendous.

I spent a great deal of time on the design of the original three-valve set and I have spent still more time on the design of this one. Not only that, experiences of readers who were kind enough to write to me about the first set have been carefully considered in the design of this.

They tell me that this is the finest four-valve set ever produced. Now I want *you* to tell me, when you have built and used it, what is *your* opinion.

Having briefly described the circuit and my reasons for designing the set on the lines indicated, let me go into the matter a little more closely.

In the first place, I must say that I have been most satisfied with the coils, which are of the air-cored type, made by Wearite. These are remarkably efficient and the success of the set is in no small measure due to them.

As already mentioned, the input to the H.F. pentode is of the band-pass variety; this I consider is essential in a small set, in order to preserve quality with selectivity. The coupling between the screen-grid valve and the detector is by H.F. transformer, another aid to selectivity and to stability.

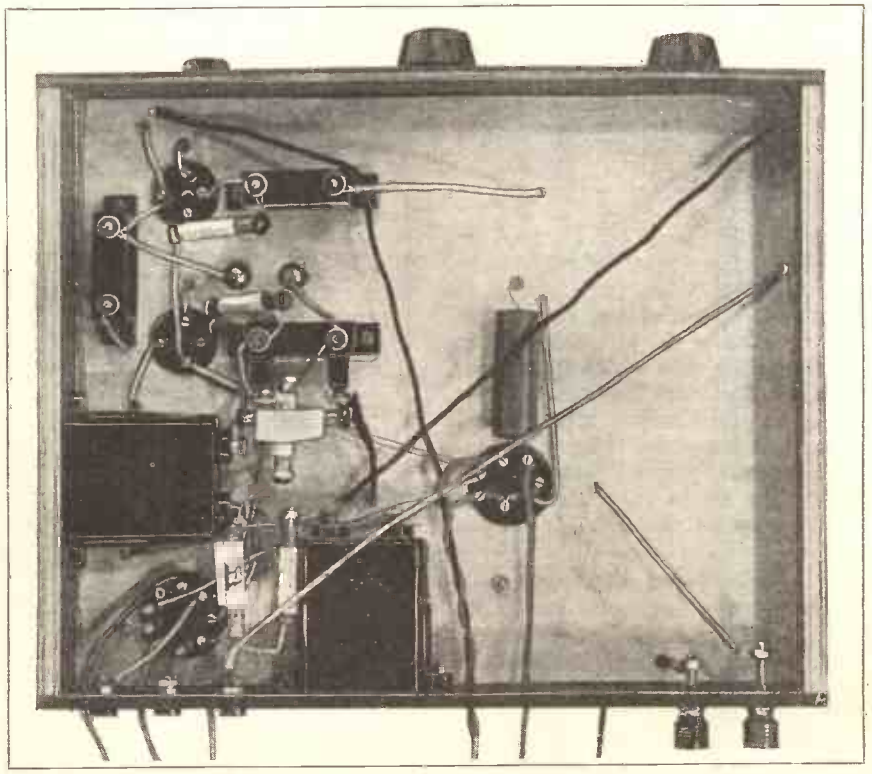
"IN ORDER TO PRESERVE QUALITY AND SELECTIVITY I HAVE USED BAND-PASS INPUT TO THE H.F. PENTODE, WHILST THE COUPLING BETWEEN THE H.F. PENTODE VALVE AND THE DETECTOR IS BY H.F. TRANSFORMER."

Volume Control

The screen pentode is of the variable mu variety, enabling pre-detector volume control to be carried out, and so avoiding overloading of the detector on strong transmissions. The variable volume is obtained in the usual manner, through a potentiometer across the bias battery, while a three-point on-off switch breaks both the filament-battery and the grid-bias-battery circuits when the set is out of action.

With a metallised valve and

VERY LITTLE WIRE IS NEEDED

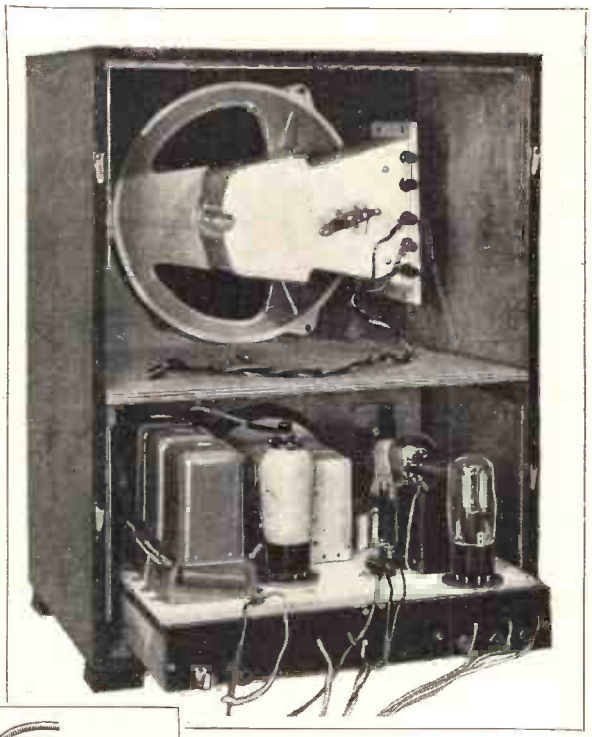


The lay-out of the Roberts Four is so well thought out that the whole of the wiring was accomplished with twelve feet of wire. Here is an under baseboard photograph of the receiver.

metallised baseboard and shielded coils there is no need to worry about the stability of the H.F. circuit, provided a sensible layout is employed, and so you will find that this set is perfectly stable under all conditions.

Efficient Detection

Reaction is applied to the grid coil of the detector by means of the special winding and the ·0003-mfd. condenser. I have not used a differential reaction condenser, but have connected a ·0002-mfd. fixed condenser from anode to earth of the detector valve. This ensures not only good H.F. filtering but high-efficiency rectification throughout the medium and long wavelengths, whether reaction is being used or not.



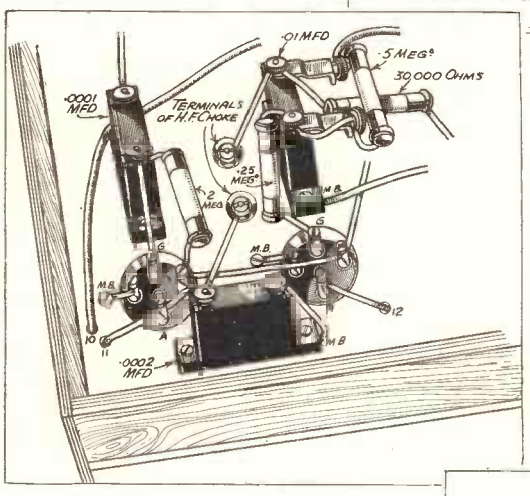
The photograph above shows the speaker in position in the cabinet, and the set partly pushed into its section below the speaker.

* * *

On the left is a close-up sketch of the wiring of the detector and first L.F. valve holders.

* * *

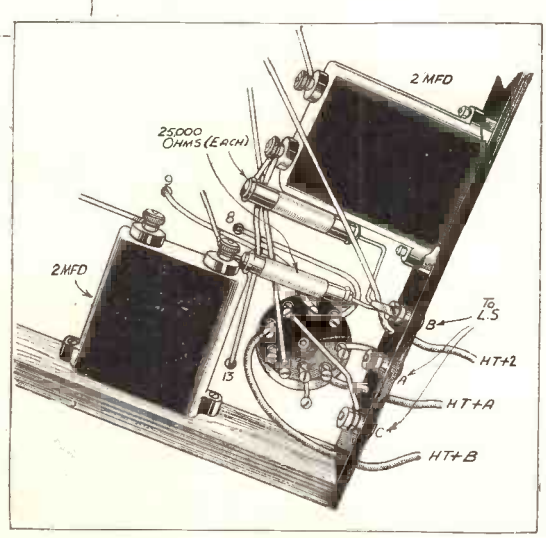
Below is a sketch of the wiring of the nine-pin valve holder for the Q.P.P. valve.



Leaky-grid detection is used for sensitivity: the selectivity of the set is such that there is no need for anode-bend rectification to be used for the sake of the lessened damping on the grid circuit which it provides. I do not need such lessened damping, since the grid circuit is all right as it is, and so I can use the popular and effective leaky-grid rectification. This makes the set as sensitive as it can well be up to the detector output.

Decoupling Provided

The detector is coupled to the first L.F. stage by means of resistance-capacity coupling and is decoupled from the H.T. supply in the usual way. A grid stopper is inserted in series with the grid of the first L.F. valve so as to make sure that no vestige of H.F. shall be applied to the grid. This is important, for I have used a very steep slope valve in the output stage. As I have mentioned, this is a double pentode, one of those Q.P.P. valves which provide such a large output power with so little average consumption of H.T.



There is no need for the user to match this valve, as it is already matched by the makers before sending out. This is a great advance on the earlier Q.P.P. valves which required individual matching with a milliammeter: it makes things very much simpler.

Ensuring Stability

The ·25-megohm resistance, in series with the secondary of the Q.P.P. input transformer and the grid bias, is for the purpose of preventing any tendency of the valves to oscillate; they do sometimes unless precautions are taken, and the result is the most horrible distortion. But the ·25-megohm resistance completely prevents any such trouble.

The whole of the set is built on a metallised baseboard, which is supported on runners—a simple-to-make chassis—greatly aiding in the easy construction of the receiver.

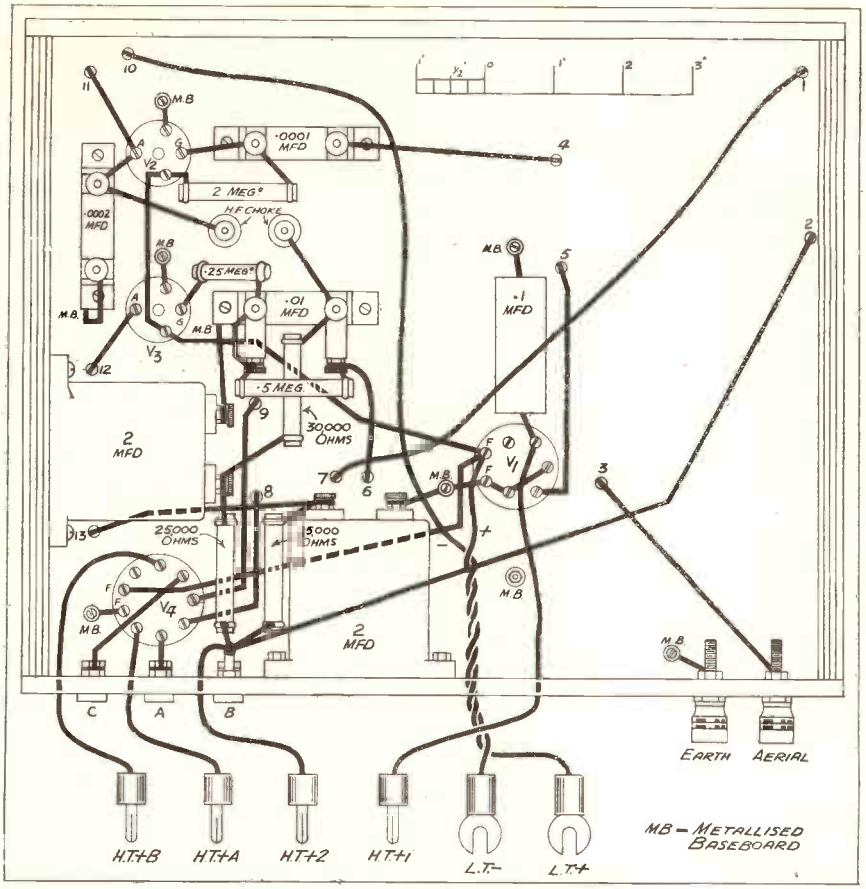
A wooden panel is used and the whole chassis slips into the cabinet in one piece, the batteries being situated behind the loudspeaker. The whole receiver, loudspeaker and batteries, fit into an attractive cabinet.

One thing that has been found most convenient in using the set is the wavelength calibration, which is remarkably accurate. It is achieved by the careful collaboration between the manufacturers of condensers and coils. The result is that one can trim the condenser and find that the tuning will hold through the whole of the wavelength scale.

Wavelength Range

As the set will cover from 200 to 550 metres or more on the medium wave-band, and from 800 to 2,000 on the long waves this is no small accomplishment, especially considering the set is of the home-constructor variety, and the advantages of matching methods that are available to the manufacturer are not available here.

There are very few points that I want to bring out regarding the construction. One that must be mentioned, however, is the fact that the



The under baseboard wiring diagram. All holes through which leads go to the upper surface are numbered, so that reference between this diagram and that on page 230 is made easy.

corners of the scale on the gang condenser must be trimmed off with a pair of scissors in order that they shall not foul the baseboard.

A second point concerns the ·01-mfd. condenser on the under-side. This is fitted with grid-leak clips which have to be ordered when ordering the condenser. These clips are fitted to the condenser in the usual way, but the metal spring parts are removed and the bakelite portion and the terminals are used for the support of the ·5-megohm resistance, as shown. Without the grid-leak clip idea it is difficult to anchor the resistance securely; there is no other safe and insulated fixing point.

"WITH A METALLISED VALVE AND A METALLISED BASEBOARD AND SHIELDED COILS THERE IS NO NEED TO WORRY ABOUT THE STABILITY OF THE H.F. CIRCUIT, PROVIDED A SENSIBLE LAY-OUT IS EMPLOYED."

Note that many connections are taken to the metallised baseboard and are marked in the diagrams "MB." These must be made securely with round-headed screws and washers, the wire being looped in each case and placed between the washer and the baseboard.

Be careful over the connections to the nine-pin valve holder. Owing to the arrangement of pins, it is very easy to slip up and make a wrong connection. There is a pair of pins on the holder closer together than any other pair. These are the filament pins. Once these have been located, you should be quite all right as regards the rest of the valve holder.

One point on the baseboard you will see is marked "M.B.", without any wire being attached to it. That mark corresponds on each side. It is the position of a bolt that passes through and screws tight with a nut, to bond the two surfaces of the baseboard together, thus making sure that the upper surface is truly connected to the earth terminal, which is connected to the under-side of the baseboard.

Two other points may attract your attention; they are the H.T. plus B and H.T. plus A. These are for the two screen-grids of the Q.P.P. valve, and are placed in positions in the H.T. battery according to the directions given with the valve.

Now let us assume that the set is built, and is ready for test. The H.T. battery specified is one with grid-bias incorporated, but we need not take any notice of that. The *whole* of the battery is used for the H.T., the H.T. negative plug being placed in the grid-bias voltage marked —6. A separate bias battery is used for the set.

The idea of using the whole of the battery for H.T. is that much closer tapping adjustments of H.T. can be obtained with this type of battery than with the ordinary types, and the close voltage taps are essential for the correct operation of the Q.P.P. valve.

As we are on the subject, let us get the Q.P.P. valve voltages set first,

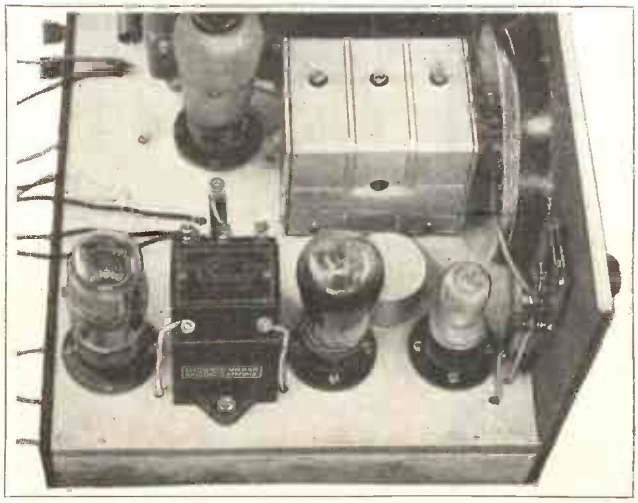
VALVES.

S.G.	Det.	L.F.	OUTPUT.
Marconi or Osram, V.P.21.	Marconi or Osram, H.L.2.K	Marconi or Osram, L.21.	Mazda Q.P.240.

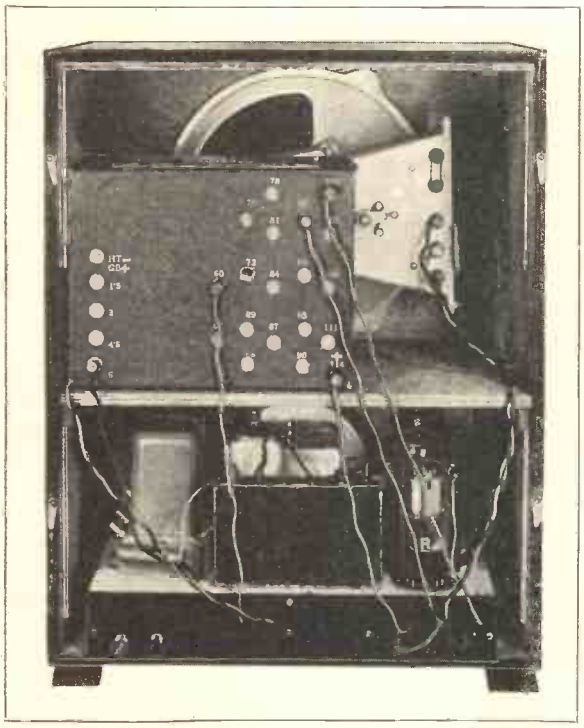
LOUDSPEAKER.
W.B. "Stentorian" Senior (type 36S).

BATTERIES.
H.T. 120 volts, Drydex type, H.1059.
L.T. 2 volts, Exide C.Z.G.4
G.B. 9 volts, Drydex

THE L.F. END OF THE SET



On the right of this photograph is the detector, to its left the first L.F. valve, and on the extreme left the Q.P.P. output valve. All battery connections are made direct with flex, no terminals being used.



Another view of the back of cabinet. It shows the H.T. and G.B. batteries in position, and it will be noted that plenty of room is available for the L.T. The .0005-mfd. condenser across terminals A and C of the speaker is for high note reduction and is quite optional.

and then turn our attention to the other H.T. taps.

In the box with the Mazda valve you will find a pink slip on which are the directions for use. On the valve are markings A and B on the base against the two anode pins. Opposite the appropriate side of the valve are markings on the bulb, either P, Q, R, S or T being used. These denote voltages which should be used for the screen in the section of the valve in which the particular anode (A or B) is situated. A table is given on the slip with the valve, and the nearest H.T. voltage to that specified on the table should be used with the set.

Voltage Tappings

The total voltage of the battery is 120, so that the screen voltages marked on the valve slip required for 120 volts anode voltage should be used. The H.T.2 tap should be in the marking on the battery "114" (which with the 6 volts "bias" makes up 120), and in calculating the voltage for the A and B tap it must be remembered that the 6 volts has to be added to the marked voltage on the battery. Thus, if the directions with the valve are for 94 volts, you must subtract 6 volts and then place the tap in the socket nearest 88. Otherwise you will get approximately 100 volts instead of 88.

The H.T.1 tap goes into the socket marked "66" or 72 volts, and the loudspeaker is connected up as shown on the diagrams, the A, B and C markings being actually on the loudspeaker transformer, and connected as shown.

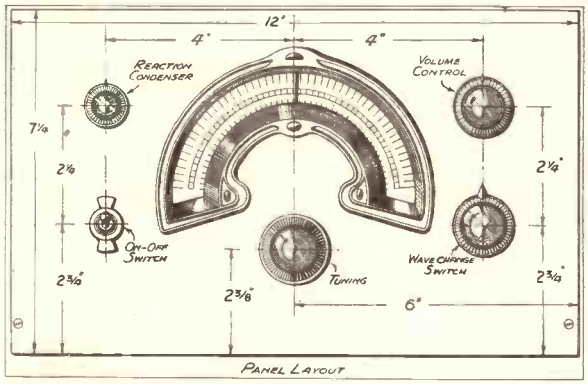
The trimming of the set is quite easy. With everything connected, set the trimmers of the condenser to maximum, and then unscrew them all equally about half a turn. Tune-in a station and trim roughly; then tune-in a well-known station and test the wavelength reading. If it is too high, you must add trimming capacity until the reading comes right. If it is too low, decrease the trimmers until the reading comes right when the condenser knob is rotated.

Finally, set all the trimmers on a weak station (whose wavelength you know) near the bottom of the dial. You may have to alter slightly the adjustment of the front trimmer, after which you will have the wavelength reading properly set. Use reaction fairly close up to oscillation point during trimming.

"GOOD H.F. FILTERING AND HIGH-EFFICIENCY RECTIFICATION ARE ENSURED THROUGHOUT THE MEDIUM AND LONG WAVE-LENGTHS, WHETHER REACTION IS BEING USED OR NOT."

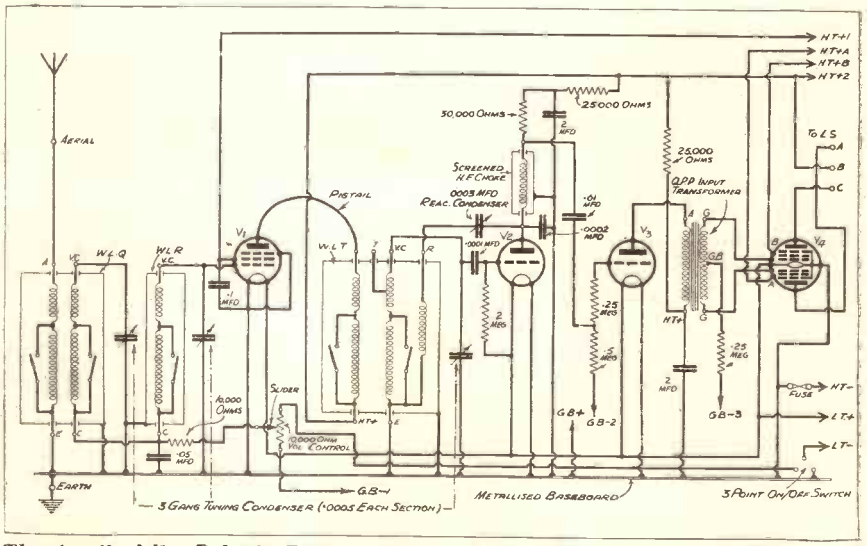
Reaction is used on the set in the normal way, and, with the wise use of reaction and the volume control, a wonderful degree of selectivity can be attained, while on powerful stations the output volume of the set is very large. Something like 2,000 milliwatts is available, without distortion, while the average anode current is a mere 10-12 milliamps and the static current in the neighbourhood of 7 milliamps!

As regards grid bias, which I have not previously mentioned, this should be about 9 volts for G.B.—1, 3 volts for G.B.—2, and 9 volts for G.B.—3.

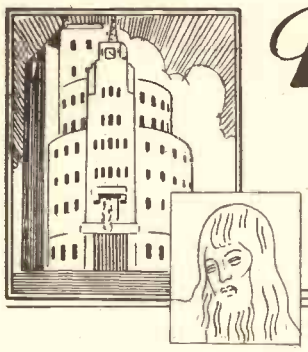


The panel drilling is carried out in accordance with the above diagram. A template is provided by the makers for the cutting of the escutcheon slot.

HOW THE CIRCUIT IS ARRANGED



The circuit of the Roberts Four is easy to follow. The terminals on V_4 marked A and B are those marked on the valve base by the makers to denote the two sections of the valve. This is explained in the text.



British Broadcasting NEWS & VIEWS

By "Prospero"

In Charge of Programmes—Transmission Quality—B.B.C. and the "Oxford Group"—Regional Policy—Exhibition Broadcasts.

More Houses

The B.B.C. staff continues to migrate from Broadcasting House. Now the whole of the Music Department has moved to Brock House. Several other houses in the vicinity of Broadcasting House are being demolished to be rebuilt for the B.B.C. afterwards.

Really it is astonishing that the B.B.C. authorities had so little foresight when they passed the plans for the new building. The present situation, after only about three years of occupation, is that the B.B.C. is far more scattered than it ever was when it outgrew Savoy Hill. The expense must be considerable.

Mr. Graves in Charge

Mr. Cecil Graves is now in definite charge of all B.B.C. programmes. I hear he has tightened things up a bit. Colonel Dawnay, despite his military career, was inclined to be informal in method; not so his successor. On the other hand, there is also a general speeding up of the work made possible by a bigger staff. I believe there is a fair chance of the new organisation being reflected in better programmes after Christmas.

Quality of Transmissions

The music officials of the B.B.C. have been making a special survey of the quality of transmissions recently. After consultation with the engineers concerned, the musicians report that in their opinion the chief fault lies with the bass transmission and not, as some had supposed, with the quantity relation between "top" and "bottom." "Bottom," apparently, is not too great in volume; it is regarded, however, as too "boomy" in quality. The quantity of "top" is reported on as satisfactory.

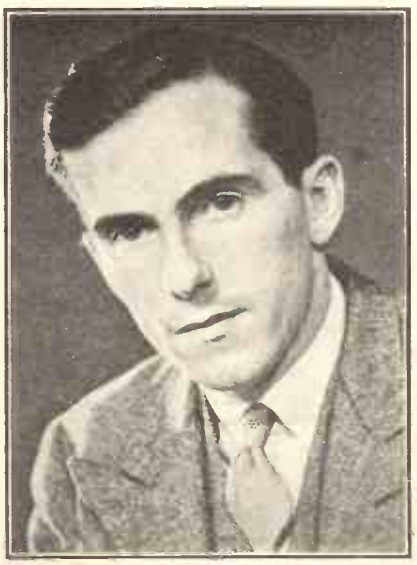
Filling Empire "Spaces"

The process of brightening up the Empire programmes continues. The latest move is to fill in some of the longer gaps during the day and night. This is being done with the use of appropriate gramophone records, given in prepared recitals as required. There is also a decline of the formality of announcers, much to the pleasure and relief of Overseas listeners.

"Plans for To-morrow"

On Tuesday, November 19th, at 10 p.m. in the National Programme will be given the first of a new series of talks entitled "Plans for To-morrow." This is to provide a forum for the elaboration of views of all kinds about the future. There will be "advanced" as well as "reactionary" plans, and it is hoped to attract a good deal of acute controversy in this way. Apparently the new regime at the "Big House" does not mean to tone down all the talks to a timid and unchallenging level.

B.B.C. REPRESENTATIVE



Mr. Felix Greene, who has gone to North America to represent the B.B.C. in that Continent. He has been with the Corporation for the last two years.

Sir Noel at Programme Board

Mr. Graves has reconstructed the Programme Board at Broadcasting House. The most important change is the addition of Sir Noel Ashbridge, Chief Engineer. Sir Noel has strong views on programme subjects, and his presence will be a help on this side.

Also programmes in future will have to depend increasingly on wavelengths and wavelength changes. I gather that the Regional Scheme may have to be modified again before the new stations in the North-East of England, Highlands of Scotland, and Ulster are in full operation.

"Oxford Group" and the B.B.C.

The B.B.C. remains singularly silent about the work of the "Oxford Group" which has been a good deal at Geneva this summer and was there recognised officially by the League Assembly. I gather that news of the activities of the Oxford Group is banned from the B.B.C. Bulletins, and that there has been no sign of any intention on the part of the B.B.C. to invite the Oxford Group to state their attitude on the air.

The B.B.C. angle is that the admission of a minority religion such as the Oxford Group would be a precedent for a vast number of other religious minorities that could not be accommodated in the limited time available for religious broadcasts.

Sir John Reith Sits Back

For the first time in the thirteen years of the B.B.C., Sir John Reith is really sitting back and reviewing his work with the detachment necessary for comprehensive surveying. Sir John is telling his friends that he is thoroughly satisfied with his senior staff. He has the fullest confidence in his Control Board, upon whom he is devolving more and more. It has always been Sir John's aim to get

things so arranged that he might go away for a year, or even leave entirely, without being in any sense apprehensive about the B.B.C.

As things are now, that condition is fulfilled. If Sir John chose to go away for a long period, or to retire before the end of 1936, his job would fall automatically to Sir Charles Carpendale, the Deputy-Director-General. After the end of 1936, the succession would be most probably in favour of Sir Stephen Tallents, who by then will have settled sufficiently into the business to take charge of it.

Mr. Kenneth Adam's Visit to America

Mr. Kenneth Adam has been on a long visit to the United States and Canada. Mr. Adam is second-in-command to Professor Coatman, chief news editor of the B.B.C. Mr. Adam has made a careful examination of the broadcast news situation in North America and, while in New York, consulted with both N.B.C. and Columbia about various plans for the "three-cornered" co-operation that Mr. Paley has been discussing simultaneously in London.

Regional Policy Again

It was, of course, inevitable that as soon as Mr. Charles Siepmann got down to his new job of Regional Liaison, he would bring forward recommendations. Mr. Siepmann is completing an intensive study of staff and work at the various regional headquarters. It is believed that Mr. Siepmann will advocate a general raising of the standards of regional programmes with corresponding changes of staff.

I do not profess to know what Mr. Siepmann's criteria will be, but I hope he will be careful to make due allowance for "localism," and also remember that London standards are not necessarily universally infallible.

"Transatlantic Bulletin"

Mr. Raymond Swing's weekly talk from America, arranged by the B.B.C. and the Columbia Broadcasting System, had its origin in a conversation at the White House between Mr. Paley, President of Columbia, and President Roosevelt himself. The admitted success of the series has given rise to hopes of early renewal.

The B.B.C. is anxious, however, to bring Canada properly into the picture before doing more with the United States. Arrangements are being considered with this object in view.

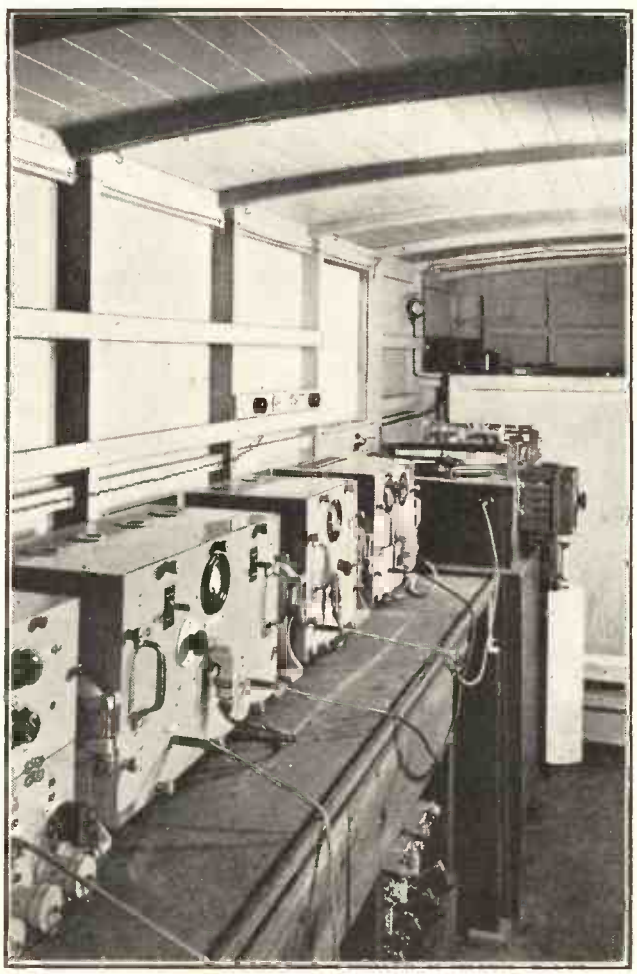
B.B.C. NEWS AND VIEWS

The B.B.C. and Radio Exhibitions

The B.B.C. is reconsidering its attitude towards radio exhibitions in future. Until now there has been active co-operation with the R.M.A. and others, taking the form of vaudeville performances, and so on. The Board of Governors, however, are becoming apprehensive that it is not dignified of the B.B.C. to imitate music-halls in public performances.

The whole subject is to be reported on afresh by Sir Stephen Tallents, himself an authority on exhibitions of all kinds.

THE RECORDING VAN



One of the two complete recording outfits that are carried in the B.B.C.'s mobile recording van. From left to right are the microphone terminal and mixing unit, microphone amplifier, playback amplifier, recording power amplifier and recording machine.

HOW I BECAME "STAINLESS"

By Stephen

(*Continued from page* 227.)

regular B.B.C. entertainers. I have been on the air over two hundred times in all.

In 1928 I was specially engaged by the British Legion to appear as "Old Bill" at the Opera House, Lille, during a show given to entertain the Prince of Wales prior to the dedication of the Menin Gate Memorial, and during a radio surprise item in the following year I performed the hardest job in my whole career when I played eight different characters in a sketch.

I write all my own material and songs and have been responsible for the creation of such wayward characters as Radio Rastus, Oscillating Oscar, Sibilant Cyril and Atmos P. Herics, etc.

Privately I am a very keen cyclist and once cycled over 350 miles in the North Road Twenty-Four Hours' Race.

There are no other comedians in my family. My sisters and brother are accomplished pianists, but I have always had a flair for mimicry and burlesque, and frequently got into trouble at school by impersonating the teachers.

The Three Reasons

My first broadcasts were a series of topical talks, and it was not until I adopted my present name that I began to be recognised as a broadcasting figure. I chose this name for various reasons: (*a*) I come from Sheffield where stainless steel is made; (*b*) the dictionary defines "stainless" as "immaculate; without blemish"! (*c*) and I always insist that my material is stainless from beginning to end.

I usually appear on the stage wearing a stainless steel shirt—with traffic lights down the front.

SHORT-WAVE DEVELOPMENTS BY W.L.S.

★ A REVIEW OF THE PROGRESS THAT HAS TAKEN PLACE IN SHORT-WAVE RECEPTION DURING THE PAST FEW YEARS. ★

We no longer hear of people making the fatuous remark that "wireless is still in its infancy!", although, judging by the lusty noise it makes in some quarters, it hasn't quite attained the age of manhood yet. Short-wave radio, however, *may* truly be said to be quite young. Its exact age is a little hard to decide, but it certainly is very little more than eleven years old.

Made Amazing Strides

During these eleven years it has made the most amazing strides, and even now it is changing radically from one month to the next. Receiver development, however, seems to have lagged behind more than anything else, and is just getting into its swing.

Until the middle of 1932 the average home-constructed short-wave receiver had not progressed far beyond the "low-loss detector-and-one-stage" made famous by John Reinartz 'way back in the early days. Such superhets as there were seemed full of the most glaring faults. Most of them used an autodyne as frequency-changer, with the result that there was not the least hope of differentiation between the wanted and unwanted channels.

The lines along which development *had* been taking place were mostly in the "taming" of the rather fierce detector-and-L.F. receivers; the use of screened-grid detectors; the devising of methods of getting rid of threshold howl; hand-capacity and general instability; and the use of a tuned or untuned stage of H.F.

The average superhet, then, would receive amazingly strong signals from the usual handful of really strong stations, but when it came to real DX work it was almost preferable to use one or two valves for the job.

At about the same time that Dr. Robinson's "Stenode" was giving people something to think about, the Americans tried out the idea of a quartz-crystal filter for the reception of C.W. signals, and eventually came out with the famous "Single-Signal" receiver. This was a superhet giving such selectivity that even a C.W. signal was only audible on one side of the "zero-beat" position, thanks to the use of a quartz filter and slightly off-set tuning in the I.F. amplifier.

This receiver, originally intended for C.W., is now being turned out by more than half a dozen firms in the U.S.A. Under various names, it remains, basically, the "Single-Signal" superhet, although it is provided with variable selectivity and is altogether admirable for telephony reception.

Fig. 1 gives a rough idea of the controls on the front panel of a receiver of this type. There are two H.F. stages at signal-frequency, first detector and separate oscillator ("electron-coupled"); two or three I.F.'s; second detector with another local oscillator for beating with C.W.; and a compensated audio amplifier.

Single-knob tuning is provided, and the three or four sets of coils are "ganged"—i.e., they plug in as one unit, with self-contained trimmers.

Silent Searching Provided

Delayed A.V.C., silent searching, and all the refinements of the modern broadcast receiver, are incorporated with the result that this type of set is undoubtedly the Rolls-Royce of short-wave receivers.

Its price, naturally, is somewhat high, and unfortunately it is a job that is well beyond the capabilities of the average home-constructor. Many very promising superhets of similar type, however, have been built by amateurs in this country, and I know of several men with home-made "Single-Signal" receivers who obtain really excellent results.

The use of a quartz filter is not absolutely necessary, as very high selectivity may be obtained by making one of the I.F. stages regenerative—not to the point of self-oscillation, of

A "SINGLE-SIGNAL" RECEIVER FOR ULTRA-SHORT-WAVES

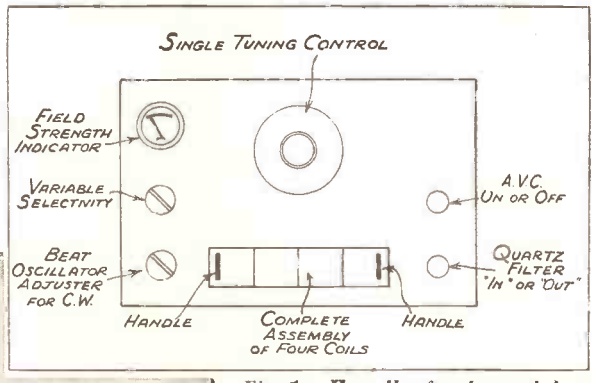
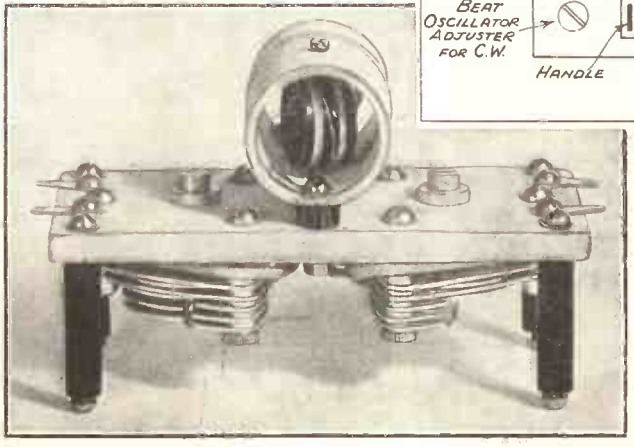


Fig. 1.—How the front panel lay-out of a "Single Signal" receiver is arranged. This type of set, originally intended for C.W. reception, gives excellent results on telephony.



One of the latest B.T.S. Intermediate Frequency Units for ultra-short-wave work.

course. When the whole thing is home made, it is easy to provide a reaction winding on one of the I.F. transformers, and the degree of regeneration may be controlled by varying the voltage applied to the screen of the valve used for that particular stage.

At least one firm, however, is now marketing a 450-kc. air-tuned transformer with a tapping on the primary winding, so that an ordinary Hartley circuit can be employed.

A DI-POLE SCHEME

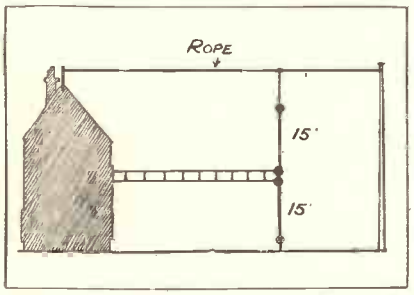


Fig. 3.—A di-pole aerial having the dimensions given above is well worth trying.

One of the most striking effects that one meets with on one of these selective superhets is the appreciable reduction of noise level, even from local man-made static. This, of course, may be simply explained by the fact that the "door" through which signals are admitted is so extremely narrow that less untuned noise, naturally, is admitted.

Internal Noise Problem

Fig. 2 is a diagram showing the various stages in a selective superhet, starting with a non-selective aerial input circuit and ending up with something really sharp, representing an ideal state of affairs. *Internal* noise level, generated by valves and other components, of course, is the biggest problem of all, in a way. It can't be tackled by the amateur, however, and the commercial people who supply us with our parts may be relied upon to do their best.

Side by side with the development of receivers there has been, on the commercial side, a wonderful development in aerial systems. Directional arrays, noise-reducing aerials, and so on, all designed for the reception of some particular signal only, are in everyday use at all the big stations. Unfortunately these developments are hardly available to the ordinary short-wave listener, who wants to receive stations from every direction and on every conceivable wavelength.

He cannot even erect a successful di-pole type unless he confines his experiments with it to one particular

AERIAL AND VALVE DEVELOPMENT

waveband. The amateur transmitter, who is probably interested in reception only on the 40- and 20-metre bands, can erect an effective di-pole or doublet which will work in these two bands, but he is in a different position if he suddenly wants to pick up 30-metre or 16-metre broadcast.

Some listeners claim to be getting excellent results from a vertical di-pole of the type shown in Fig. 3, where the vertical arms and the feeders are "any old length," with the proviso

HIGHLY SELECTIVE

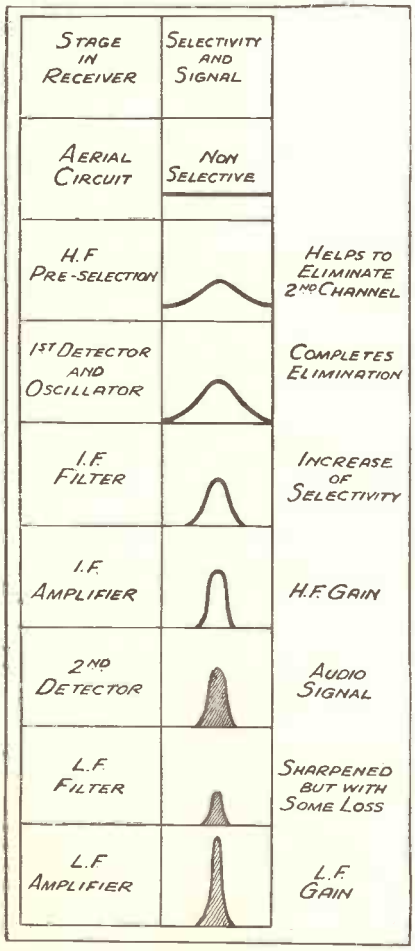


Fig. 2. This series of curves shows the effect of the various stages of a selective superhet.

that the arms must, of course, be of *equal* length.

Two 15-foot vertical sections bring the thing within the possibilities of the average aerial mast and garden; but readers who try this out must not expect phenomenal results on all wavelengths!

Another scheme that has become popular is that employing a screened low-impedance down-lead. An auto-transformer connects the horizontal portion to the down-lead, which is enclosed in an earthed casing. Another step-up transformer couples the down-lead to the receiver.

Caused by House Wiring

In cases of severe trouble with man-made static—especially where it is being re-radiated by the internal mains wiring, such a scheme will give a definite freedom from noise. In the unfortunate cases in which locally-generated noises are actually picked up by the aerial, nothing will help, except, perhaps, the use of an underground aerial, a system which has been developed during the last few years, but suffers the disadvantage of being very directional.

An interesting innovation during this year has been the new triode-hexode valve, intended for use as a frequency-changer in superhets. The ultra-selective supers that I have already described usually use a screened-grid mixer and a separate oscillator, but the ordinary superhet for short-wave broadcast reception has generally, hitherto, employed the popular heptode.

The heptode was all very well until we got down to something below 20 metres.

Inside the Valve

Its first two grids were used as the grid and anode of the oscillator. Next came a screen (G3, Fig. 4), then the detector grid, then another screen (G5), and finally the anode, from which the "mixed" output was taken.

The chief disadvantage from which the arrangement suffers is a considerable degree of "pulling" which the tuned input exerts on the oscillator circuits. As the frequency is increased, the percentage difference between the frequencies of these two circuits becomes very minute and the "pull" results in a real loss of efficiency.

THE HEPTODE

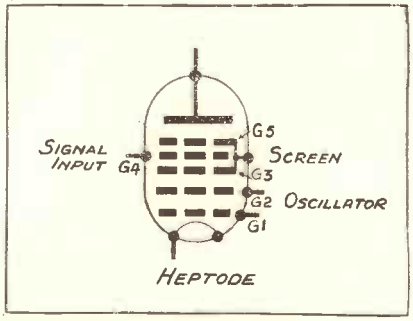


Fig. 4.—The electrode arrangement of a heptode. This valve has certain disadvantages on wavelengths below 20 metres.

The triode-hexode is arranged as in Fig. 5, the complete triode doing the job of oscillator. Its grid is connected to the third grid of the hexode section (G3), and the input circuit is now fed into the first grid (G1).

Two advantages are claimed for the new valve—immunity from "pull," and stability of the tuning of the oscillator section when the bias on the hexode input grid is altered. This

FOR FREQUENCY-CHANGING

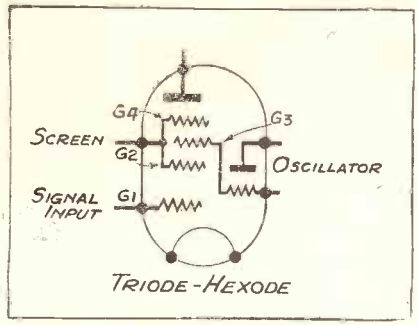


Fig. 5.—The triode-hexode is one of the most recent developments in valve design. Immunity from "pull" and stability of tuning are two of the advantages claimed for this valve.

makes the use of A.V.C. a much simpler matter.

Whereas it was almost impossible to use an ordinary heptode successfully for ultra-short-wave reception, the new triode-hexode behaves admirably on 5, or even 2½ metres.

The ultra-short waves, of course, are a development in themselves. One can hardly claim that their existence was discovered by the amateurs, but the amateurs, definitely, were the first to make practical use of them, and to demonstrate that they were going to be a far more important branch of radio than had originally been expected.

Long Range Reception

An unfortunate craze for the use of rather crude portable transmitters and super-regenerative receivers has rather limited any work on the long-distance possibilities of these waves, but crystal-controlled transmitters and good superhets are now being used, and phenomenal results are being obtained, especially in the U.S.A., where distances of over 1,000 miles have been covered.

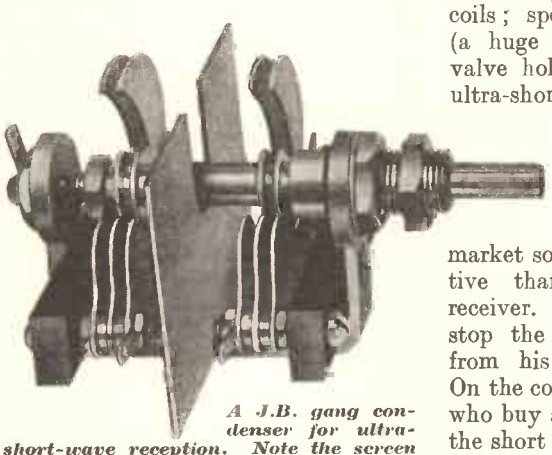
One of the changes that has definitely come about during this year is a drastic revision of the so-called "quasi-optical" theory, which I, for one, always found it difficult to believe; 5-metre waves don't travel as far as 10-metre waves, simply because it is a well-known fact that absorption and attenuation effects become more severe

PROGRESS IN COMPONENT DESIGN

as the frequency of the transmission increases.

We used to think of 360-metre broadcast as freakish compared with 1,600-metre waves; 180 metres is a still more freakish version of 360. The same applies all the way down the scale, with the important exception that the waves between about 60 and 15 metres depend almost entirely upon reflection from the ionised layers for their success. The ground-waves certainly travel farther than a 5-metre "ground-wave," but they are useless compared with waves of 300 metres.

I think the whole gamut of wavelengths could be charted quite logically, the characteristics of each bearing a definite relation to the wavelength. The 10-metre reflected



A J.B. gang condenser for ultra-short-wave reception. Note the screen between the two sections.

wave has "come to light" this year. Frequent contacts are being made between this country and South America, between the U.S.A. and Japan, and between Australia and both Japan and the U.S.A. This is the first real year of 10-metre long-distance work since 1928-9, and we do not yet believe that we have reached the peak.

Rumours of reflected waves of 5 metres in length are already going round. Who knows what may happen next year? We may easily hear of two-way contacts with the Antipodes on 5 metres. But they obviously will be of no commercial value if they can only be established in the "peak" year, once in every eleven years.

A gratifying line of short-wave development has been adopted by certain of the manufacturers who still pin their faith to the marketing of components. One cannot deny that there is an extremely fine array of short-wave components now available to the home constructor. The manufacturers presumably know that the short-wave fan is a discriminating kind of fellow, for one finds efficient and well-finished apparatus turned out at a reasonable price—not shoddy stuff built down to a ridiculous one.

Special Coils and Chokes

When one thinks of the small variety of good slow-motion condensers, or even slow-motion dials, that was available a few years back, and then looks at the range on the market today, one appreciates the fact that the short-wave man's existence is being realised at last.

Other parts to come to mind are the now popular four-pin short-wave coils; specially designed H.F. chokes (a huge variety of them); special valve holders and a whole range of ultra-short-wave gear.

The all-wave set can hardly be treated as a "short-wave development," but it is a definite attempt to put on the market something that is more attractive than an ordinary broadcast receiver. I don't think it will ever stop the experimentally minded man from his home-construction habits. On the contrary, hardened "B.C.L.'s" who buy all-wave sets and meet with the short waves for the first time may easily become keen enough to forage around for themselves and build a special short-waver.

One development that occurs by the way, though, is concerned with wave-change switching. Attempts to switch from long to medium and then short waves, a few years back, were positively laughable, and resulted in the most hopeless inefficiency on the short-wave side of the set, where high

(*Please turn to page* 283.)

A GIANT SUPERHET FOR S.W.

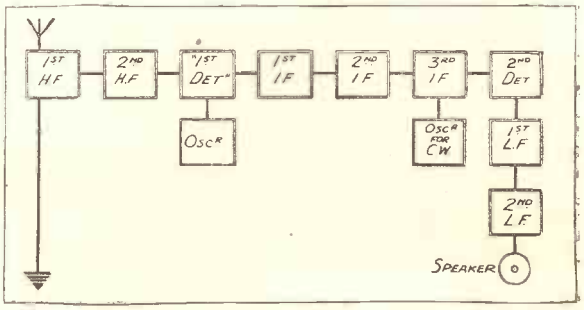


Fig. 6.—The schematic lay-out of a really big short-wave superhet. Receivers of this type are used in America.

WHAT THE TRADE CHIEFS ARE SAYING—No. 1

WE ARE CLEANING UP THIS RADIO!

Says RICHARD HAIGH to Our Special Representative

Mr. RICHARD HAIGH

WHEN I stepped out of the lift taking me up to Mr. Richard Haigh's office in Clerkenwell Road, London, I was not quite sure whether I ought to criticise H.M.V. sets or praise them.

Mr. Haigh settled my doubts right away. With characteristic urbanity he said: "Let's talk!" And how we talked! Mainly, it seems, of how very closely the radio trade as a whole is following—at a discreet distance—the trends of the older-established industry of motor-cars.

"All Very Much Alike"

"Yes, the more I think about it, the more certain I am that in many important ways this radio trade is like the motor trade," said Mr. Haigh. "Take the Show, for example. An array of models, all looking very handsome, all very much alike. Not merely in their exterior appearance, either. The 'guts' looks much the same, too. And all makers naturally claim equally good performances!

"That being so, what is the poor uninitiated set buyer to do? The more he looks at the vast array of sets the more bewildered he must surely become, the more hopelessly impossible is his final choice!

"It is at this point I think my motor-car parallel shows up very strikingly. A few years ago, you remember, the car manufacturers were faced with the same problem. Basically similar specifications, I mean, had to be made to look different. And that was done, you remember, by introducing a variety of gadgets.

"Gadgets All Very Well . . ."

"But in the meantime the car owners came to realise that gadgets were all very well in their way—and yet did not affect the main essentials. Your average car user demanded a reliable means of transport, with reasonable speed, and a fair standard of comfort.

"My parallel in radio holds good, I think. Your average listener wants to be able to get a fair number of stations—and he wants them pleasantly reproduced. If you like, you can regard good quality of reproduction as equivalent to good riding comfort—aesthetic rather than physical!

"Reliability? Yes, I agree. That's a factor of great importance. In the past two years or so there has been a vast cleaning-up process going on. In details, I mean, rather than fundamentals. In future this process is bound to continue—in, I imagine, two broad ways. First, through an increasing tendency to simplify the manufacturing designs. Secondly, through the accumulation of experience in making them.

Our Trade Chief this month is British Manager of "His Master's Voice." He was concerned with the foreign business when H.M.V. were concentrating entirely on records and gramophones, but on the firm entering the radio field, Mr. Haigh became chief of all the home commercial activities. Has plenty of prior experience in the sale of other commodities.

"To-day I think I can safely say that a wireless set is no more vulnerable to faults than any other piece of electrical apparatus. Our own experience bears out that contention, anyway. The percentage of returned sets has dropped very greatly.

"I agree with you that listeners no longer care as much about the technical specifications as they did. Indeed, we have largely dropped such information from our advertisements—again following the trend of the motor-car industry, where technical features are now completely overshadowed by performance points the ordinary person can understand and appreciate.

"The reaction of the public to couponed advertising is, we find, very much greater now that it deals with non-technical selling features. And, let me add, about seventy-five per cent of those who fill in the coupons eventually become buyers—it is not just catalogue hunting.

"Prices? Well, I think we have touched rock bottom there. Again quoting the motor trade, cannot you see a further parallel? Your £200 car to-day gives you something that, a few years ago, you would have had to pay about £450 for. In addition, of course, it gives you features no car, whatever its price, could have provided then.

"More Value For Money"

"In other words, you get much more value for your money. And so it is—and will continue to be—with the radio industry. Basic prices will remain, I think, much as they are to-day. The 12½- to 13-guinea sets, for instance, will represent the popular-priced model for some time to come—but as time goes on it will offer more and more features for the money.

"It was time a halt was called to the downward rush of prices. That halt has now been called by the responsible members of the radio trade. The justification for keeping up prices to an economic level needs no emphasis from me. But our own further justification is, as I say, that actually we do give an ever higher performance for the money."

In this short summary of my chat with Mr. Haigh I have picked out only the leading points of his searching analysis. I left him with the firm conviction that, while we have such broadminded executive chiefs helping to guide the destiny of the radio trade, we listeners can be sure of a well-ordered progress along sane lines.

IT ALL DEPENDS ON Lisburn

" The B.B.C. Engineers seem to be at the cross roads, as far as aerial design is concerned," says Alan Hunter in this article on the new Irish station.

UPON the success—or, let me whisper, the failure—of the new Lisburn station now nearing completion depends the whole future of Bigger and Better British Broadcasting.

Now how comes this ? Lisburn, you know, is the site of the new North Ireland Regional, a full-blown 50-kilowatt transmitter being brought into service in the near future to take over the function—indeed, to enlarge the function—of the poor little 1-kilowatt Belfast transmitter.

A good thing for Ireland, at any rate, for those within, say, 70 to 80 miles of Lisburn. Always it is a good thing when listeners are blessed with a really powerful regional signal—even though, at the start, it may cause some trouble with unselective receivers.

But why is Lisburn so focal a point in the tortuous development of the B.B.C.'s technical service ? I will tell you. Because it will make use, for the first time in this country, of an anti-near-fading aerial.

Now let's get this quite straight. Abroad, various kinds of aerials and masts have been put up to combat—some think to eliminate—the curse of night-time fading. Over here there seems to be a fairly widespread impression that the B.B.C. has lagged miserably behind its Continental rivals in this department of transmission. Actually, the B.B.C. is fully alive to the possibilities—and it knows, what thousands of listeners do not, apparently—that such aerials cannot avoid fading.

Concentrated Radiation

The best result to be expected from an anti-near-fading aerial is implied in its very name—freedom from fading *near* the transmitter. Well, translate that " near " rather liberally. Make it 70 to 80 miles, which is a good 10 or 20 miles greater radius than can normally be reckoned as fade-free.

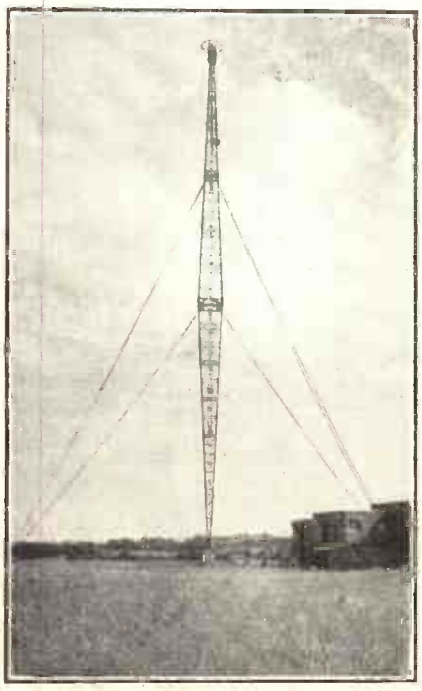
You see, these anti-near-fading aerials tend to cut down the upward ray in the radiation, to concentrate the radiation along the ground ray. But then, the curvature of the earth must not be forgotten. If you send out a horizontal ray with respect to the station site, it will, owing to earth curvature, become something like an upward ray at any great distance.

Definite Limitations

As soon as there is anything approaching an upward ray, darkness will bring fading, due to the out-of-phase arrival of ground and upward rays at the receiving end. So that it is as well to bear in mind the limitations of anti-near-fading aerials.

Lisburn, so soon to hurl its kilowatts upon the long-suffering ether, will make use of a modified anti-near-fading aerial, in which, as is usual with such affairs, the mast itself becomes the radiator. On Belfast's present wavelength of 307·1 metres it will have a fair chance to prove the value of anti-near-fading aerials—or disprove it.

TO REDUCE FADING



A great deal depends on the operation of this anti-near-fading aerial erected at the new Northern Ireland Regional station. From the results obtained will be decided the types of aerial to be used with future transmitters that the B.B.C. has in hand.

Following Lisburn, the B.B.C. proposes to open the North Scottish Regional. Already, at Burghead, not far from Lossiemouth, the station building is taking shape, although, so far, no machinery has been installed. This, too, will be a standard Regional transmitter with a power of 50 kilowatts. Its aerial design, the B.B.C. tells me, has not yet been decided upon—and will not be decided upon until the engineers have had some practical experience with the Lisburn anti-near-fading device.

Similarly with North-eastern Regional. At the moment, this is little more than a pious hope—or should I say a plot of ground at Bukley, some miles inland from Newcastle. A 50-kilowatt transmitter is planned for this site—but again there is nothing definite to be said about its aerial. It all depends on Lisburn, you see.

In other words, the B.B.C. engineers seem to be at the cross roads as far as aerial design is concerned. They designed the 200-ft. masts at Brookmans Park under severe restrictions from the Air Ministry. They were able to spread themselves over North Regional, and up went three 500-ft. masts. Westerglen boasted the first of the umbrella type aerials for Scottish Regional, and West Regional followed.

Extending the Service Range

But the development of broadcasting all over Europe—indeed, the world—has brought home the fact that some kind of special attention must be paid to the problem of extending the serviceable range of a transmitter—and the anti-near-fading aerial design seems to point the way.

Power increase, as such, does not materially alter the fade-free service range. In fact, owing to the greater amplitudes involved, it conceivably

makes fading more pronounced. No, the way to decrease fading at a given distance is to change the relationship between the rays arriving over the ground and those coming down from above.

Many critical listeners must have noticed how, at a time when many foreign stations—notably German—are lining up their powers to a round 100 kws., the B.B.C.'s station continues on 50 kws., with very little hope, apparently, of being able to increase.

The B.B.C.'s Attitude

Here, again, we come right back to the Lisburn experiments. The B.B.C.'s attitude seems to be that it is no use merely increasing the power of existing stations without at the same time doing something about the aerial design.

Yet the need for an all round power increase in our main Regionals grows daily greater. Take North Regional, as an example, and you will see why. Immediately above this B.B.C. station of 50 kws. is Cologne with 100 kws. Below is Sottens, at present with 25 kws., but in the not very distant future scheduled to graduate to the 100 kw. class.

Now, for listeners living within 10 or 15 miles of Moorside Edge the peculiar activities of Germans and Swiss may mean rather less than nothing. But to those poor souls 30 or more miles from the centre of radiation, the after-dark effect of these adjacent station power increases is decidedly a matter for mental anguish. For the interference ratio will be considerable enough to make them wonder whether they have a local station or not.

It is for this reason that the B.B.C. must eventually envisage power step-ups for all its main stations. It cannot, naturally, dictate power limits to the foreigners, more especially since it subscribes to the International Broadcasting Union's acceptance of 100 kws. as a reasonable maximum power for medium wave stations.

Taking the long view, then, we can see that one day our broadcasting system will include 100 kilowatters with anti-near-fading aerials. That is, if Lisburn turns up trumps!

A Knotty Problem

Meanwhile, the engineers are exceedingly busy with their mobile transmitter in the Plymouth district. They are up against a pretty tough nut, I gather, for the sandstone and granite sub-soil plays the very devil with signal radiation.

The aim is to find a site that will enable yet another 50 kw. transmitter to be put up, this time to serve the undoubtedly hard-done-by West of England listeners. Allied to this high power station will be a low power relay near or at Bristol, synchronised on the same wavelength.

Talking of synchronisation reminds me that the engineers are about to tackle an extremely interesting experiment. They propose to try to work West Regional—destined to become Welsh Regional, you remember—on the same wavelength as a 5-kw. transmitter to be erected at Beaumaris, Isle of Anglesey.

Between Washford in Somerset and Beaumaris lies the grim Snowdonia range, an effective blanket, it is felt, against a too serious encroachment of mush on either station. If this experiment succeeds, it will hearten the engineers in their attempt to synchronise Plymouth with Bristol. Admittedly, there is no providential Snowdonia between them, but there is Dartmoor and all that.

Filling in the Gaps

And so they will go on, trying to fill in the glaring gaps of poor service. Hampshire and East Anglia will have to wait a long time for their particular locals, but the B.B.C. has not forgotten them.

Indeed, it waits upon the success of Lisburn to proceed with high power stations. No less upon the success of synchronisation to go ahead with the low power gap-fillers.

Where are all the wavelengths to come from? That is a question ever in my mind. It seems certain that the National triplets—London, West and North—will go in the end, as may Scottish National. The B.B.C. is merely biding its time, keeping these stations on the air only so long as it can spare the precious wavelength.

Meanwhile, of course, it is educating listeners to rely as much as possible for the National programme on Droitwich. By the time Droitwich has to be tuned-in—when the "little Nationals" are finally squashed—it is hoped that industrial interference will have materially lessened on the long waves, and that the set makers will have seen fit to raise the high frequency cut-off on the long-wave tuning circuits.

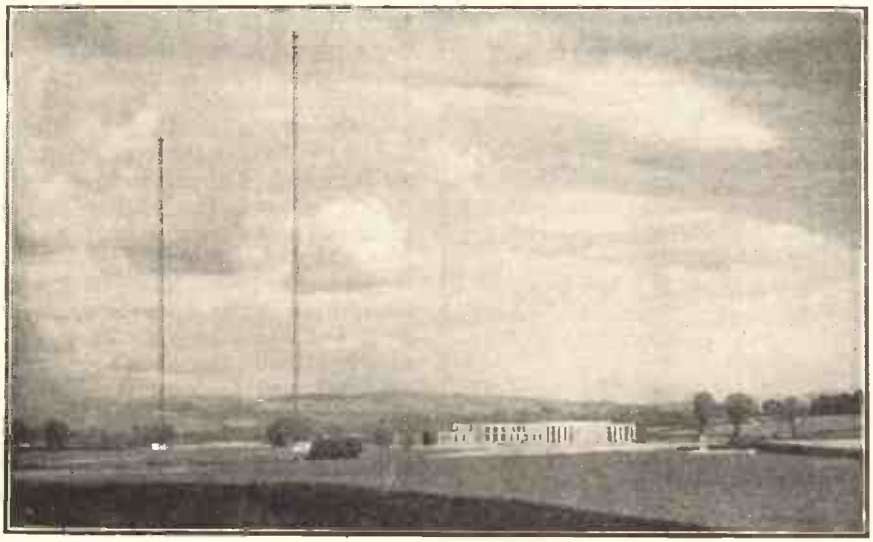
Second Best Alternative

At the moment it cannot be denied that Droitwich, for all its power, is a second best alternative for those listeners fortunate enough to be well within the mush- and fade-free service range of one of the "little Nationals." They find there is less crackling and that quality is better.

Whatever the B.B.C. engineers do there will be an outcry from some quarter. Simply because it is impossible to give everyone an equally good service with so many unalterable restrictions. But they mean well, the engineers. Give them a little consideration as they battle with their knotty problems. And watch Lisburn, for so much depends on its success or—but we won't talk about failure.

ACTIVITIES IN THE WEST COUNTRY

UMBRELLA AERIALS IN SOMERSET



This is the West Regional, where two masts are used to carry the two aerials—one from each mast—of the umbrella type.

Germany's Tower of Babel

The author of this article, Rosellen Callahan, is an official of the Columbia Broadcasting System of U.S.A., and has just concluded a visit to Germany and other countries to study European methods

THERE are times when the supervisor's room in the very modernistic building that houses the German short-wave station on the outskirts of Berlin, sounds like the proverbial Tower of Babel. It is the time of day when the Deutcher Kurzwellensender services the five short-wave zones into which they have divided the world. The babble of Portuguese, Spanish, English, Dutch, German and Zulu emerging from the loudspeakers forms a strange jargon for the ears of the visitor.

One of the most complete short-wave services in the world is offered by this station. The aerial masts at Zeesen, a small village about 50 kilometres from the studios, spread across sandy plains and reach skyward like a regiment of Eiffel Towers standing sentinel. They are the arms which reach across distance and time to bind the world into a family circle, and represent five years of experiment, development and constant improvement.

Using a Direct Beam

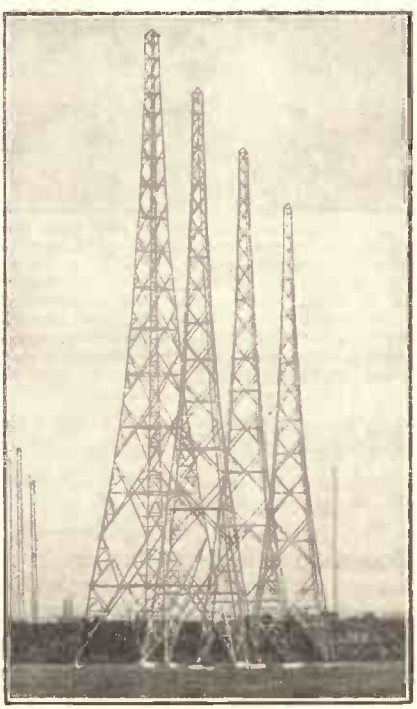
In 1929 Germany attempted sending programmes on short waves without exercising any definite direction or control. Four years later, through the application of the direct beam system —which has made possible the actual control of the direction of the waves to a definite point, regular broadcasts to North America were begun.

The difficulty of directing the waves was solved through the new aerial which works on the principle of the spot light and reflector. The beam is directed on a definite part of the world, and the reflector turns back all energy that would otherwise be lost in other directions. Through this it is possible to use the language of each part of the world for its private broadcast, and to arrange hours convenient to each group of hearers.

The broadcasts to North America proved so successful that aerials were subsequently constructed for broadcasting to South America, Africa, and East Asia. More recently an aerial was put into operation for South Asia and Australia, and another for Central America.

In servicing all nationalities and races, many difficulties are encountered. The very definite and diversified tastes in entertainment of people on the five continents, the multitudinous dialects and tongues they employ, and time changes (the world travels more slowly than radio waves) present the greatest problems.

IN A ROW



"Like a regiment of Eiffel Towers standing sentinel," says Mr. Callahan, of the 300-foot aerial towers of Zeesen. These are the masts for the North American Service.

Not only must the announcers be night owls, working the clock around, but they must also be linguists, for at least two languages are employed for each zone. In listening to their announcements you will hear them speak English with an Oxford accent, Spanish in the true Castillian manner, and even Zulu! Many of the announcers have spent some years in several countries, and match their youth (they range between twenty-two and thirty) with the youth of the industry. In most cases they have been interested in radio from their early boyhood.

The German short-wave company has zoned the world off as follows: To Zone 1, which is South Asia, they speak in English and German. When the midday concert is heard in Shanghai, the musicians in Berlin are playing at the early hour of 6.30 a.m., having probably worked from some time before midnight, and returning home when other people are preparing for departure.

A World-Wide Service

Zone II includes East Asia, to which news reports, and so forth, are broadcast in English, Dutch and German. Zone III includes Africa, and they broadcast in German, English and Zulu. Zone IV takes in South America and Central America, serviced in Spanish, Portuguese and German. Zone V includes North America, to which they speak in English and German. When the announcer says "Good-night, everybody in America!" at 10.45 p.m., it is 4.45 a.m. in Berlin, and on his way home he finds the streets deserted except for an all-night taxi or two.

The world-wide broadcasting service from Zeesen was originated with the view of providing fellow-countrymen throughout the world with typical

AT ZEESEN

THE MAIN TRANSMITTER

The top photograph is of the two announcers for the Germany-U.S.A. short-wave transmissions, while the large illustration shows the transmitter house at Zeesen, containing the long-wave Deutschlandsender and two S.W. transmitters. On the right is the central aerial switch. The wooden figures are a souvenir from an appreciative listener in Africa.

entertainment, music and news from the homeland. But its field, at the request of short-wave enthusiasts, became international, and now the programmes are designed to please the general tastes and special requests of people in the remotest parts of the world.

The programme director told me that they did not always conform to these demands. His former position as an agent for an international concern had taken him to the far corners of the earth, and he seemed well equipped with the knowledge of just what sort of entertainment was best received in Australia, Somaliland, China, England, and both North and South America.

"We try, whenever it is at all possible," he said, "to build our programmes around the requests of our listeners, and do—to a great extent—satisfy their tastes in entertainment. There are times, though, when we find it most difficult to oblige them. Such petitions as those sent in by an anxious mother in the Belgian Congo, asking us to broadcast a message to her son in Europe to be sure to visit his aunt; or asking us to consult a fortune teller and broadcast whether or not this will be a good year to prospect for gold, are not easily handled.

"Realising that it would be scarcely suitable to send the same programme fare to North America as that transmitted to listeners in China or South Africa, we have planned separate monthly programmes," he continued. "Each is printed in German and the languages used most frequently in that zone. These schedules are prepared six weeks in advance, so as they may be in the hands of the listeners at the beginning of the month."

The programme director finds that short-wave radio owners in Asia prefer one-act comedies, chamber music and current events. South Asia follows this schedule pretty closely, too, with the exception of an extreme enthusiasm for dance music of all kinds. Africa has a weakness for military bands, song festivals and current events. Other features heard in these and other zones include a goodly sprinkling of programmes on the work of the Hitler Jugen (Youth), descriptions of local flower, auto, and other shows, and topical talks by members of the National-Socialist party.

In talking to the announcers about the volume of their fan mail (it arrives at the rate of about two thousand letters a month), one finds their fans are most constant. One of the young commentators replied, in answer to a query, that he had been corresponding for months with a rubber plantation owner in Brazil. They had become quite fast friends, and discussed many problems, both personal and of world-wide interest, in their correspondence.

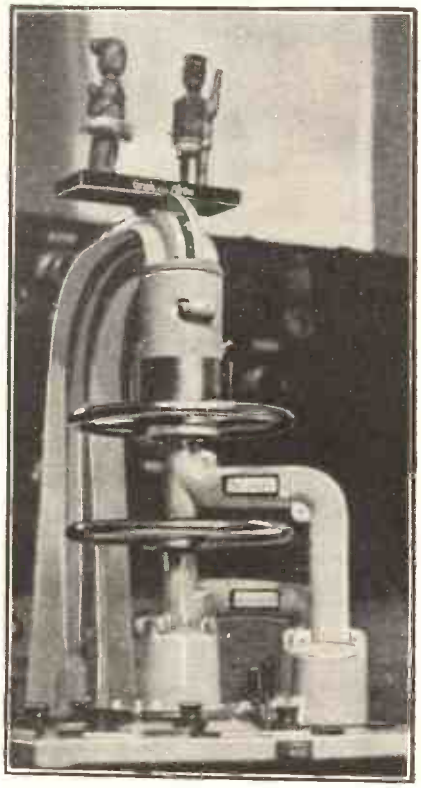
Lengthy Correspondence

There are many of these people who are starved for human companionship and understanding, who correspond at great length. It is not at all unusual for these short-wave purveyors of the news and heralders of salon music to receive eight, ten, and even twelve-page letters.

Sheep raisers in Australia, whose solitary existence makes a voice heard constantly over the air seem like an old friend, write all about their herding problems, ask advice, and confide secrets that they wouldn't dream of telling their own families; huntsmen in darkest Africa send letters by

(*Please turn to page* 288.)

THE AERIAL SWITCH



The "Super-Regen"

a One Valver with Amazing Sensitivity

Designed and Described By
H. A. R. BAXTER

This receiver is based on the most sensitive detector principle ever devised—and it is a principle which is greatly enhanced by modern valves because they remove the trickiness of operation which was previously a drawback.

THE sensitivity of this little one-valve set is colossal; there is no other word for it. On a frame aerial the size of a postcard it will pick up stations hundreds of miles away. I have tuned in stations at good strength using no aerial of any kind, and not even an earth connection. The pick-up was merely on the coils, and the wiring of the outfit!

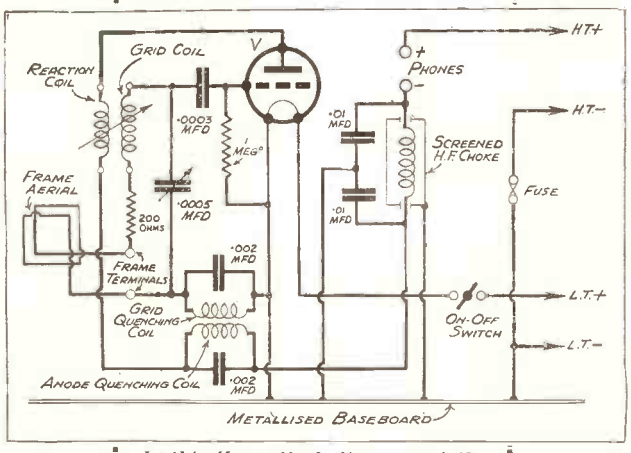
The set is worth building if only to experience its unparalleled sensitiveness. The moment you put on the headphones the set's abnormal receptiveness is at once apparent from the rushing but not loud background.

Remarkable Performance

The most expertly hotted-up one-valve set of an ordinary kind cannot produce anything like its performance. Stations which on such an outfit are heard as merely extremely weak carriers are receivable quite loudly on the "Super-Regen." Yet it is as simple to operate. There are only the two controls—tuning and reaction.

The secret of the little receiver's astonishing powers is the super-regenerative principle. This at one time was quite popular, but the idea fell out of use because of the trickiness of its operation. But modern valves and components have eliminated this fault.

The super-regenerative principle is extremely ingenious and interesting. It is based on the quality of a detector circuit to be most sensitive when it is in an oscillating condition.



In this theoretical diagram of the "Super-Regen," the positions in the circuit of the two quenching coils can be seen. Note the use of a frame aerial.

Effect of Reaction

You know how on an ordinary set the application of reaction gradually increases the sensitivity of a set until there arrives a point where the set bursts into oscillation and the station can be heard only as a squeal? A super-regen set is in this condition of oscillation and extreme sensitiveness the whole time it is in operation.

The reaction effect is obtained in a quite normal manner by coupling the grid and anode circuits of the valve together, and this is done in the present one-valver by the two home made coils on cardboard formers.

By arranging that these coils shall couple moderately tightly the set is made to oscillate.

There are two other coils known as the quenching coils. These generate a quenching frequency. And at that frequency the oscillation of the set is interrupted.

The quenching frequency is of the order of some 8,000 cycles, and so is heard as a very high pitched note although not loud enough to interfere with reception.

Now it is to be noted that although when this remarkable little outfit has once been constructed correctly its operation is as consistent and straightforward as that of any other kind of simple set, it definitely does require considerable care in construction.

No Difficulties

There are no difficulties to be encountered, but everything must be "just so" or otherwise the astonishing super-regenerative effects will not be obtained.

It is for this reason that we urge all constructors who may in due course decide to go all out for a powerful loudspeaker outfit on an experimental basis, to build this present one-valver and so gain experience of this type of receiver.

There are three limitations to be noted in the "Super-Regen" one-valver to which we must draw readers' attention. In the first place there is no provision for the reception of long waves. And, again, as we have already mentioned, there is a very high-pitched note to be heard.

Finally, the enormous sensitivity of the little compactum of radio dynamite is really far too great for its selectivity. Therefore, some distant stations are heard together with heterodyning and other forms of interference, and complete freedom from this can only be guaranteed on those programmes prepossessingly placed.

Three-Valver Experiments

However, all these things can be overcome, and I am even now developing a three-valver which I hope will be free from these things. It is going to be *some* three-valver, as you can probably imagine! What it won't bring in on the loudspeaker using a hairpin aerial just isn't in existence if it works!

In the meantime, you simply must try this small one-valver in order to gain an insight into the remarkable potentialities of the modernised super-regen principle, and also to prepare yourself for any larger outfit. Of course, this "Super-Regen" will be found to be a very excellent provider of headphone programmes, particularly in such circumstances as where it is not convenient to employ an aerial of the outdoor or ordinary indoor type. But please bear in mind those above-mentioned limitations, and then there can be no confusion between my claims and your results.

And now for the construction of the outfit. Keep in mind the essential requirement of this type of circuit that all the electrical values must be just right. Where there can be a little latitude I will mention it. In all other cases exactitude must be your watchword.

First of all, the coils. The quenching coils need to be made with great care for their task is an extremely vital one. If they do not perform it correctly, then the set becomes just an ordinary one valve detector arrangement!

It would be convenient if the two formers could be turned on a lathe out of solid material, but only a few will be able to do that. My own were built up in this way. The cheeks have a diameter of one and a half inches and were cut from three-sixteenth-inch ebonite. The hubs are each half an inch in diameter and half an inch thick.

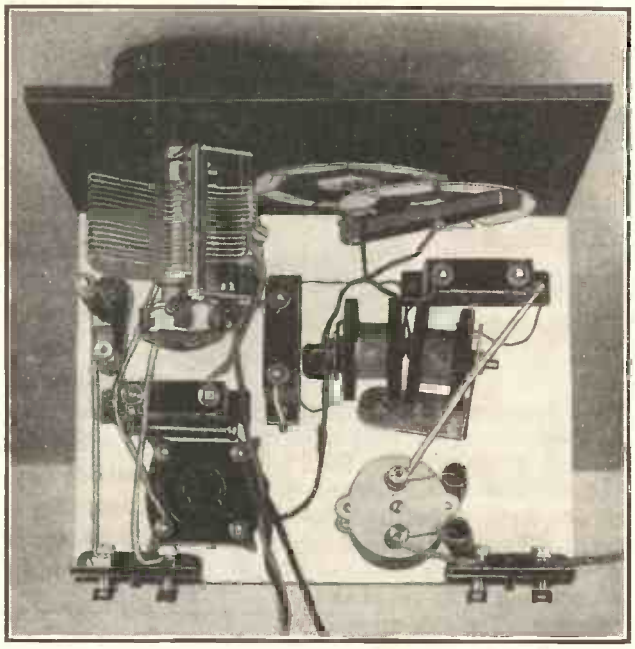
Each of the two formers is held together by means of a one and a half inch 2BA screw having a countersinking head. The head is carefully countersunk so that the two coils can be brought close together, for a close coupling between them is necessary. The heads of the screws, countersunk, must be at opposite ends of the formers, on the left in one case and the right in the other, so that they come together. This is quite obvious, I know, but is just one of those little points which one can so easily overlook.

Ebonite is Preferable

I should mention that the hubs, too, are of ebonite. Wood could be used in the case of those unable to handle the harder material, but care should be taken that the work is well smoothed off with sandpaper of a fine grade, otherwise the wire, which is very thin, may be caught up and broken in the winding.

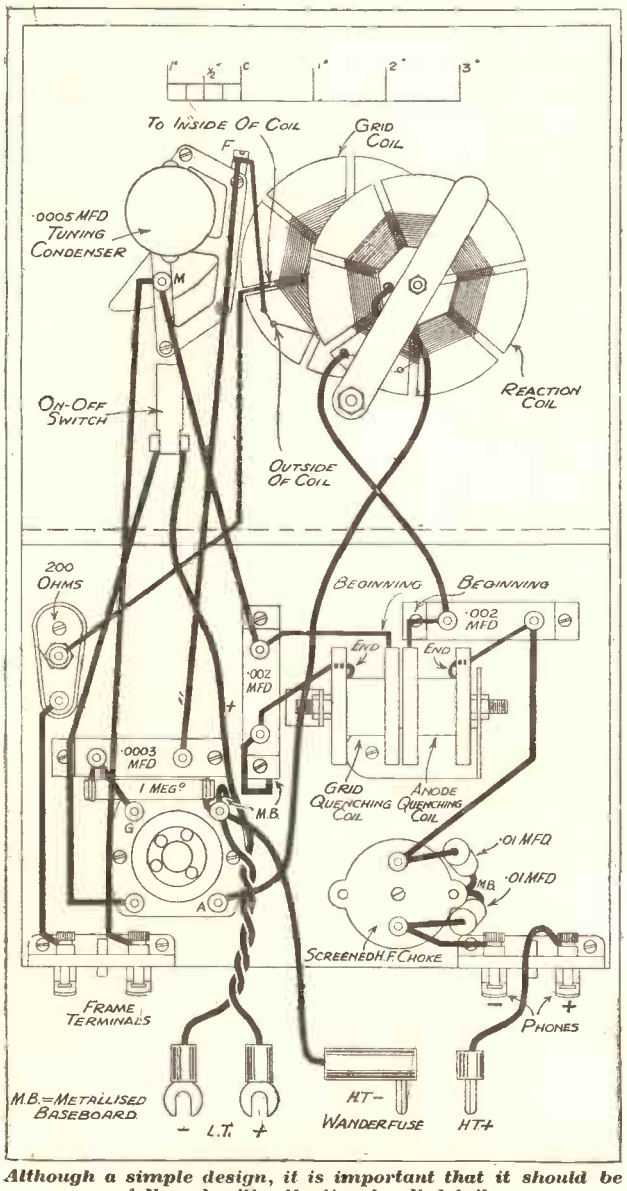
Also, you could have square cheeks instead of round ones if you like, but here again that will make it rather

A GUIDE TO THE CONSTRUCTION



Assistance will be rendered in the lay-out and wiring processes if this photograph is compared with the practical diagram to the left.

FOLLOW THE DESIGN CAREFULLY



Although a simple design, it is important that it should be followed with attention to all details.

awkward for the winding and is for that reason hardly to be advised.

For the windings use 42-gauge enamelled copper wire. You will require about one ounce or a little over. But get two ounces to be on the safe side.

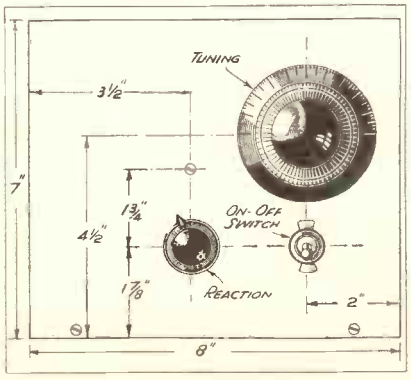
The grid quenching coil requires five thousand turns and the anode quenching coil four thousand five hundred turns. That sounds a somewhat tall order, but the winding is easily and quickly enough done with the aid of a hand drill and a vice.

The Winding Operation

Fix the drill in a vice in a convenient position and then secure the former in the chuck of the drill. You must work out the ratio of the gearing of the drill. Mostly it is four to one, but there are exceptions. It is easily worked out. Slowly rotate the handle one full revolution and count how many times the chuck rotates. If you divide this figure into the five thousand (or four thousand five hundred in the case of the other coil) you will at once know how many times you must rotate the handle of the drill in order to complete the winding.

The windings of both coils must be in the same direction. This is important. Run the wire on neatly in layers but do not worry if a spot of untidiness creeps in now and then. Keep a fair tension on the wire but do not strain it too much or it will break, for it is quite thin stuff. And don't

THE THREE CONTROLS



Operation is simple enough, the controls on the panel consisting of two variables and one switch.

forget to leave enough spare at each end for connecting purposes. A small hole can be drilled through the one cheek of the former down close to the hub to carry through the inside end.

But you can't take out 42-gauge wire for external connections, it is too fragile. Therefore, it is advisable to fasten some stouter wire to the ends of the windings for connecting.

When the winding is complete it should be covered with adhesive tape in order to protect it. Medical plaster is convenient material for a job like this.

The coils when completed can be mounted on the baseboard by means of simple brackets cut from sheet brass, aluminium or anything else that is handy. And don't forget that the coils must lie closely together, the cheek of one touching the cheek of the other.

The remaining two coils are even simpler to construct. The formers in this case are merely of cardboard. Not that very rough thick stuff, though, for that is both clumsy to handle and not too satisfactory after one has handled it!

Use Cardboard

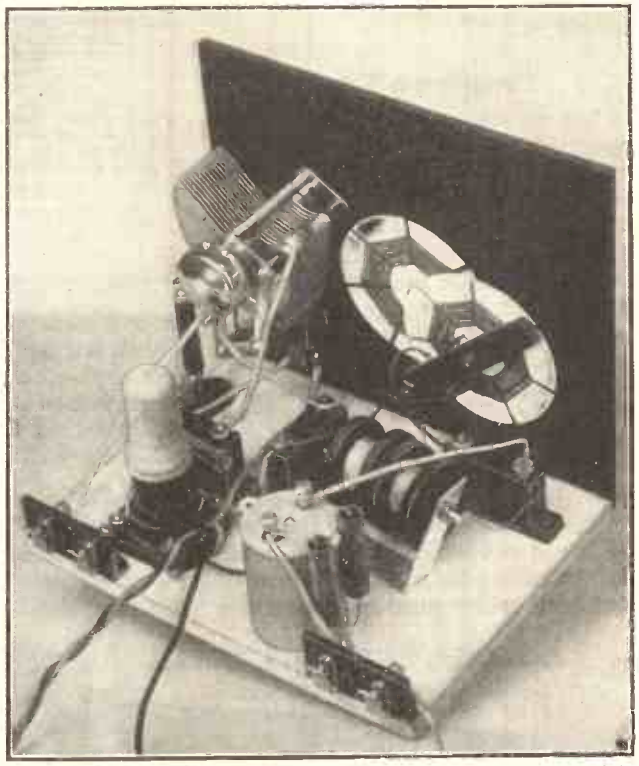
Cardboard of a rather superior quality is desirable such as is generally to be found in boot boxes and boxes of chocolates and which is about twice as thick as a postcard, although it must be said that thickness doesn't matter much. What you want is just a reasonable amount of rigidity, enough to hold the wire in position, anyway! As a matter of fact, I have wound coils like these on postcards before now, but I must admit there was a tendency for the sections to flap about and to be cut into by the wire!

Each of the formers needs to be three inches in diameter with seven equally spaced slots of about an eighth of an inch in width running down to a one and a half inch centre. To cut the former correctly draw on your cardboard two circles, one of three inch diameter and another one dead in the centre of it one and a half inches in diameter. Then draw in lines to guide you in cutting the slots.

For these coils you require 34-gauge single silk-covered wire, and only a small quantity, for there are only sixty turns on each coil. The wire is wound on by passing it through first one slot and then the other, and you will meet with no difficulties in this operation. Again, it is, however, quite essential that these two coils, too, should be wound in the same direction.

You will then have to tackle the problem of mounting the coils on the panel so that the reaction one can be swung right away from the grid one or right over it as required. This is your reaction control. Clearly the one coil needs merely to be fixed on the panel by means of a small central screw and nut, but the other must be carried on an arm so that it can be swung by the operation of the knob.

A COMPACTUM OF RADIO DYNAMITE



The amazing power provided by the few components used in this set must be experienced to be thoroughly grasped.

Made from Old Parts

I am not going to give detailed descriptions of the bits and pieces I used for this job because you may not be able to obtain exactly the same kind. Briefly, I took the bush and spindle of an old potentiometer and these, together with a strip of ebonite to hold the coil, completed the fitment.

But no doubt all readers have an old component of some sort which would yield suitable parts for the job. But I do not recommend you to try to "make do" with just lying the coils on the baseboard, trusting to a primitive shifting of their positions to give the adjustment, for the reaction of this little set is somewhat

critical as can be imagined, and it needs to be referred to for each different station you tune in.

However, a little individual ingenuity will no doubt enable all of you to fix up your swinging reaction control quite effectively. The moving coil must, of course, be connected in circuit by means of flexible wire. Single-stranded wire is liable to fracture under the strain of continual movement.

Component Values

Let me interpose here a few more words about component values. The condensers particularly must be of the capacities stated, and in order that they shall not deviate you are urged to use the makes specified, for these are certain to be sufficiently accurate for the circuit.

I will take it for granted that you will place the parts as shown in the diagram and photos. The layout is not frightfully critical, but I am not going to guarantee that you will get the set to give its full effects if you plan different layouts of your own!

There is not much wiring to do and so it will add little to the time taken in assembling the set if you carry it out with rather more care than you might devote to an ordinary one-valve hook-up. Also, you should check the wiring over to make sure everything is as it should be.

You see, this little set has two distinct personalities as it were. It can operate as a normal one-valver and it may still do this even if there is a slip up in its construction, and that would mislead you very considerably. On the other hand, if it is all in order, it will "super-regen" and assume a sensitivity colossally in advance of an ordinary one-valve arrangement.

It is not critical in regard to the valve. Practically any valve of the H.L. type will give good results. And it will work with sixty volts H.T., although only just and if everything is in apple-pie order. I strongly recommend you to employ a full 120 volts, and you will then be sure to get a satisfactory effect.

Details of the Aerial

There is no advantage at all in using a large aerial with this set. You can rig up a simple frame aerial by merely winding about eight turns of wire (any gauge) round a box of about the size of an H.T. battery, keeping the turns slightly separated. The box can be a bit bigger than that or the turns one or two more or less. There is certainly nothing critical about the frame aerial. But it must be a simple frame aerial something on the lines I have indicated.

You will know at once whether or not the set is working in the correct manner, for the moment you put on the 'phones you should hear a rushing sound indicating a condition of extreme sensitiveness. If there is absolute silence, then you have slipped up somewhere.

The set is tuned more or less in the normal manner. There is just the one tuning control and a reaction adjustment to manipulate. But the reaction does not handle in quite the normal manner. It is a sensitive adjustment and must be just right. However, you will soon get the knack of handling it and amaze yourself and all your friends with the uncanny receptiveness of the outfit.

To the jaded and blasé radio constructor who has nearly outworn his enthusiasm for trying new sets, I strongly recommend this "Super-Regen." He will find it quite a revelation and will undoubtedly want to pursue the principle into more ambitious outfits. We hope to be able to show how this can be done on some future occasion. As I have said I have in mind a three-valver and one with bandpass tuning, an H.F. and an L.F. stage. Goodness knows what this outfit will accomplish when there are incorporated some of the new ideas that are even now in the process of development!

Adding Further Stages

In the meantime, I hope that WIRELESS readers will themselves carry out experiments with the principle. It is easy enough to add an L.F. stage to the one-valve arrangement I have just described. I have managed to arrange the position of the H.T. and so on, so that the L.F. amplifier can be connected straight on in the same manner as an L.F. stage is added to an ordinary detector circuit.

All that are needed are an L.F. transformer, a valve holder and grid bias battery. But there is the snag that there may be a tendency for the high-pitched whistle to come up out of proportion with the strength of the speech and music. In which case a single audio-filter is indicated. Also, of course, there is the terrific sensitivity still further increased with no step-up in relativity. However, here is meat for amateur research with the prospect of some pretty wonderful results to be achieved.

EVERYTHING THAT YOU WILL NEED

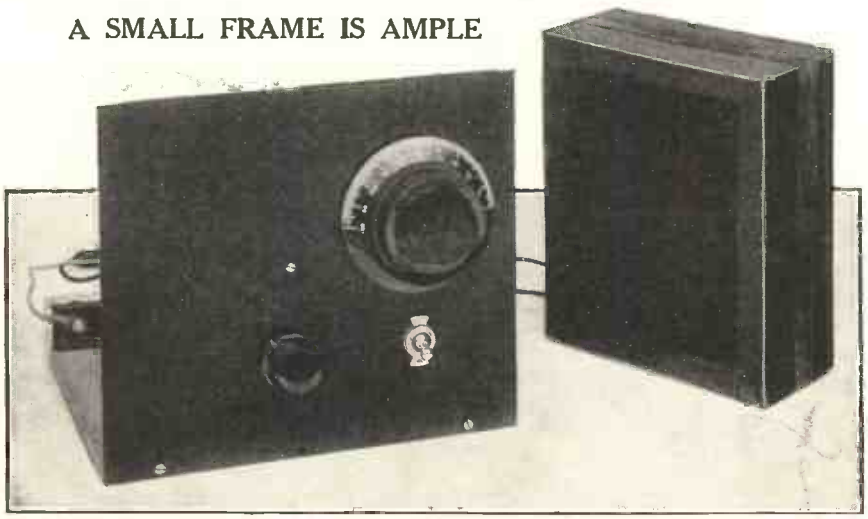
1 J.B. ·0005-mfd. Popular Log S.M. condenser.
1 Benjamin Vibrolder 4-pin valve holder.
1 Bulgin toggle on-off switch type S.80.
2 Dubilier ·002-mfd. fixed condensers type 620.
1 Dubilier ·0003-mfd. fixed condenser type 620.
2 T.M.C.-Hydra ·01-mfd. tubular fixed condensers.
1 Bulgin screened H.F. choke type H.F.10.
2 Graham Farish Pop terminal blocks.
1 Erie 1-meg. grid leak 1-watt type.
1 Graham Farish 200-ohm "Ohmite" resistance in vertical holder.
1 Peto-Scott ebonite panel, 8 × 7 ins.
1 Peto-Scott wood baseboard, 8×6×⅜ ins.
1 Wander plug, 1 wander fuse, 2 accumulator spades.
Wire, etc., for coils. (See text)

PHONES: Ericsson.

VALVE: Marconi or Osram H.L.2K.

BATTERIES: H.T., 120 volts Drydex. H1006
L.T. 2 volts Exide. O.C.G3

A SMALL FRAME IS AMPLE



No ordinary aerial—not even a wire round the room—is necessary for good results to be obtained from the "Super-Regen." The small frame seen in this photograph, wound on a cardboard box, gives ample pick-up for long-distance reception.

The B.B.C.'s Television Transmissions

A review and explanation of the details recently issued concerning the Baird and E.M.I. systems of transmission to be used at Alexandra Park.

By K. D. ROGERS

PROGRESS in the setting up of a high-definition television service in this country has been so slow that the public has almost given up hope of ever having it. The Selsdon Committee moved rapidly. The report came out and most people thought things were "sitting pretty." Then the Advisory Committee was formed, the B.B.C. came into the picture, and apparent stagnation began.

But the stream of television development has not completely ceased to flow. It has many all but stagnant pools, and some deep waters too, but the progress towards its culmination is present if imperceptible.

Many knotty points have had to be decided, commercial problems solved, a site for the station found and approved, and so forth.

Service Next Easter

The station site has been decided and work begun on it. And the commencement of the service is expected to be round about Easter next year, with a few weeks of experimentation before then.

One cause of exasperation in commercial circles has been the lack of reliable technical information about the two proposed television systems, especially in the case of the Marconi-E.M.I. method.

Though it is realised that Baird Television Ltd. and H.M.V. (Marconi-E.M.I.) will go either directly or indirectly into the television set market, it had been stated by the television committee that other radio concerns should have the opportunity—under licence perhaps—of marketing television receivers to pick up the B.B.C. broadcasts.

Details

To be able to turn out receivers capable of doing that meant that certain technical information concerning the two systems to be used was necessary. That information was not forthcoming. Hence perturbation in the laboratories of many of the radio firms.

But the information—or perhaps I should say, the bare bones upon which the flesh of the complete television receiver design has to be placed—had been promised, and at long last it has arrived. Baird and E.M.I. have divulged a certain amount of their transmission secrets. These consist of such things as the character of the scanning, the percentage of picture modulation, and the percentage of the synchronising impulses in relation to the carrier; the length of the synchronising impulses, their slope, details of interlacing and so forth.

The crux of the matter is, of course, the synchronising. With details of that known there is a chance for the television research engineers to get down to it and develop the right sort of time base. To the expert the official jargon that follows will be reasonably clear. The inexperienced student of television may be forgiven if he stumbles somewhat over the phrasing and the diagrams. So let me explain one or two points. But first have a look at the official statements. Here is that of Baird Television, Ltd.

The accompanying drawing (Fig. 3) gives complete details of the waveform for picture modulation and synchronising impulses. From this it will be seen that, using the arbitrary aerial-current-units of zero to 100, the total modulation for synchronising (black) extends between the tolerance limits of zero to 5 and 37·5 to 42·5, while the picture modulation (black to white) extends between the tolerance limits of 37·5 to 42·5 and 100.

It will be noted that the high-frequency synchronising impulse is rectangular in shape and is maintained for 8 per cent. of the total time taken in tracing the line, and occurs between the *line* traversals. The low-frequency synchronising impulse, which is also rectangular in shape, is maintained during the time that 12 lines are traced, and occurs between the *frame* traversals. These traversals, as seen by an observer looking at the received image from the front, scan from left to right (line) and from top to bottom (frame).

THE E.M.I. SYNCHRONISING SIGNALS

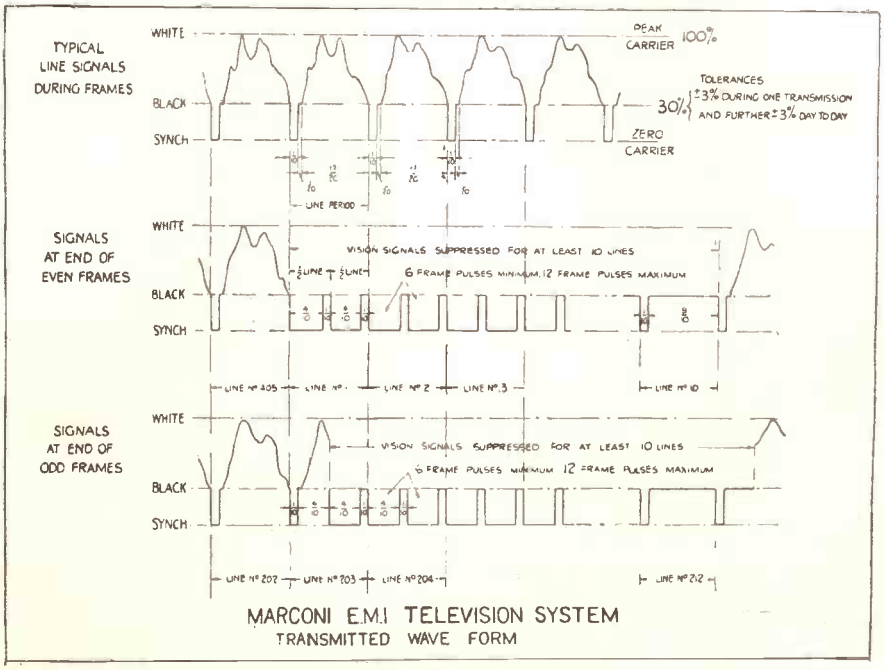


Fig. 1. This official E.M.I. diagram shows the relation of the line and frame synchronising signals to the modulation.

BLACK EDGE

The diagram also shows that, in addition to the above 8 per cent. of the line traversal time occupied by the high-frequency synchronising impulse, a further 2 per cent. is masked off to form a black edging. Similarly, an additional 8 lines are masked off in the case of the low-frequency synchronising impulse for the same purpose.

The total number of lines in the complete picture is 240, scanned sequentially and horizontally at 25 picture traversals per second and 25 complete frames per second. The line frequency is thus 6,000 impulses per second and the frame frequency 25 impulses per second. The dimensions of the observed picture have the ratio of 4 horizontal to 3 vertical.

Amplitude modulation is employed, which results in light-intensity modulation in the

observed picture, the transmitter carrier increasing towards the white. The line synchronising signals and the frame synchronising signals are in the sense opposite to increasing picture modulation. The maximum frequency band involved in the transmission is 2 megacycles, and the average component of light in the picture is transmitted, a black in the picture being transmitted as black and a white transmitted as white, in accordance with the modulation per centages referred to above.

This is the easier system of the two to understand. Everything is straightforward. With no modulation, a certain level of rectified current at the receiving end is provided, being between 37·5 and 42·5 per cent. of the maximum. When modulation begins (a picture) the level will rise and fall, but will always be above 37·5 per cent. and below 100 per cent.

Between Lines

At the end of a scanning line the current will drop suddenly to about 5 per cent. stay at that for 8 per cent. of the time taken in tracing a line, rise suddenly to 37·5 per cent. or so, pause for 2 per cent. of a line time, and then rise in accordance with the modulation. The second line will have commenced.

At the end of each frame the frame synchronising impulse is sent. This is of the same type as the line synchronising, but of longer duration. The frame impulses take the time of 12 lines. This is followed by 8 "line time" units before the second frame begins.

The full black of the picture is obtained in the 37·5 per cent. rectified current—no modulation—and anything below that does not affect the cathode-ray tube. It is, therefore, often referred to as "blacker than black." The synchronising impulses are said to be on the "blacker than black" system.

One thing you will note is that though the Baird system is said to be of 240-line scanning, actually you do not see 240-lines—20 are taken up by the frame synchronising and the subsequent pause. But the definition is said to be 240-line definition. The picture frequency is 25 frames per second.

And now for the Marconi-E.M.I. system. This is similar in some respects to the Baird—you will see from the diagram how the "blacker than black" synchronising is used, but this time the modulation starts at 30 per cent. of the rectified strength.

EXPLAINING INTERLACING

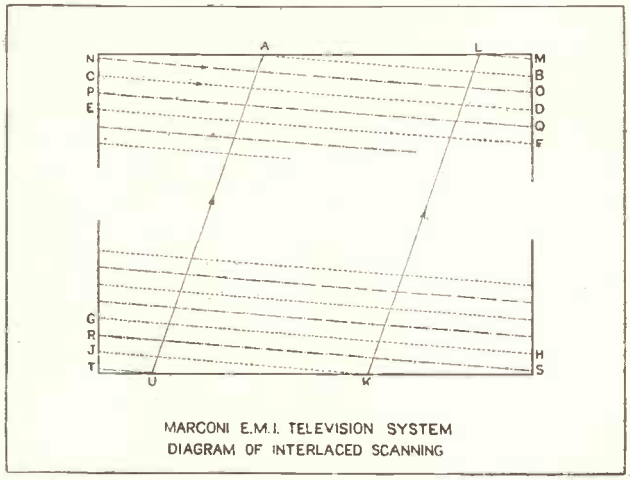


Fig. 2. This diagram shows how the scanning lines in the E.M.I. system interlace with one another.

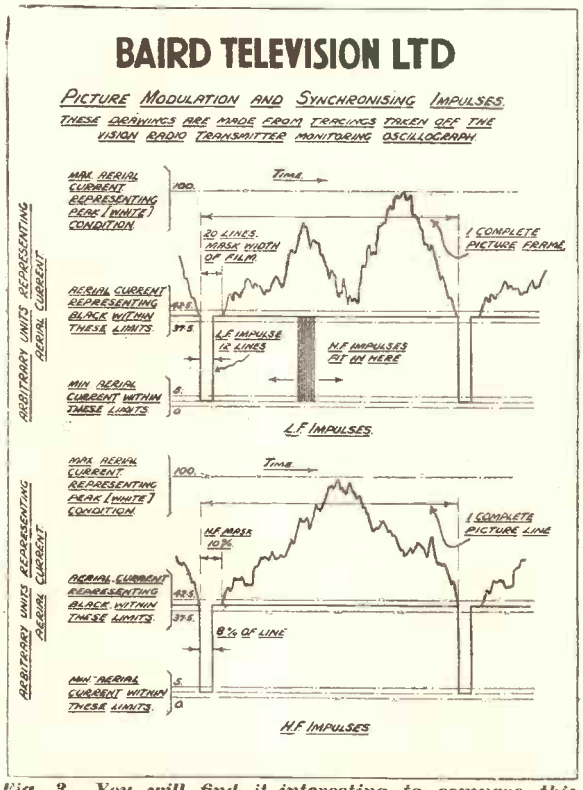


Fig. 3. You will find it interesting to compare this diagram of the Baird system with the E.M.I. one on the previous page.

E.M.I. System

Here is the official description of the E.M.I. interlaced method. The interlacing is clearly explained, so will not need any elucidation by me.

MARCONI-E.M.I. TELEVISION SYSTEM

The Marconi-E.M.I. television system transmits 25 complete pictures per second, each of 405 total lines. These lines are interlaced, so that the frame and flicker frequency is 50 per second. The transmitter will radiate signals with sidebands extending to about 2 megacycles either side of the carrier frequency. Good pictures can be received utilising only a fraction of the radiated band, but naturally the quality of the received picture will depend upon the degree to which the receiver makes use of the transmitted band width. The transmitted wave-form is shown in Fig. 1.

(1). *Line Frequency.*
10,125 lines per second, scanned from left to right when looking at the received picture.

(2). *Frame Frequency.*
50 frames per second, scanned from top to bottom of the received picture.

(3). *Type of Scanning.*
The scanning is interlaced. Two frames, each of 202·5 lines, are interlaced to give a total of 405 lines with a complete picture speed of 25 per second. The line component and the frame component of scanning are regularly recurrent, the interlace being derived from the fractional relationship between line and frame frequencies. An explanation of the method of interlacing is given at the end of this specification.

(4). *Interval Between Lines.*
There will be intervals between the vision signals of successive lines, which intervals provide time for the transmission of a line synchronising signal, and also provide time for the return of the cathode ray beam to the beginning of the next line. The minimum interval between the vision signal of successive lines will be 15 per cent. of the total line period (1/10,125 sec.), the first 10 per cent. of this interval between lines being occupied by the line synchronising signal and the remaining 5 per cent. by a signal corresponding to "black" in intensity. The remaining 85 per cent. of the total line period is available for transmitting vision signals.

(5). *Interval Between Frames.*
There will be intervals between the vision signals of successive frames. The minimum interval between frames will be 10 lines, leaving a maximum of 192·5 active lines per frame, or 385 active lines per complete picture.

(6). *Picture Ratio.*
The picture ratio will be 5 : 4, that is to say, the distance scanned during the active 85 per cent. of the total line period will be 5/4 times the distance scanned during the 192·5 active lines of the frame.

(7). *D.C. Modulation.*
The picture brightness component (or the D.C. modulation component) is transmitted as an amplitude modulation, so that a definite carrier value is associated with a definite brightness. This has been called "D.C. working," and results in there being no fixed value of average carrier, since the average carrier varies with picture brightness. The radio-frequency transmitter output is specified in what follows as a percentage of the peak output. This percentage is in terms of current (or voltage) and not in terms of power.

(8). *Vision Modulation.*
The vision modulation is applied in such a direction that an increase in carrier represents an increase in picture brightness. Vision signals occupy values between 30 per cent. and 100 per cent. of peak carrier. The amount by which the transmitted carrier exceeds 30 per cent. represents the brightness of the point being scanned.

(9). *Synchronising Modulation.*
Signals below 30 per cent. of peak carrier represent synchronising signals. All synchronising signals are rectangular in shape and extend downwards from 30 per cent. peak carrier to effective zero carrier.

(10). *Line Synchronising Signals.*
The line synchronising signals are of one tenth of a line duration, and are followed by a minimum of one twentieth of a line of black (30 per cent. peak) signal.

(11). *Frame Synchronising Signals.*
The frame synchronising signals comprise a train of two impulses per line, each occupying four-tenths of a line and having one-tenth of a line interval of black (30 per cent. peak) signal between them. At the end of even frames, the first frame pulse starts coincident with what would have been a line signal. At the end of odd frames the first frame pulse starts half a line after the preceding line signal. At least six frame signals will be transmitted at the end of each frame, but the number may be increased to any number up to 12 pulses (6 lines). During the remainder of the intervals between frames, normal line synchronising signals will be transmitted with black (30 per cent. peak) signals during the remaining nine-tenths of the line.

It will be noted that throughout the interval between frames (as during the whole transmission), the carrier falls from 30 per cent. to zero regularly at line frequency and in phase with the beginning of the normal line synchronising pulses.

(12). *Variations in Transmitted Wave-form.*
The 15 per cent. interval between vision signals

(*Please turn to page* 288.)

From My Armchair

The S.T.700 and Listeners' Aerials are among the subjects dealt with by John Scott-Taggart in this month's contribution.

WITH the regularity of Halley's Comet, my annual star set will—when you have begun to read this—have appeared in the high heavens.

The S.T.700 is published in "Popular Wireless," sister journal to this more de luxe publication. If you are quick, you may still be in time to seize a copy of the issue dated November 2nd, but on sale from October 30th.

I am very pleased indeed with this new receiver. I'm not going to describe it, because those who pay me enormous fees for designing their sets desire to get some of their money back, and they get a good deal of it out of those who pay the paltry threepence necessary to learn all about the S.T.700.

I wonder if you ever think of that angle of home construction? For three copper coins you can have designed for you a radio receiver that represents the last word in next year's ideas. If you consulted me privately, I should expect exactly thirty-six thousand times the fee.

New Features

The S.T.700 will show that there is a great deal of life in home construction and amateur radio. It is true that people no longer want cheap imitations of commercial sets. They look for something different—something they cannot get in factory-built sets. In the S.T.700 they obtain certain new features quite apart from a high performance. One is a new step in the direction of quality reproduction, and another is local station annihilation—or moderation, if you wish to be kind. The third is the dial.

They say it is the dial that sells the set. If so, it is a stupid reason. You never take a man at his dial value. But, given good performance, the dial caps it. I have given the S.T.700 a really honest-to-goodness face—a he-man amongst dials. It has 112 station names, and they are there to be used, not to be admired.

Special Free Gift

This dial, by the way, is given with "Popular Wireless," free, together with a blue print and a data sheet—all for threepence! If that is not a real bargain, I'll go back to circuit S.T.1! I wonder how many of you know what is circuit S.T.1? Or S.T.200?

As regards the latter, I am uncertain myself. It is the mystery circuit even to me. S.T.100, S.T.300, S.T.400, S.T.500, S.T.600 and now S.T.700, have all cut a dash, but S.T.200—if there ever was such a circuit—wasted its fragrance on the desert air. It was probably developed in the days when a good thing was simply a good thing. The modern spirit calls for telling people about good things.

The vulgarity of publicity, the beating of drums, has seized on every aspect of life. The engineer finds himself blinking into the hard light of publicity, but when he gets used to it he stops minding it. A certain sense of humour comes to his aid.

And the public *does* benefit. The searchlight of publicity cannot benefit, for example, a third-rate design—not for long. Very soon it throws into relief any defects in the design. I suppose I have stood up to publicising better than most. I have just completed 21 years of published set designs, and they still seem to find favour. You get a mighty lot of limelight—do they use lime these days, by the way?—in twenty-one years.

Effect of Publicity

Contrary to public opinion, publicity is professionally injurious to the professional man. Writing and designing for the amateur, however, is so far removed from my ordinary work that it neither helps nor hinders my professional work or studies.

What a long time 21 years is—or are! Good gracious, I'll soon be pompously saying I was designing wireless sets "before you were born." No, I don't think I will. I haven't much respect for years. I believe that grey hairs are a symptom of age, not a proof of wisdom.

A UNIQUE RECEIVER SEEN AT THE NEW YORK RADIO SHOW

The Spartan mirror radio set—a unique design recently shown at the National Electric and Radio Exhibition in New York. As can be seen, the receiver is mounted upon a circular mirror with the tuning and other controls arranged above the loudspeaker.

LISTENERS AND THEIR AERIALS

There are youngsters to-day who can learn in a week facts and theories that took some of us years to find out or prove, and they know those facts and theories just as well—probably better—than we do. The youngest of these youngsters, of course, do not discriminate between learning and finding out, which is the cause of much callow bumptiousness and jejeune truculence. The greatest invention in the world is, as often as not, capable of being scribbled on a tablecloth in a Soho dive. Two minutes afterwards, Tom B.Sc., Dick B.A. or Harry B.Eng. could prattle confidently about it.

Betraying Character

Aerials, I always think, betray the characters of their owners. Not that I have any patience with those who "do not want to disfigure their houses." To me the worst aerial, strung up with frayed rope from a tottering chimney pot to a broken reed of a clothes prop nailed to a rickety fence, is better than the old-maidish mealy-mouthed prim little lengths of wire which go round the picture rail. But I realise that this is a strictly personal view point.

Not everybody even possesses a back garden, and the indoor aerial is *sometimes* a good compromise if there is local electrical disturbance, e.g. lifts, refrigerators, etc. But an outdoor aerial does disclose such qualities as neatness, technical knowledge, sloppiness, superstition, gullibility—and even a strong sense of compromise. An aerial that has recently aroused my admiration consists of a full 100 ft. length of wire, beautifully hoisted to the tops of two immaculate flagstaffs and descending to a scrupulously efficient lead-in insulator. So far, so good. But here is the exclusive, inimitable and trenchant feature: You know the various kinds of "patent" aerial. Well, one of these, looking like a small aspidistra, was connected at the very far end of this hundred feet of wire.

On a recent visit to Glasgow a more subtle aerial was brought to my spellbound attention. It was a clothes rack festooned with wire. Ignorant Londoners may be unfamiliar with the contraption so popular in the North, for drying clothes before the kitchen fire. The rack consists of a sort of parallel-bars of wood which with a rope may be hoisted to the ceiling or lowered to permit the draping of damp clothes fresh from the wash boiler.

The demonstratee became demonstrator and showed me how by hoisting and lowering the rack (complete with washing and aerial) he obtained a most effective volume control. Ingenious but not, I am afraid, patentable.

The demonstration was a trifle marred by my host dropping the rack a little too suddenly on the head of his better-half who was busy poking the fire. But for my restraining presence an even more dynamic use of the poker might have resulted.

* * *

DURING THEIR TOUR

Dance band leader Harry Roy and his wife photographed in their Manchester hotel shortly before Mrs. Roy was taken ill with appendicitis. They are now back again in London.

"Can you," writes A. J. T., of Windermere, "give me a recipe for designing a set that will make all my friends gasp?"

The following, based on a Mrs. Beeton formula, will probably do the trick:

Take three dozen new laid eggs, three gallons of cream and mix slowly, having first removed the whites from the eggs. Allow to stand for half an hour. Then add five large bottles of triple star cognac. Whip the whites of the eggs and stir in slowly. Serve cold. Sufficient for twenty designers.

A. J. T. should lock himself in his room, think, and sip the above slowly. By the time he has finished he should have produced a design calculated to stimulate the interest of his fellow Windermerians. If it does not make them gasp, he can console himself with the satisfaction that it will have made him gasp.

THE NEW FINNISH GIANT

BEFORE these lines appear in print the new 150/220 kw. long-wave station Lahti will have concluded its test period and will be regularly on the air. The station, which is entirely British built, will replace the old 40 kw. transmitter.

The new station will bring the voice of Finland very much more to the notice of West-European listeners. Finland, with its many thousand lakes, large forests and enormous expanse from the Baltic Sea to the Arctic Ocean, can only hope to provide the scattered population with a broadcasting service by means of a very high-power long-wave station.

A Six-Wire Aerial

The Lahti transmitter is about 500 ft. above sea-level, and the distance from the capital Helsinki is, as the crow flies, about 50 miles. The aerial masts are another 500 ft. high and a 6-wire "T" aerial is employed. The transmitter has all the features of a modern high-power long-wave station including crystal drive, floating carrier and adaptability to any wavelength between 1,000 and 2,000 metres.

Building operations started in November, 1934. The transmitter building was ready by May, 1935, and tests started recently.

Twenty miles of bare copper wire have been buried to act as earth. Another curious feature of Lahti is the fact that part of the old transmitter building containing the 40 kw. outfit, which is shortly to be dismantled and re-erected at some suitable site further east, will now be used as an aerial tuner house.

Finland has 10 kw. medium-wave stations in Helsinki, in Viipuri, in Oulu, and another will shortly be opened at Vasa. There are five small relay stations with powers varying between 1 and 5 kw. in other parts of the country.

A. A. G.

1936 RECEIVERS of RENOWN

"WIRELESS" is, and always has been, the journal for the listener as well as for the constructor. Right from the very first issue the underlying policy has always been to cater as generously as possible with all aspects of broadcast entertainment and to retain just sufficient flexibility of outlook always to enable us to adapt ourselves to the changing conditions.

AUTHORITATIVE GUIDANCE

But there must of necessity be a limit to editorial activities where, for obvious business reasons, the size of the paper is governed by the price of sixpence. And zealously as we have sought to perpetuate our policy of catering for all shades of opinion, with the seven million mark passed in the number of broadcast licences, an urgent need has arisen for authoritative and detailed guidance on the subject of commercial sets which could not be met adequately in a paper of limited size.

AN ALL-EMBRACING SERVICE

But with the far more generous contents made possible by the increase in price, we are now able to offer our readers an impartial and all-embracing service that is without parallel in present-day radio journalism. The test department which is responsible for the conduct of this service is already the most quoted authority of any in this country—a significant indication of the importance that is attached by the manufacturers to a WIRELESS verdict—and with our now greatly increased facilities the reader is assured of guidance that is absolutely second to none.

As a fitting inauguration of the bigger and better WIRELESS, it is our pleasure to present in the pages which follow a comprehensive survey of the most outstanding receivers and radiograms of the new season. It will provide the reader with an excellent indication of the general trend of development in receiver design, and it will serve as a useful guide to the prices which now appertain in the various classes.

In subsequent issues, these and other models will constitute the subjects of our technical reports, and it will be our constant endeavour to show, without fear or favour, how each and every one may be expected to perform not under the ideal of laboratory conditions but under the average home conditions in which they will be used.

HIGH LEVEL OF PERFORMANCE

Of the sets with which this new season has been ushered in, it may be stated even now with complete confidence, and as a result of tests which we have already conducted, that the general level of performance is higher than it has ever been, and prices, almost without exception, are rock-bottom. Cabinets are better, controls are fewer, dials are more easily readable, sets are more reliable and, in fact, there is abundant evidence to show that 1935–36 is indeed a vintage season for radio.

PRICES AT THEIR LOWEST

But before leaving you to the survey which follows, we should perhaps conclude with a note of warning in season. Prices today are at rock-bottom. Do not hesitate in your selection in anticipation that ere long they may fall even lower. It has been stated in authoritative quarters, and by the manufacturers themselves, that a rise in price levels next season is almost inevitable. To act without delay may therefore save you money!

CONTENTS

COSSOR

AN INGENIOUS TABLE RADIOGRAM

To Cossor must go the credit for having produced this year what is believed to be the only table model radiogramophone of its kind available. For years the listening public has been awaiting the arrival of a really first-class table-radiogram at a reasonable price, and that Cossor should thus have breached the gap is but another instance of the seemingly inexhaustible enterprise that is so closely interwoven with Cossor history right from the start. A tip-top all-electric superhet radio set, a quality-perfect electric gramophone and a beautifully made cabinet—that, in brief, is what you are offered in this instrument. Absolutely endless entertainment, and yet—and it seems almost too good to be true—it can be yours for only 16 guineas! The secret of the low price in this case is undoubtedly due in large measure to the almost unlimited manufacturing resources of the organisation that is behind it, an organisation that has been built up on the underlying policy of service to the listener and reliability. Cossor sets are second to none, a fact not unconnected with the firm's vast experience of valve design and manufacture. Who, after all, can better design receivers than the people who are responsible for the valves that are used in them? This is an instrument that you would be well advised to hear demonstrated when next you pass your Cossor dealer.

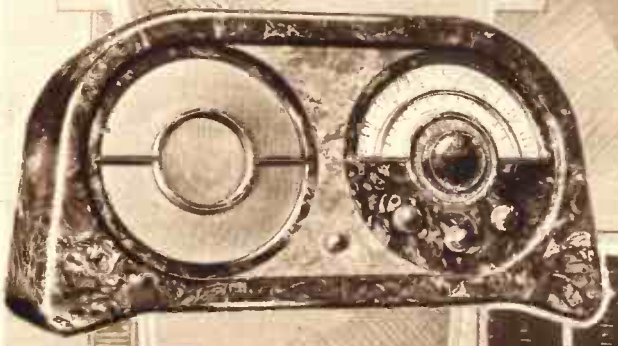
Extreme simplicity of control, the exclusive Cossor feature of "Thermometer" tuning and the calibration of stations by names as well as wavelengths are features of the Cossor model "736" and greatly facilitate station selection. The instrument is for A.C. mains.

Below we take you behind the scenes at the Cossor hive of industry at Highbury. This is but one of many such receiver assembly shops all of which are necessary to keep pace with the ever-growing demand for Cossor products.

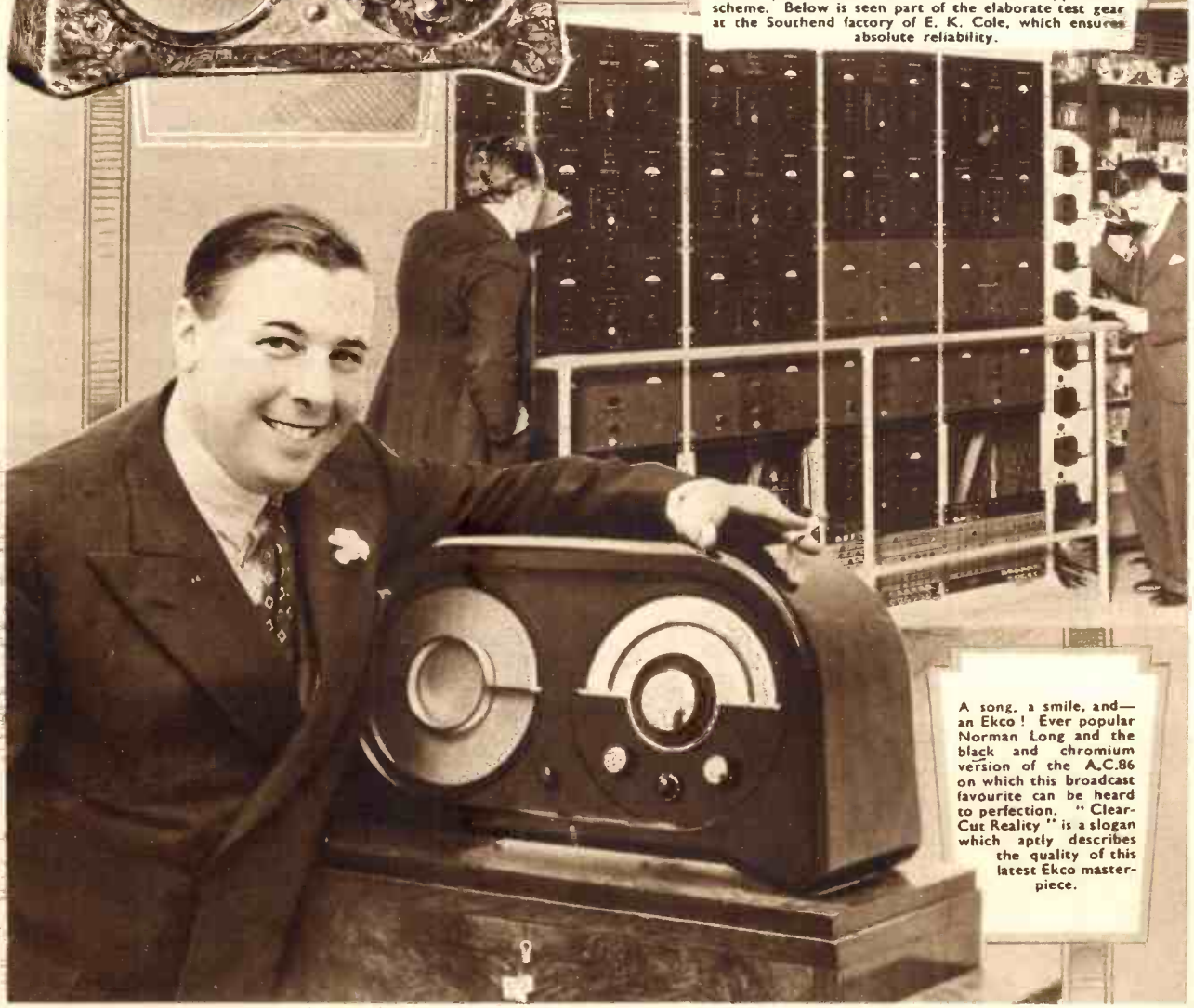
EKCO

MODEL A.C.86 FOR CLEAR-CUT REALITY

This quality-perfect highlight of the better-than-ever Ekco range for 1936 is an eight-stage superhet of exceptional merit. It may justly be described as pre-eminently the set for the ambitious listener of limited means in that, although it costs only 12½ guineas, it is provided with every worth-while modern refinement. Station selection and identification is rendered particularly simple by the large opened-out scale which is illuminated and calibrated both in station names and wavelengths, and the controls have been cut down to the lowest minimum possible consistent with the attainment of completely satisfactory results. The receiver, which is for operation on A.C. mains, is housed in a walnut-finished bakelite cabinet of striking design, and it can also be supplied in black with chromium fittings for an extra charge of 10s. 6d.



The clean, workmanlike appearance of the A.C.86 chassis (above) bears testimony to the skill with which the instrument has been designed. The superhet circuit includes fully delayed A.V.C. and the Ekco station pre-selector and automatic noise suppression scheme. Below is seen part of the elaborate test gear at the Southend factory of E. K. Cole, which ensures absolute reliability.

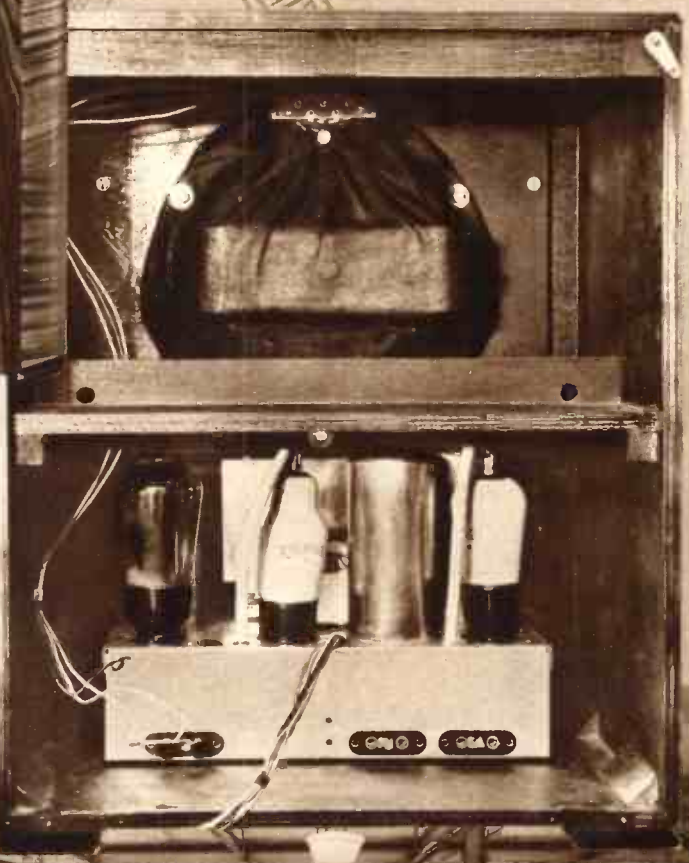


A song, a smile, and—an Ekco! Ever popular Norman Long and the black and chromium version of the A.C.86 on which this broadcast favourite can be heard to perfection. "Clear-Cut Reality" is a slogan which aptly describes the quality of this latest Ekco masterpiece.

G.E.C.

BATTERY RECEIVER TRIUMPH

When an organisation so universally famed as the G.E.C. devotes its attention to the design of a battery receiver, the listener without mains is indeed assured of something absolutely first-rate. That the G.E.C. Battery S.G. Three more than fulfils that expectation is not, therefore, surprising, but as to how this world-famous firm has succeeded in producing such a fine set for £7 19s. 6d., complete with batteries and valves, is a secret known only to them. It is modern battery-radio at its very best at a price to suit everybody.

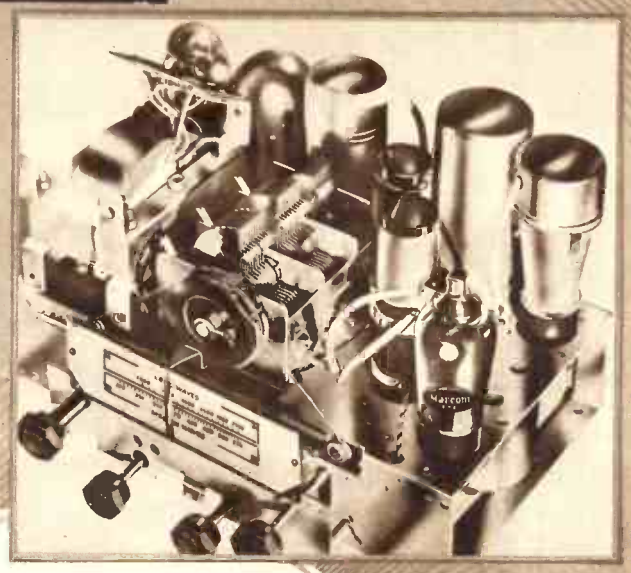


The G.E.C. Battery S.G. Three is justly described by the makers as being a receiver in the luxury class. And as proof that this is no idle claim, the listener has only to study the technical specification. The set employs super-selective low-loss tuning coils and the circuit comprises a variable-mu screened-grid H.F. stage and an H.F. pentode, followed by an economy pentode output, a combination that can be relied upon to provide a wide range of alternative programmes. The powerful 8-inch permanent magnet moving-coil speaker incorporated provides quality of reproduction hitherto only associated with receivers of the mains type, and consistent purity of tone is ensured by the inclusion of an ingenious automatic biassing scheme which compensates for the drop in H.T. voltage as the battery is discharged. The set is simple to operate, and the single-knob tuning and wavelength calibrated dial greatly facilitate station selection. Incidentally, sockets are provided for external speaker and pick-up. Typical, too, of G.E.C. thoroughness, the cabinet is of dignified and impressive design. The general proportions are in every way in keeping with the modern trend in furnishing ideals, and the walnut finish and chromium-framed escutcheon stamp it as a quality production.

* * *

The G.E.C. factory at Coventry in which the Battery S.G. Three is made covers a vast area and provides employment for many thousands of people. The view on the right is of one of the receiver main assembly shops.

MARCONI



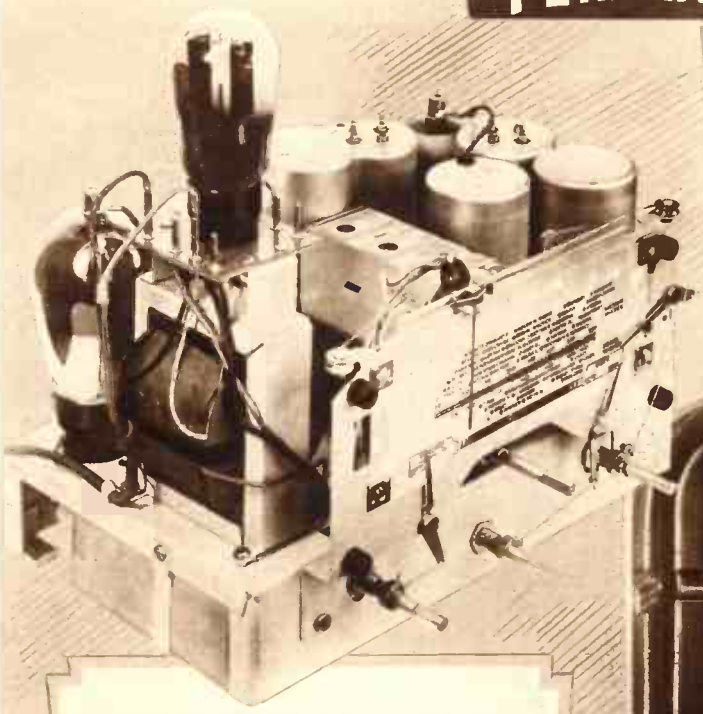
A FINE RADIOGRAMOPHONE

One might have cause to doubt the performance of a seemingly tip-top radiogram at the remarkably low price of 22 guineas were it not for the fact that the model shown here bears one of the most famous of all the names in radio. This magnificent Marconiphone instrument—termed the model "287"—is one of the most famous of all the modern, reasonably priced radiograms, and it is, in itself, an article of furniture of instant appeal to the connoisseur. The masterful blending of carefully-chosen walnut veneers is in keeping with the most modern ideas of cabinet making, and the design throughout is a striking exemplification of cabinet craftsmanship at its best. On the radio side, the chassis incorporated is a five-valve seven-stage superhet arrangement with all the refinements that go to make a thoroughly modern design. It is a set on which the listener can be certain of a whole gamut of alternative programmes at any hour of the day or night, and it possesses the great advantage of extreme simplicity of operation. The only external control, which is a tone-compensated volume control, is effective on both radio and records, and the change-over from broadcasting to gramophone can be achieved in an instant by the movement of a switch. The instrument is for operation on A.C. mains.

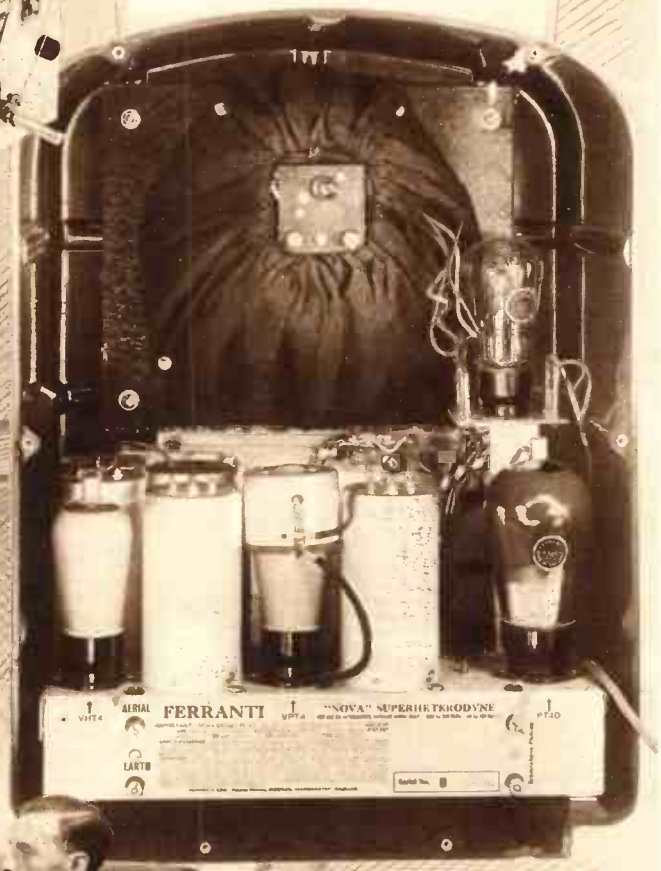
FERRANTI

THE "NOVA" CONSOLETTE

The prestige associated with the name of Ferranti—in itself a guarantee of perfection—is likely to be carried to even greater heights with the introduction this season of the "Nova" consolette. Without doubt, it is a triumph both of engineering skill and artistic presentation, and the listening public generally has been quick to realise the merits of such a fine set at only 11 guineas. Ferranti means quality both of workmanship and reproduction, and of the "Nova" consolette no more need be said other than that it is true to tradition. It is a masterpiece of design, well thought out, and then well built.



The chassis of the "Nova" consolette (which is for operation on A.C. mains) is built up around an advanced superhet circuit arrangement, from an examination of which it is evident that every necessary modern refinement has been incorporated. Particular regard has been paid in the design of this set to the effectiveness of the A.V.C. system incorporated, and fading is almost entirely eliminated.

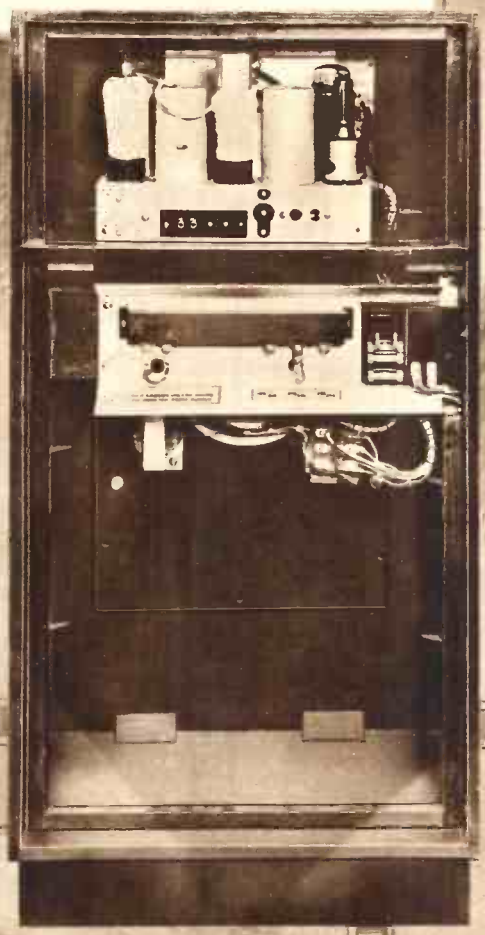


Most listeners these days are vitally concerned with the ease with which a set can be operated. It is for that reason that the famous Ferranti "All-In" dial has achieved such tremendous popularity, for it is believed to be the only dial on the market in which the movement of each control is recorded visually. This dial is one of the features of the "Nova" consolette, and the reception and identification of distant stations is greatly facilitated by the use of names as well as wavelengths on the illuminated scale. Incidentally, wholly satisfying volume for all normal domestic requirements is assured with this set, which provides a 2½-watt output. The receiver is provided with all the usual refinements, including provision for pick-up and external speaker.

H.M.V.

A MUSIC-LOVER'S CONSOLE

Although it is only comparatively recently that the console type of radio receiver has come into prominence, this distinguished-looking instrument of "His Master's Voice" is already enjoying tremendous popularity. It is a four-valve A.C. D.C. superhet with a truly remarkable performance, and it is in every respect an instrument for the music lover. Without any doubt, price for price, the "341" is unsurpassed at 15 guineas.



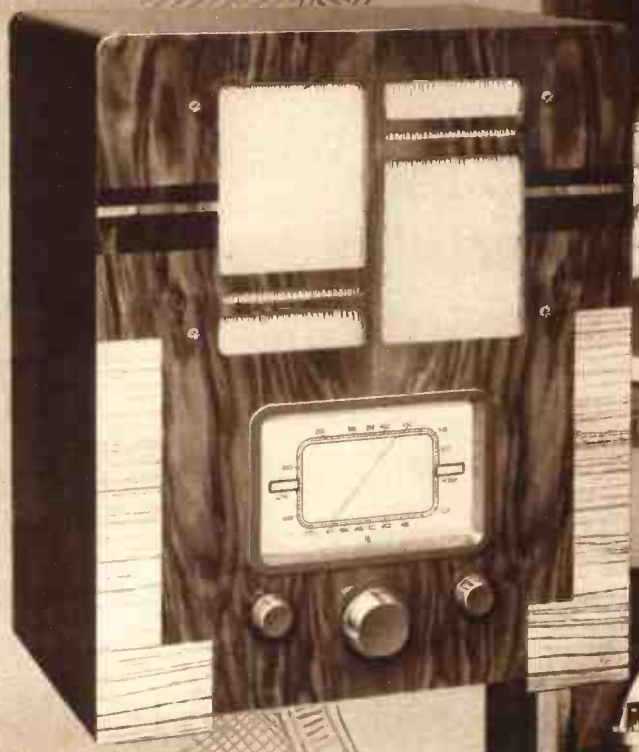
Because in itself it is so much more an article of furniture than the average table type of instrument, the H.M.V. model "341" console, with its delightful proportions and fine cabinet craftsmanship, appeals particularly to the feminine eye. It is, in fact, the ideal "family" receiver in that, although it is amazingly simple to operate, the performance of which it is capable is likely to satisfy even the most exacting critic. Perhaps, above all else, the "341" is a quality instrument—an instrument, in fact, that could not have been more appropriately named than "His Master's Voice."

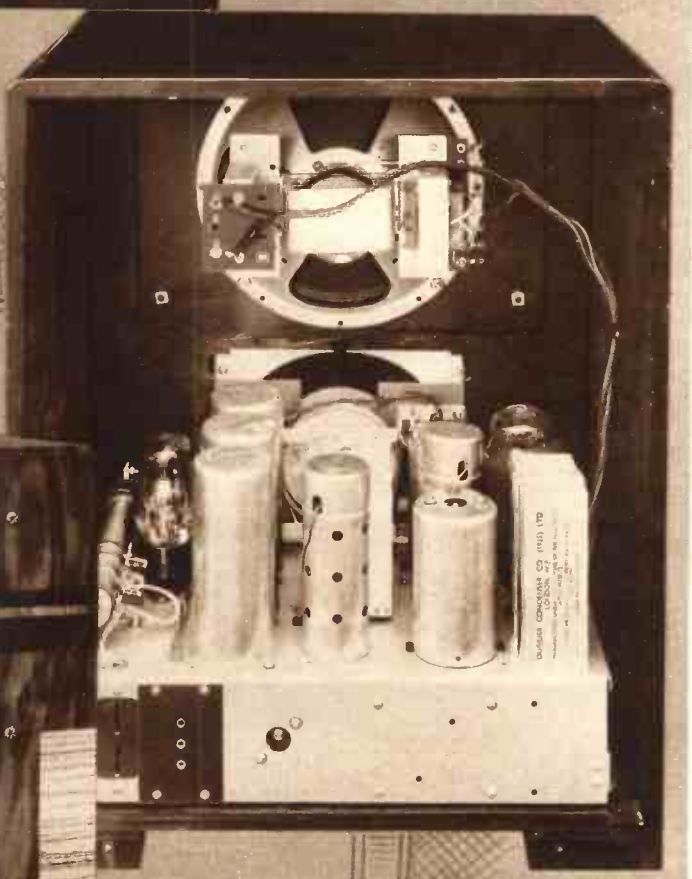
A striking aerial impression of the gigantic "His Master's Voice" works at Hayes, Middlesex, in which the model "341" console is made from beginning to end. As an indication of the thoroughness with which all H.M.V. sets are tested prior to despatch, this enterprising firm has installed a "vibrating table" on which, in a minute or two, sets can be subjected to the equivalent of a train journey from London to Glasgow!

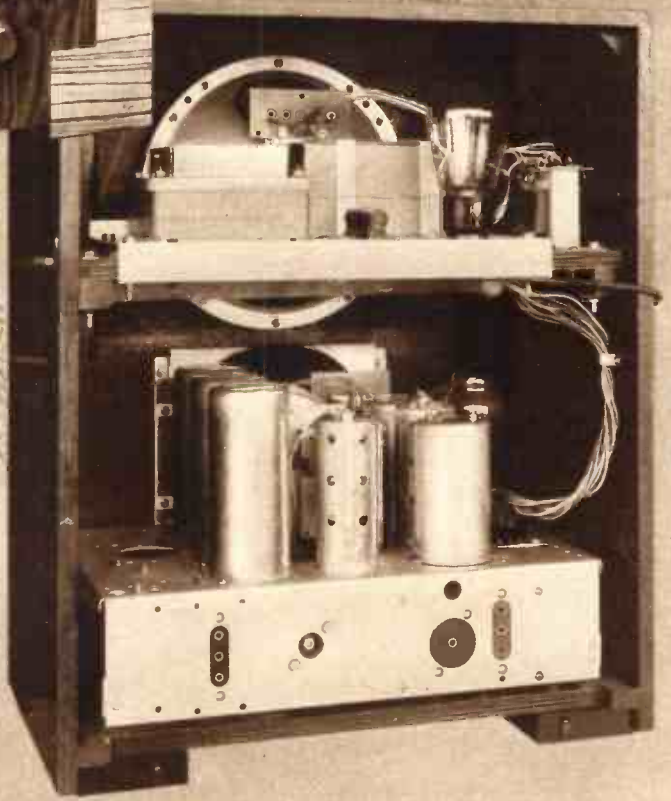
KOLSTER BRANDES

A 1936 TUNING INNOVATION

One of the most ingenious tuning developments of the season is the K.B. "Fototune" system in which the name of the station being received is automatically projected on to one of two translucent screens, one being provided for the medium waves and the other for the long waves. This clever device, which, for obvious reasons, greatly simplifies the reception and identification of distant stations, is featured in the models "426" and "427," two of the most outstanding receivers in the K.B. 1936 range. They are both table model superhets, and the cabinet work is of the highest order—typical, in fact, of the craftsmanship for which K.B. is famed.







The K.B. models "426" and "427" are almost identical in external appearance and, in fact, differ technically only in that the "426" (seen at the top of the page) is for universal mains operation while the "427" (right) is for A.C. only. The chassis in both of these models is a four-valve (excluding rectifier) superhet arrangement with six tuned band-pass (H.F. and I.F.) circuits ensuring a very high degree of selectivity and remarkable freedom from heterodyne whistles. The circuit, incidentally, is provided with delayed automatic volume control, and a simple but clever control provides for the adjustment of selectivity and the regulation of tone with one knob. It is important in these days of such severe "man-made" static interference troubles that mention should be made of the fact that both of these sets are designed for the K.B. "Rejectostat" System, a device which will, in most cases, effect a certain cure. These two sets undoubtedly represent remarkable value for money at only 12 guineas each.

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FAVOURITES of the MICROPHONE

WHETHER or not you are in favour of that type of vocalism called crooning, and said to have reached its highest state of perfection in Bing Crosby, you must admit that there is a certain art and personality among at least the leading crooners of to-day.

They are interesting people, those with the soft, honeyed voices who murmur ridiculous words into our broadcasting and recording microphones. And for the most part they are young—surprisingly so. Let us have a brief look at a few of our leading dance vocalists.

Number One

Crooner number one is **Elsie Carlisle,** famed for her long association with Ambrose and his orchestra and for her excellent comedy duets with Sam Browne—also once of the same band. Her age ? Well hardly polite to mention it, but she is as yet unmarried. Says she has no time for matrimony—in spite of her "He wooed her and wooed her and wooed her."

Elsie takes very little sleep, and has not had a holiday for years. Faced her first audience at twelve in Manchester. Has been singing since half that age. Can't help singing. Has to have several secretaries, two pianists, chauffeur, business manager, and a stage manager. Spends her days rushing to and from recording studios (Decca), broadcasting studios, the music halls, and her dance-band engagements. In between she rehearses or practices at home. And frequently she will entertain at private West End parties.

But in spite of all—and making money is not all honey—Elsie Carlisle is always smiling.

* * *

A COMPARATIVE newcomer to the microphone is trumpeter and crooner **Nat Gonella.** Has broadcast once or twice and records for Parlophone. Blond, about 26 years old, son of a London cabby, started business as furrier's apprentice at 14. Saved up from his 4s. a week to buy a £5 cornet. Has played with Billy Cotton, Roy Fox and Lew Stone. Then formed his own band, The Georgians.

Great fan of Louis Armstrong, the American negro trumpeter, and models his playing on that master. Learned to play the trumpet and to do scat-singing by listening to Armstrong records.

* * *

ALL Jack Payne's fans know **Billy Scott-Coomber.** Irish, full of ideas and effervescent. Started to be a painter, but found this form of art did not pay. Billy's father was an army man and tried to induce Billy to take up his career in line with the family tradition. Later Billy tried insurance. Hated it.

Hobby was singing, and Jack Payne heard him on the radio. Next day he had joined the famous band. Billy cannot read a note of music, but he composes popular lyrics and his ear is remarkably quick to pick up tunes. A great stunt-merchant, too, is B. From his fertile imagination come many of the ideas that Jack Payne puts into his shows.

ACE OF CROONERS

Popular Elsie Carlisle, famed for her comedy numbers with Sam Browne. She has a particularly busy life, singing on the stage, at recording studios, with Ambrose's dance band, and at private parties. Never has time for a holiday. Started entertaining at the age of twelve.

DESCENDANT of brilliant criminal lawyer grandfather in Petrograd, twenty-five-year-old **Val Rosing** always had a love for lowbrow music, though his father was an opera singer. After leaving Westminster School, Val went to Oxford for a year. Then joined "The Night Watchmen," a Cambridge band that played at a café in London. Played the drums and sang in a weak voice. Later became Henry Hall's first crooner. Left Henry to go on the halls, and is now studying singing with ambitions towards singing and acting on the films. Fond of bridge—and football.

* * *

WE must not forget **Pat O'Malley.** Once with Jack Hylton, Pat now tours the halls, records, and broadcasts with Sid Lipton. Was once a Hendon choirboy. On leaving school went into fur trade as traveller. Fell in with group of Cambridge undergraduates and joined their dance band.

Next Pat formed his own band and played at Brent Bridge Hotel, Hendon, for five years.

It was when he had joined the Cambridge band again and had returned from a tour on the Continent that Pat O'Malley was heard singing in the Café de Paris by Jack Hylton. Then began his long association with the famous dance-band leader, an association that has only recently been broken.

Changing "Halls"

WE shall miss **Len Bermon,** the famous drummer-vocalist of the B.B.C. dance orchestra. He has left Henry Hall for the other type of hall, that lodestone of so many radio artists, and will be appearing on the boards shortly after you read this.

What his act will contain is not yet divulged, but probably he will have two pianos to back him up and maybe other instruments. He is pretty certain to introduce some "funny business" into his vocalising—it will be expected of him. His reputation as vocalist, founded on "Leave the Pretty Girls Alone" and continued up to recent date with "Olga Pulloffski," will see to that. Here's good luck to him.

The "SPANSPACE"

"I believe my 'Spanspace' to be very definitely ahead of anything of the kind that has been done before," says Mr. G. T. Kelsey, describing his latest short-wave battery set.

THE ever popular "H.F.-det.-L.F." combination of three valves can hardly be said to be new so far as short waves are concerned. It must have been used from time to time by dozens of different designers and in a hundred and one different circuital arrangements.

When I say, therefore, that I believe my "Spanspace" to be very definitely ahead of anything of the kind that has been done before, it will be obvious that I am indeed making bold claims for it. May I say first and foremost that those claims have been proved up to the hilt in tests which I have conducted with this new set, and that the ease with which it has been possible to tune in stations in all parts of the world has given me a greater degree of enthusiasm for short waves than any set I have ever designed.

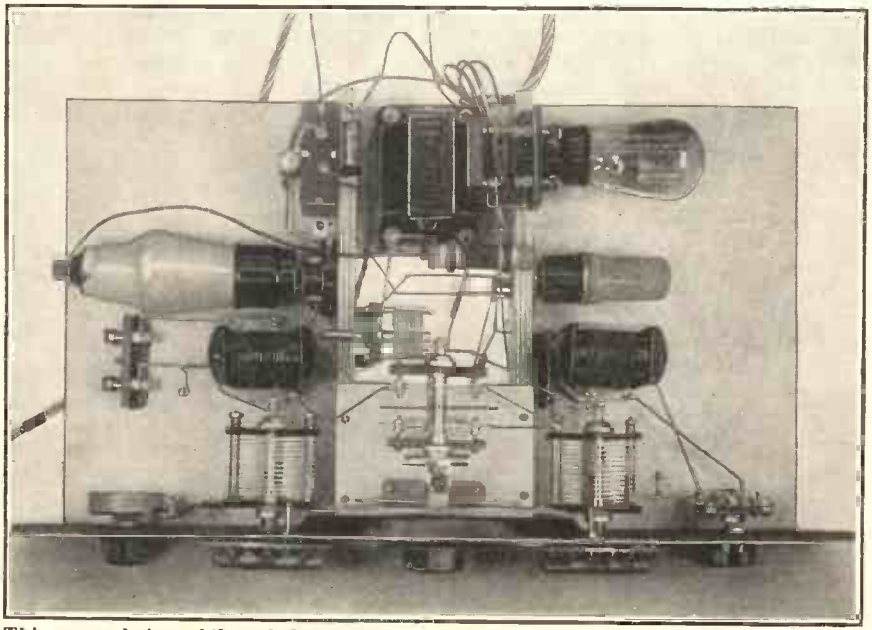
But I try to put myself in the position of the reader who contemplates spending not just a few shillings, but a few pounds, in order to substantiate those claims, and my immediate reaction is to want to know why that should be so. After all, on the face of it, there must be a limit to the degree of amplification that can be obtained from three valves in whatever circuital arrangement they may be employed, and I must confess that it seems a little strange that this set should be all that much better than any apparently similar set.

The fact remains that it is better—a whole lot better—and the real secret is to be found not in the employment of any stuntish circuit arrangement but in the use of good, modern valves that at last make possible the attainment of a substantial degree of short-wave H.F. amplification.

Until comparatively recently, an H.F. stage on short waves has been of little practical value from the point of view of amplification on account of the fact that the inter-electrode capacities of the valve, while negligible on ordinary broadcast waves, have nevertheless seriously affected its function as an amplifier at the higher frequencies.

It has been the practice, however, to include an H.F. stage for the very useful purpose that it has served as a "buffer" stage between the aerial and the detector valve. The fact that when used in this capacity it removes the annoying phenomenon of aerial "dead-spots" has, up to now, been ample justification for its inclusion.

But so very marked have been the improvements of late in the design of valves for H.F. work, that subject to the employment of a properly designed circuit to go with them (or it), it is now possible to get not just a suspicion of amplification, but a very substantial degree. And that substantial pre-detector gain makes all the difference to programmes that



This general view of the set shows the unique lay-out. Note the raised platform for the band-spreading condenser, and the "basement" wherein the L.F. transformer is mounted.

USE THESE COMPONENTS

2 J.B. ·00015-mfd. Midget Minor variable condensers.
1 J.B. Twin Midget variable condenser (15-mmfd. each half).
1 J.B. "Arcuate" slow-motion dial.
2 Sets of Colvern short-wave coils (U.S.1. U.S.2, and U.S.3).
1 Erie 50,000-ohm potentiometer.
1 B.T.S. ·00015-mfd. differential reaction condenser.
1 Eddystone 65-mmfd. air dielectric trimmer, Cat. No. 978.
2 Bulgin Four-pin low-loss type valve holders, S.W.21.
2 Clix Four-pin chassis-mounting valve holders.
1 W.B. Four-pin valve holder.
1 Ferranti A.F.8 L.F. transformer.
1 T.M.C.-Hydra 2-mfd. fixed condenser.
1 T.C.C. Type "S" ·0003-mfd. fixed condenser.
1 T.C.C. Type "S" ·001-mfd. fixed condenser.
1 T.C.C. ·1-mfd. tubular fixed condenser.
1 Formowatt 3-megohm grid leak.
1 Amplion 10,000-ohm resistance (1 watt type with wire ends).
1 Bulgin S.80 toggle on-off switch.
2 Graham Farish "Pop" two-terminal mounts, with terminals.
1 Eddystone short-wave H.F. choke, Cat. No. 1010.
1 B.T.S. short-wave H.F. choke.
1 Peto-Scott 18-in. × 9 in. Metaplex baseboard (mention "Spanspace").
1 Bulgin B.C.4 six-way battery cable.
2 Wander plugs for independent G.B. battery leads.
1 Eddystone welded steel cabinet, 17 in. × 9⅜ in. (with panel), Cat. No. 1034.
Wire, flex, screws, etc.

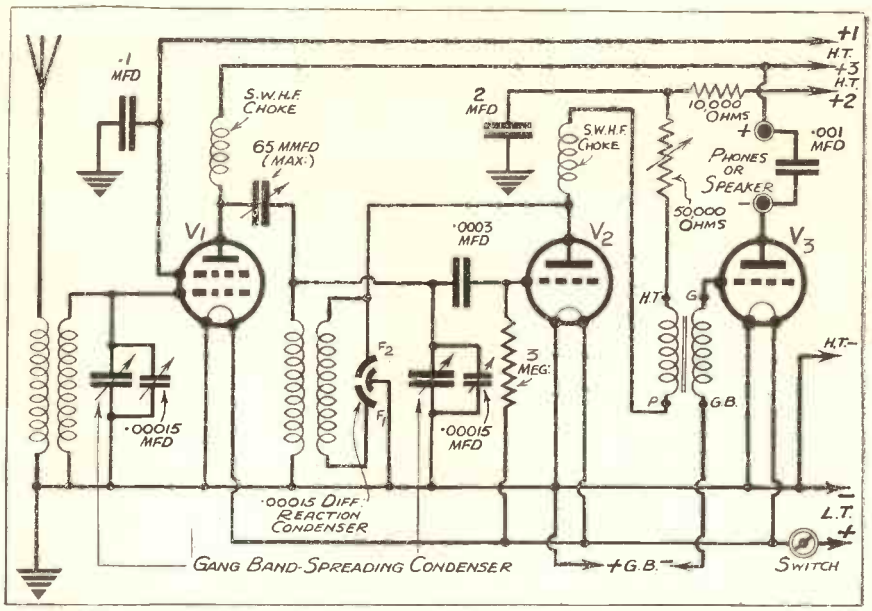
VALVES: Cossor 210 S.P.T., Marconi H.L.2/K, Marconi L.P.2.
LOUDSPEAKER: Amplion "Harmona."
BATTERIES:
H.T. 120 volts, Drydex, Type H 1051 L.T. 2 volts, Exide C.Z.G.2
G.B., 9 volts, Drydex H 1001.

are coming from perhaps thousands of miles away. *In fact, stations that have hitherto been inaudible on this particular type of set can, with the "Spanspace," be heard quite easily!*

Difficult as I find it to restrain my own enthusiasm for this new set, I am not going to waste time in acclaiming its merits, for the enormous advantages of attaining at last a substantial degree of H.F. amplification is in itself an indication of the performance that may be expected. I will just leave you to draw your own conclusions from the fact that I have adopted the "Spanspace" as my own standard short-waver, and have, in fact, "dethroned" the superhet that went before it.

Many Advantages

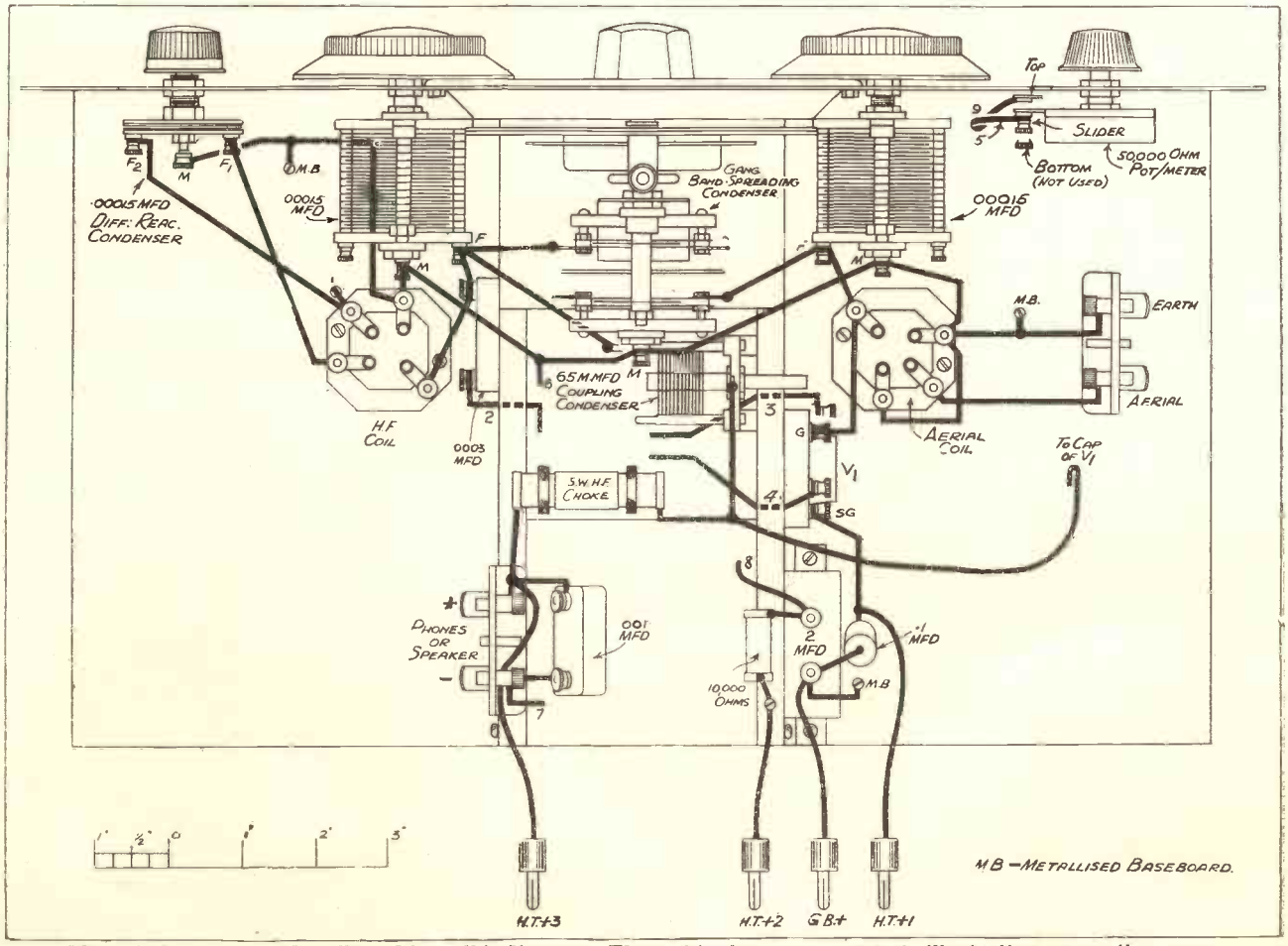
I am not going to say that the "Spanspace" gives greater overall amplification than the superhet, for I don't suppose for one moment that it does. But the "Spanspace" gives an infinitely lower noise-to-signal ratio, it is, I think, easier to tune, the quality of reproduction is undoubtedly better and the running costs are infinitely lower. As a programme provider, as distinct from a noise producer, it is quite frankly the finest short-waver I have ever operated. And that brings me to another point of vital importance.



The circuit is a very straightforward one, as can be seen in this diagram. Note how the reaction is arranged to provide fine control.

The absence in the past of any appreciable degree of amplification in a short-wave H.F. stage has meant that the tuning of that particular stage has been very flat. In other words, it

THE MAIN WIRING DIAGRAM OF THE "SPANSPACE"



Most of the wiring can be followed from this diagram. The rest is shown on a separate illustration on another page.

has been possible to do all the tuning with the detector-stage tuning control, using the H.F. tuning control merely as a vernier.

But in the case of the "Spanspace," in which the H.F. stage is really pulling its weight, that method of operation is not possible. Both circuits must be kept appreciably in step. Now I have always felt that the success of any short-waver, in the hands of the listener who is going to use it, is dependent upon the ease with which it can be operated. I do not believe in complications, and I am equally certain that the listener does not want them.

Ganged Main Tuning

But as to how to overcome the difficulty of two tuned circuits which, for technical reasons, it was not desirable to gang, was a problem the solution of which was only arrived at after a good deal of experimental work. And the scheme I finally adopted was to use the two main tuning condensers merely as "tank" condensers, and to carry out the main tuning by means of ganged band-spreading condensers, one across each of the "tank" condensers.

This system of tuning, which I believe is introduced for the first time in the "Spanspace," results in a design that can literally be handled almost as easily as a broadcast set. There is no hyper-critical knob-twiddling, and it is as simple to tune in on the speaker a programme from the States as it is to tune in a continental station on an ordinary broadcast set!

But that it is not a matter of tuning alone. With any short-wave design in which signals are to be received over such colossal distances as those which separate this country from America and Australia, it is obvious that reaction must play a big part.

Hand Capacity Avoided

It is desirable, therefore, not only that reaction should be very smooth in operation, but that there should be no appreciable hand-capacity effects. But that is more easily said than done, and in my experience of short-wave designs I have found it practically impossible completely to eliminate hand-capacity effects on the reaction condenser unless insulated extension handles are employed. The use of a metal panel and a reaction condenser with an insulated spindle are not, in my opinion, sufficient.

But there is another way—and as my results with the "Spanspace" have proved, a highly successful way—of almost entirely overcoming the hand-capacity bugbear, and that is by the use of a variable resistance in series with the detector H.T. supply. Used in the way that I have used it, there is no noticeable hand-capacity at all, and what is perhaps of even greater importance, the change to the oscillating condition with this scheme is so very smooth *that it is difficult to tell when the change has taken place!* I am convinced that it would be impossible to have a finer reaction control.

I have proved that such excellent reaction control is not possible with condenser or resistance alone. But by combining the two—using the condenser for rough adjustment and the resistance as a final vernier control—the results are remarkable.

But I think I have said enough concerning the features of the "Spanspace" to convince you of its merits. The ease with which it can be operated make it eminently the set for the newcomer to these fascinating bands, and the overall efficiency of the arrangement, coupled with the fact that it covers the bands from 14 to 100 metres, will appeal to the more advanced enthusiast. The "Spanspace" is, I think, the ideal short-waver for everybody, and it is a design with which the chances of success are 99 to 1.

But I would particularly ask you not to be put off by the somewhat unconventional constructional procedure involved. I spent hours and hours in working all that out, not just to make the set look pretty, but to obtain maximum efficiency with minimum constructional work! As a result, I think another name for the "Spanspace" might well have been the "short-wire short-waver."

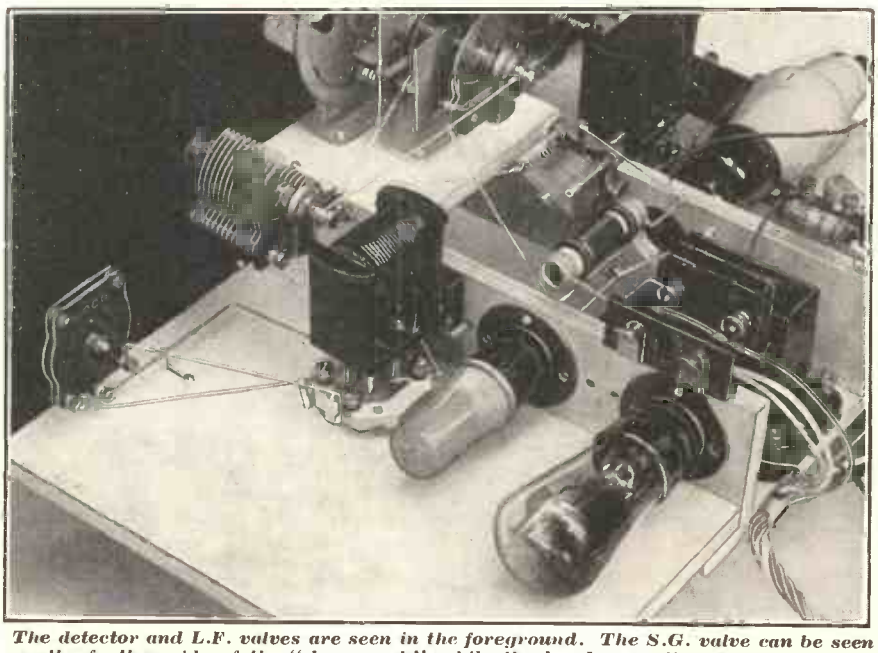
The wiring is not only simple but is easy to carry out, and as a result of the partition idea on which to mount the valve holders, etc., the battery leads are all grouped reasonably together and do not wander all over the baseboard.

Easy Construction

Once you have built the general framework, you will find that you will be able to proceed at breakneck speed for the rest of the constructional work in child's play.

But it is doubtless a fact that not all of you have a flair for cabinet work, and perhaps still less for metal work. Do not let that daunt you, for you can get the panel ready drilled, and the woodwork all cut to size and ready for assembly from Messrs. Peto-Scott. And as for those of you who want to make your own, well, you can get all the necessary dimensions for the "pieces" from the drawings accompanying this article. But I think it is only right to warn you in these circumstances that the cutting away of the metal panel for the fixing of the escutcheon is no light task, and you might find it a lot easier to use polished plywood with a coating of "Metaplex" at the back. Peto-Scott will supply such a panel quite reasonably, and this

CLEAN LINES ARE RETAINED THROUGHOUT



The detector and L.F. valves are seen in the foreground. The S.G. valve can be seen on the further side of the "basement," while the band-spreading gang-condenser appears on its platform at the top of the photograph.

departure from the original design is not likely to make the slightest difference to results.

With regard to the two halves of the baseboard and the two vertical partitions, these are all cut from an 18 in. × 9 in. baseboard Metaplexed on one side. The Metaplexed surfaces in the case of the vertical partitions face outwards, and they must be joined electrically to the metalising of the baseboards, which faces upwards. The top edges of the vertical partitions should not be Metaplexed.

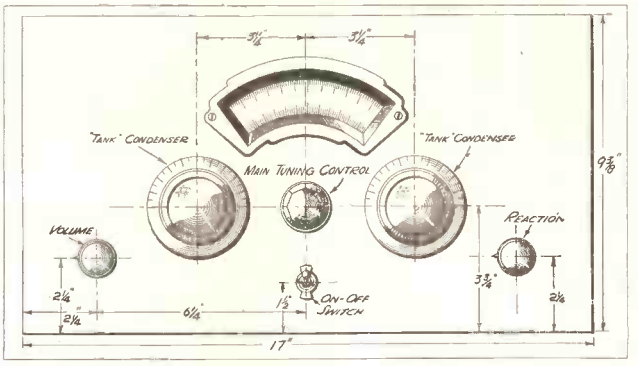
Baseboard Fixing

The horizontal baseboards should not be fixed right at the bottom of the metal (or plywood) panel, for otherwise the set when finished will not slide into the Eddystone cabinet. The screw centres for the fixing of these baseboards should be ¾-in. up from the bottom of the panel, and two for each baseboard will be sufficient.

To minimise the amount of constructional work involved, the various components should be mounted in a definite order, and if you follow the details given below, you will not be likely to go very far wrong.

Begin by mounting up first of all the components on the panel. Then, with the wooden framework secured to the panel, proceed by mounting the slow-motion drive and the two-gang band-spreading condenser on the wooden platform across the two vertical partitions.

THE ALL-METAL PANEL

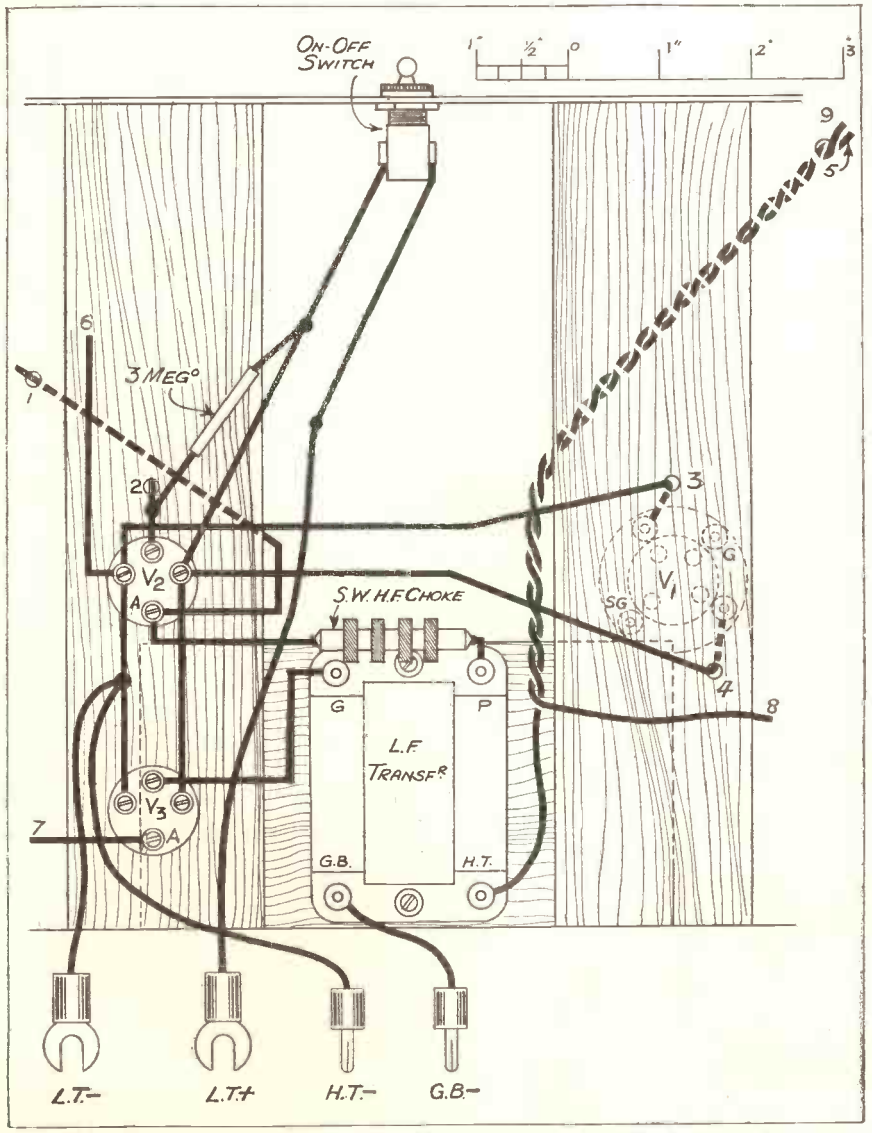


The panel of the "Spanspace" is of metal and is provided with the Eddystone box.

Next mount up in this order the grid condenser, the short-wave coil mounts, the valve holders, the "Pop" terminal mounts, the Eddystone air-spaced coupling condenser and the T.M.C.-Hydra 2-mfd. condenser. But do not mount the Ferranti transformer until as much of the wiring as possible has been done.

For details as to the actual connections to be made, you will have to refer to the wiring diagrams which, although perhaps a little confusing at first sight, are really very simple to follow. The smaller of the two wiring diagrams shows the wiring between the two vertical partitions, and to obviate confusion, wherever a lead is shown going through a hole, or is shown broken, it is given a number, and the continuance of that lead on the other wiring diagram is indicated by the same number.

WIRING THE CENTRE PORTION OF THE SET



This diagram is complementary to that on a previous page, and shows the wiring of the filaments, L.F. transformer, and so forth.

The Last Step

The fixing and wiring first of the L.F. transformer, and then of the fixed condenser across the output terminals should be the last step in the constructional procedure with the exception of the various battery leads.

Next month I am going to give you full details concerning the adjustment and operation of the "Spanspace," but in the meantime here are just a few brief details to enable you to give the set a try-out.

Put in the middle range Colvern coils, and make the necessary external connections. H.T.+ 1 should be taken to a tapping at 60 volts, H.T. + 2 to a tapping at 70 volts, and H.T.+ 3 to maximum. The 210 S.P.T. valve goes into the holder on the left of the set looking from the front, and the H.L.2/K and the L.P.2 into the holders on the other side, with the latter at the back. Bias, by the way, should be from 3 to 4½ volts.

"Plug-in" Economy

How to make a simple unit which will reduce your H.T. consumption, and can be fitted without alteration in the set

By A. S. CLARK

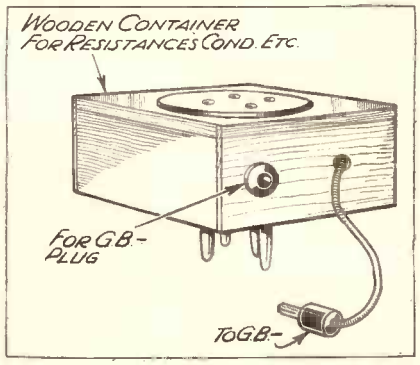
USERS of ordinary battery sets, and particularly those who like to have pretty big volume, often complain of the expense involved in the purchase of high-tension batteries. It is for these that I have designed the neat little plug-in gadget described on this page.

Its introduction into your set will neither affect volume nor quality adversely, but it will conserve the power in your high-tension battery. The lower you turn the volume control, the less the H.T. current taken by your output valve, and during silent parts of the programme its current will fall to practically zero.

Readily Adaptable

No alterations whatever to the set are required, and it is the work of but a moment to return the set to exactly the same conditions as existed before the plug-in unit was adapted. It can be applied to any battery receiver with a normal triode or pentode output value, and is adaptable to the different types of valves.

THE CONSTRUCTION



The resistances, condensers and rectifier are contained in a neat wooden box.

Before writing about the constructional points, a few words on the principle on which this gadget works will not be amiss.

As you know, the grid-bias on an ordinary output stage must be such that the L.F. grid swings above and below the bias point are always along the straight part of the valve curve and also to the left of the grid voltage at which grid current starts.

The more bias that is applied, the lower is the H.T. consumption, but the nearer the working point is to the bottom bend of the curve. Consequently the grid swings must be small if the negative portions are not to overrun the bend in the curve.

So we arrive at the fact that the weaker the grid swing (and therefore the speaker volume) the greater the bias we can use and the lower the H.T. consumption. What we want is some device for altering the bias as the volume alters, always keeping it as negative as possible.

That is just what the "Plug-in" Economy unit does. It is not a new principle, of course, but what is new (at least, so far as I am aware) is the convenient plug-in design which does not involve any alterations to the set.

A glance at the circuit on this page will help you to appreciate how our bias change with volume is achieved. Connected to the plate of the valve is a ·5-mfd. fixed condenser which bypasses some of the L.F. to a Westector rectifier via the 100,000-ohm resistance.

Controls the Bias

The Westector rectifies the L.F., which is smoothed and provides a voltage across the G.B. plug and socket shown. This voltage will naturally vary with the strength of the L.F. currents which in turn depend on the grid-voltage strength.

The voltages are in opposition to the steady G.B. applied, and therefore reduce it when strong L.F. pulses come along.

All the resistances and condensers are of the tubular type with wire ends, and the smaller they are the better. They are arranged inside a little box of thin plywood, in the bottom of which are four valve pins, while a chassis-mounting valve holder is arranged on top of it.

How It is Used

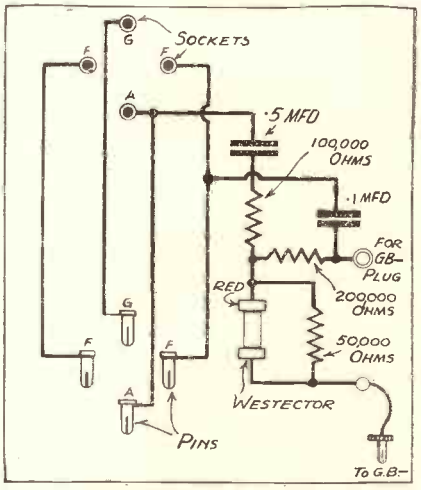
On the side is the grid-bias socket and flex lead to the G.B. plug. The connections to the chassis-type valve holder should be of flex to enable the top of the box to be screwed into place after the wiring has been carried out.

In the case of five-pin pentodes a centre pin and socket would be needed wired together.

The 100,000-ohm resistance in series with the ·5-mfd condenser is the right value for a pentode valve. For a triode it should be changed to one of from 20,000 to 60,000 ohms.

The method of using the unit is as follows: Remove the output valve from its holder and insert the unit instead. Then insert the valve in the top of the unit.

A SIMPLE CIRCUIT



How the unit is wired up. The pins fit into the output valve holder, the valve being placed in the sockets.

The grid-bias plug which normally supplies the bias to the power valve is removed from the G.B. battery and plugged instead into the socket on the unit. The plug on the unit goes to the G.B. battery itself, but should go in a tapping of double the voltage previously used for the output valve.

If necessary a larger voltage G.B. battery must be obtained. Finally, voltages 1½ volts higher and lower should be tried while the set is working to see whether any improvement in results is thus achieved.

This Death Ray Business

By JOHN SCOTT-TAGGART M.I.E.E., F.Inst.P., Fel.I.R.E

An amusing and trenchant article which throws the cold light of reason on a topical if much exaggerated subject.

DEATH rays, like oysters, are once more in season. Foreign Governments are snapping at the bait like starved trout. Barbed wire fences festoon mysterious laboratories—more, perhaps, with the idea of attracting photographers than repelling marauding spies.

An Enormous Fillip

Abyssinia and the King of Kings have given an enormous fillip to the death-ray industry. Attempts have even been made to draw Marconi into it, although all the utterances of *il duce* of radio refuse to reveal the slightest claim to a death ray. But such is the public mind that quite legitimate ultra-short-wave beams are imagined as deadly secret rays, and a denial by the Marchese or the withholding of information is at once regarded as proof of the deadliness both of the ray and its secrecy.

Of course it is all good fun, but the death-ray merchants show an appalling lack of originality. They all want to do the same things with their rays, they are all pestered by foreign Governments, spies are always prowling round their tin-pot—or tin-shed—laboratories; the British Government is always lackadaisical, jealous and obstructive—or else, in the earlier stages of the invention, keen, excited and anxious to send military experts to report on it.

Is It Possible?

What is the truth? Is a death ray possible and probable? Is the Government spurning brilliant inventive scientists? Are we in danger of losing to a *foreign power*, who may without notice suddenly become an enemy and wipe us—and, it is hoped, the inventor—out?

Let me, with such humility as I can muster, examine the situation. First of all, there are many death-ray merchants—I use the term not as one of scorn and ridicule, but from a full realisation that death rays have become an industry—there are the manufacturers of death rays, the financiers, the sales promoters, the potential market—in fact, everything is fully organised except the actual customers. And these, of course, are extremely few.

I do not say that if you approached the counter and said: "I want to buy your death ray; here is ten thousand pounds in Bank of England notes," you would be told: "I'm sorry, but we're out of death rays to-day." But I do say that the death-ray dealer would faint with surprise. No genuine conventional dyed-in-the-wool death-ray purveyor *expects* to sell his invention. His livelihood would disappear if he did. Moreover, his whole life is wrapped up in his death ray. It sounds a dangerous thing in which to wrap up your whole life, but there you are. There have been men whose whole lives have been wrapped up in dynamite and, after their deaths, leave prizes for those who further Peace.

Only Governments Interested

Actually only Governments want death rays. They are not favoured by private exterminators, who still stick to the old-fashioned sawn-off shot guns, prussic acid and blunt instruments. The reason, I think, is not that bumpers-off are narrow-minded conservatives, but that the old-fashioned remedies are cheaper. A good death ray will fetch anything up to half a million pounds and is considered dirt-cheap at that. Obviously only Governments and Foreign Powers can plank down a sum like that.

This scarcity of customers is actually a good thing for the death-ray inventor. If you are a traveller in jubilee decorations you must have some very lean years; if you travel in lighthouses you cannot expect to sell one every day. If you have only two or three possible customers, friends, financiers, and the Sunday newspapers see nothing extraordinary in your carrying on for ten, twenty, or thirty years hoping that an idiotic Government will at last see what is good for them and what is bad for other Governments. Forty years on you can still be following up your experiments.

Patriotism Triumphs!

Most death-ray inventors start by having military attachés of Foreign Powers buzzing round like wasps round a honey pot. Huge sums are proffered but spurned. Foreign Powers that always remain nameless offer wealth that is countless. But sooner or later, usually later, the inventor explains that He Would Never

FROM SHIP TO SHORE

Courtesy of the Postmaster-General

A typical scene at a G.P.O. coastal radio station. A radiogram from a ship at sea is being received.

Sell His Country—even though that country is ungrateful, stupid, niggardly and governed by incompetent, jealous fools. In other words, Patriotism has Triumphed.

You cannot, with any real decency, publicise a death ray more than once a year, but unless a rival has got in first, you will find the public as avid and the newspapers as enterprising every season. That is why just now we are trembling like aspens with flesh as goosey as the most mild-mannered inventor could wish. Nor are we altogether geese for feeling like this. Some day a death ray *may* be developed. My own belief, however, is that most of us will be dead in any case before then.

Rays With Curative Effects

To the general public a ray means some violent energy radiation which may suddenly be invented and revolutionise something or somebody. This was true enough at one time. The X-ray—the forerunner of myriad alphabetical quack rays—was an amazing and useful invention. The rays from radium have proved less spectacular, but their curative effects have relieved thousands. Ultra-violet rays have proved of great utility in treating certain diseases. Infra-red rays are used for beam telephony and other new purposes, while wireless rays or directed waves are being increasingly used.

Wave Rays

True wave-rays such as X-rays, ultra-violet, infra-red, heat, light, and wireless waves are all waves in that mysterious all-pervading medium—the ether (the existence of which is sometimes denied !). The properties of the waves differ according to their length. The different groups of waves—each group covering a somewhat vague band of wavelengths—are well known and although they are unexplored regions, we know enough to expect no triumphant death ray.

THE POWER LIMIT

The greatest stupidity of the death-ray promoter is in his statement that because his gadget will kill a mouse at a foot it will annihilate an army at a mile. "All you need is more power," he will glibly remark. The difficulty of getting more power is almost insuperable. There are death rays already quite capable of killing, if they could conveniently be increased in power. Ordinary heat rays will frizzle you to a cinder if you stand close enough to their source, e.g. a furnace. You could wipe out armies, melt shells in flight, turn tanks into molten metal, if you could " increase the power " of heat rays. Also you would have to cover a whole battle-front—perhaps 800 miles long—with apparatus for producing such rays. The task would be colossal, but the death-ray enthusiast persists in his suggestion of " increased power."

Take X-rays. These in sufficient strength will cause burns and produce pernicious anæmia. In overwhelming strength they would certainly produce fatal results. But imagine the difficulties of X-raying every yard of a battle front of hundreds of miles ! Ultra-violet rays also could be made ultra-violent ; I bear burns myself to testify to their tissue-destroying properties. But what a job to increase their strength and distribute them over wide zones ! I suppose even light—if the power could be increased enough ! —could be used to blind advancing infantry or flying airmen.

These examples are all of existing well-known rays " raised in power." The two problems are (a) increasing the strength and (b) applying it over a wide area in war. There are, of course, other problems. The apparatus for producing the rays must be immune from destruction by subterranean mines, bombs, and shell fire ; it is as well to recall what happened to many batteries of heavy guns during the 1914–1918 war.

Underclothes of Lead !

There is also the possibility that one could defend oneself from a death-ray by wearing underclothes of lead ! Perhaps tin-foil uniforms might be enough to foil some death rays. New means of offence will always breed appropriate methods of defence.

Some " rays " consist of particles shot out from the apparatus. For death-dealing purposes the difficulties of " strength " and range are likely to be tremendous, while distribution also remains the great obstacle. And what, one is tempted to ask cynically, is wrong with machine-guns ? Is there a better " ray " against infantry up to a thousand yards ? The disadvantages of machine-guns would apply to most conceptions of death rays. Although as against aircraft the disadvantage of machine-guns is that the bullets come down again.

Melting Metal Objects

The third type of ray is of the electric or magnetic field type. If an oscillatory current passes through a coil of wire and the frequency of the current is high enough, metal objects put into the field may be raised to white heat or melted. The metal parts of wireless valves are thus heated during manufacture. One might therefore melt metal aeroplanes, flying shells, tanks—even rifle bullets !—if you could create a strong enough and wide enough field and direct it properly. Such rays would make one's blood boil.

True wireless waves seem pretty harmless, but if found capable of producing high-frequency currents in human bodies, aircraft, etc., something like a death ray may be produced. Stopping aeroplane engines seems to be a chief aim of death rays. Perhaps it is intended to burn out the ignition system coils or to produce a continuous spark across the spark gaps. But even if this could be done at a distance, screening of the ignition would be very simple. The element of surprise would therefore be essential to a defending force. Could the fact be kept secret ? I doubt it, considering the publicity that attends all rays.

Summing up, it would seem that the greatest problem is that of increasing the strength of lethal rays. The technical difficulties are so great that one may even feel tempted to fall back on the problem of increasing the strength of mutual goodwill amongst the nations.

EAST MEETS WEST

A group of visitors from the Far East being introduced for the first time to Western radio—and music, through the medium of one of the latest Cossor sets.

Italia on the Air!

The Italo-Abyssinian campaign has taken up a great deal of our national news space lately. And it has been taking up a great deal of broadcasting time too, in many European countries. In this article some interesting facts are given concerning the Italian news broadcasts, which are given not only in Italian but in English.

THERE is drama in the ether these days, and Italy is supplying a big percentage of it, both indirectly and directly. The Rome short-wave station on 25·42 metres is working for long periods every day, disseminating Italian news and views in English and French. It can be heard very strongly in this country. Incidentally, it is on this short wave that Italy broadcasts complete operas, many of them being special ones written and produced solely for broadcasting.

Five "News Stations"

On the medium waves there are five stations which can be heard every night broadcasting all the latest war news from the front and talks in English. And you can hear news items which fail to find their way into our newspapers. Sometimes the difference between what, according to reports, Rome is said to be thinking and what Rome is actually chattering stridently into the ether would be laughable were it not for the gravity of the theme.

On the very day when English, French and other papers were reporting that Italy was "more conciliatory" in tone, Rome was broadcasting heatedly about Abyssinian "sneers and lies" and how ammunition and wireless stations were being housed by the Abyssinians in buildings disguised as hospitals with huge red crosses on their roofs.

It is rather a shock to hear the pleasant Italian lady announcers broadcasting in this vein, and this is heightened by a metallic ring accompanying the Milan transmissions (it sounds like landline effects) which tends to contribute a somewhat sinister tone to the voice.

Actually, of course, these Italian lady announcers are extremely pleasant persons and their rich contralto voices suit the microphone admirably. It is hard to conceive of a better or more attractive form of ether propaganda than that which employs such media.

Italy has always favoured women announcers and Mme. Boncompagni has officiated at Rome for over ten continuous years, and is now assisted by Mme. Rosa Corsini, whose voice is frequently to be heard. She is very fond of the term "so forth."

A POPULAR PAIR AT BARI

Mr. and Mrs. Scaturchio, the two announcers at the Bari station. Both were at Naples before they married, he as dramatic producer and she as announcer.

At Bari there is a married pair on the announcing staff and the wife is the Chief Announcer, the husband acting as her assistant!

Easily Received

Of the twelve or so Italian stations only Naples and Turin seem to prefer men at the mike. In the case of Naples, it may be wondered whether the fact that the present transmitter was the first one to be used in Italy has anything to do with it!

Turin and Rome are the two most important broadcasting centres, and most of the important programmes originate from them. Rome has a magnificent broadcasting house, and it is interesting and gratifying to note that the two Rome transmitters were supplied by a British company. Their power is to be raised to 120 kilowatts maximum, although as it is the station comes over extremely well on 50 kw.

Rome invariably ties up with Bolzano, Turin, Milan and Florence for the news broadcasts in English, so that there is plenty of choice on the dial beyond Rome, if conditions for that station do not happen to be good.

In the summer the evening news Broadcast in English is at ten minutes past ten, but in the winter (and that is now) the time is changed to six thirty-eight (Greenwich time). You can hear them at this time every evening of the week, and there are also Italian lessons and travel talks in English to be heard.

Immediately after the broadcasts in English comes the turn of the French listeners, and as the same bulletins are put over, those who are learning French are afforded the opportunity of some excellent practice.

Like a Local

Trieste comes over well, though its 10 kw. do not give it the punch of Florence's twenty, as is only natural. Florence is seven hundred and fifty miles from London, though sometimes, when the ether is clear, it sounds almost as if it were a local station. The interval signal is the song of the nightingale derived from a musical box.

When Bolzano increases its power from one to 10 kw. that station should come over well, but its purpose is apparently merely to relay the programmes of the larger stations.

FOR TEN YEARS

has Mme. Marilu Luisa Boncompagni been chief lady announcer at the Rome station.

Turin occupies the next channel to the London, West and North Nationals and so it is not a station which can, generally speaking, be regarded as a practical proposition for the majority of English listeners. Rome on 420 metres and Florence on 491 metres are almost always nicely clear of interference on a set which has any pretensions to real selectivity.

These Italians are worth listening to for first-class musical items as well as for interesting propaganda, and other talks. And every now and then offers of free literature are made. You have merely to send a postcard in order to obtain any one or more of various pamphlets descriptive of different parts of Italy, and even photographs, if you want them. And if you desire to learn Italian, and you inform the "English Speaker" of Rome to that effect, she will send you full details of the microphone courses they run. Or at least, she has been doing this during the past few months.

First-Hand Information

Maybe things will happen which will necessitate alterations in procedure and programmes in one way or another. It is in anticipation of hearing news of such developments straight from the horse's mouth that makes "Italia on the Air" so exciting to listen to. Though, perhaps, the term "horse's mouth" is neither polite nor apt in the circumstances!

But, of course, it is to be remembered that these Italian stations are broadcasting in English purely and simply for the purpose of stating the Italian point of view. It may or may not be a fair commentary on current events which they give; it is not for us to express opinions, for WIRELESS is a completely non-political journal.

Nevertheless, there is no gainsaying the interest and thrill of getting into such close contact with "Italia" through the medium of the ether. Probably if the language difficulty were not ever present to prevent the full appreciation of all the various Continental broadcasts by every listener of every nationality who has access to a tuning dial, Europe would not to-day be in such a precarious political condition.

As it is, the great majority of the broadcasts in English from foreign stations are designed purely and simply as propaganda for the expression of nationalistic viewpoints.

How effective they may be in their purpose is an open question, and naturally a great deal depends upon the efficiency with which the particular propaganda is composed. The Russians are improving in this respect, no doubt because they have had years of experience. At one time their interminable strings of statistics devised to prove the advantages of a Communistic regime, and the terrific seriousness with which they invested their English programmes provided a clear indication that they failed to appreciate the mentality of the average British listener.

Of recent times they have improved. The Italians started their propaganda broadcasts with the advantage of being more akin to the British in their ideas; for, after all, Italy is a Western country while Russia is largely Asiatic.

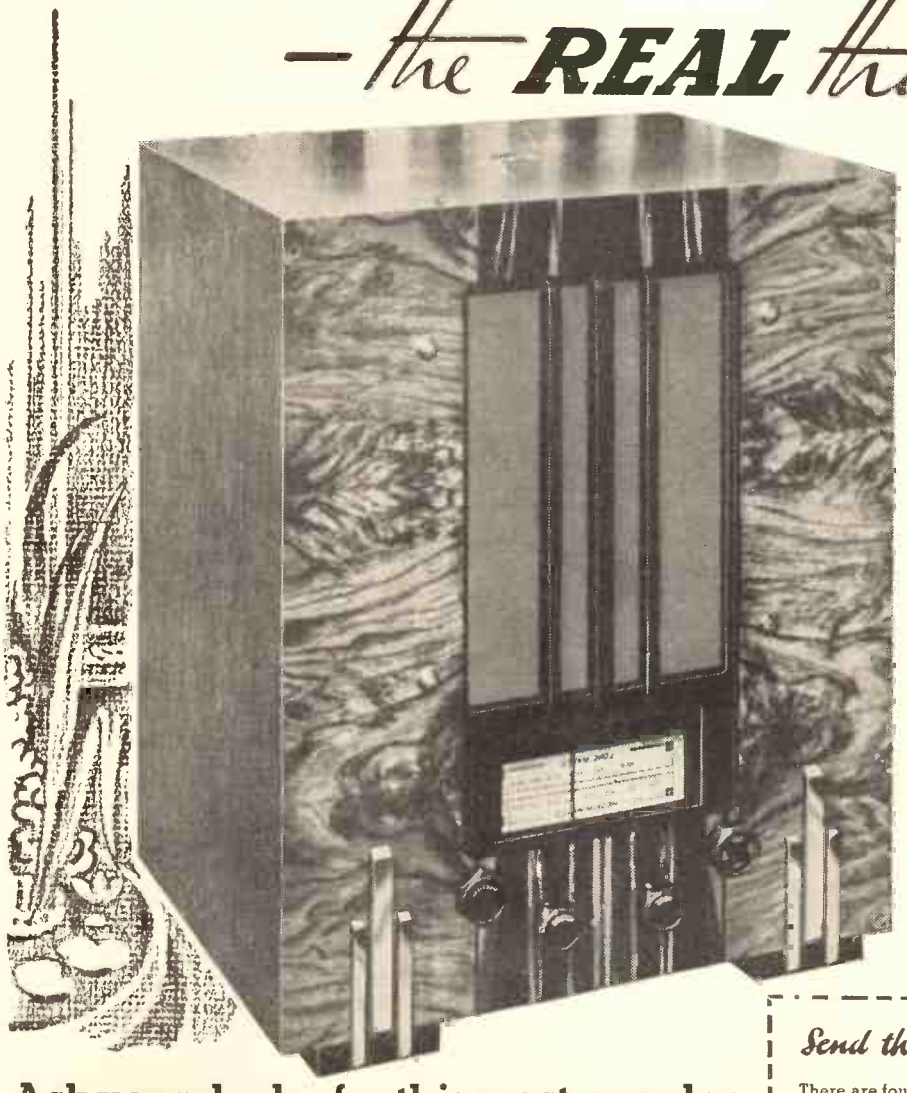
RADIO ROMA

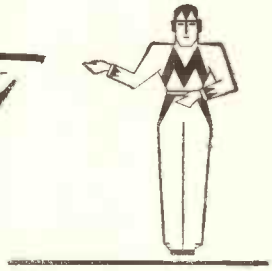
This is Maria Rosa Corsini, one of the voices heard from Rome. She assists the other lady announcer whose photo appears on this page.

THERE IS OF COURSE NO RADIO BETTER THAN

MARCONIPHONE

—the REAL thing





FROM THOSE WHO OWN THEM!

"Having one of your Marconiphone Table models, I should like to mention how pleased I am with same. Tone, range and selectivity is all that one can desire. I have not heard a set to come up to it yet." W., Birmingham.

"I would like to say how pleased I am with your new Table Grand—a first-class set." S.E.E., Crediton.

"I have heard many sets in the course of the last four years, but I reckon this latest model of Marconi's—for its price—the best of the lot." C.E.H., Bangor.

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EXCEPTIONALLY EASY TERMS ON ALL MODELS

Ask your dealer for this most popular of all British superhets. A magnificent 5-valve, 7-stage table grand superhet, typical of the splendid value offered in the wide Marconiphone range. It possesses every desirable feature including 'quiet' A.V.C., adjustable sensitivity, tone-compensated volume control and multiple Marconi valves. Housed in an exquisite inlaid Walnut and Macassar Ebony cabinet finished in chromium. Model 264 for A.C Mains.

12½ GNS.

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There are fourteen models in the Marconiphone list. Fill this in and we will advise you which model is best for your home and where you can buy it from a recommended dealer.

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LOOKING INSIDE

MODERN SCREENING & LAYOUT

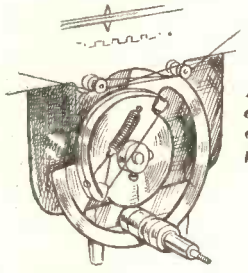
It was not so very long ago that radio receivers were built without any screening. To-day they are a mass of metal, as you will realise when you read this interesting article on modern sets.

IF you look inside any up-to-date commercial radio receiver you will find an astonishing amount of screening around valves and coils, and all sorts of odd-looking cans and boxes around vulnerable components, to say nothing of the shielded leads that are to be seen all over the place, apparently placed in quite haphazard manner.

But there are two main reasons for the mass of screening that is now used in radio set design. The first is the desire for compactness and the second the increased efficiency in every phase from aerial to speaker.

Metal chassis are used for mounting the components, and to aid in the screening, in some cases the chassis being of tinned iron, while in others aluminium is used. The Cossor A.C. Model 368 employs a solid copper chassis.

THE DRIVE



A typical example of cord indicator drive used in present-day radio sets.

The most vulnerable points as regards shielding are the coils or intermediate transformers. These are usually well "canned," and the leads from them to the anodes of the valves are shielded. "Tin hats" for the valves are also used in many cases, while in others the whole valve is enclosed in a metal pot.

A Typical Example

A good instance of "potting" a valve is given in the Cossor Universal mains receiver illustrated on page 267. The valve is the detector, a screened grid universal valve, and the valve and its grid leak and condenser are enclosed in a large "tin." The grid lead is taken from the top cap of the valve and so this is perfectly screened without high capacity loss, from the external fields from speaker, mains section, heater wiring, and so forth.

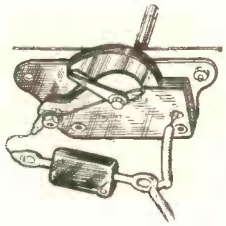
And talking about heater wiring, this is usually carried out most carefully under the chassis, where the usual components are restricted to the resistances and fixed condensers.

Many Colours

The modern chassis is a pretty sight to the radio designer. It is an ordered conglomeration of colours, the resistances and their colour coding forming an amazing display of brightness, while such things as electrolytic condenser labels, usually red or yellow, the green labels of other tubular condensers, and so on, to say nothing of coloured wiring and the brightness of the chassis itself, combine to provide an almost pretty sight.

Specially raised platforms are often used for fixing the resistances and small tag condensers, and these assist in grouping the parts so that servicing can be carried out easily. To aid service, Pye use a detachable floor to their cabinet in the T7, so that the underneath part of the set can be got at in situ without anything having to be disconnected.

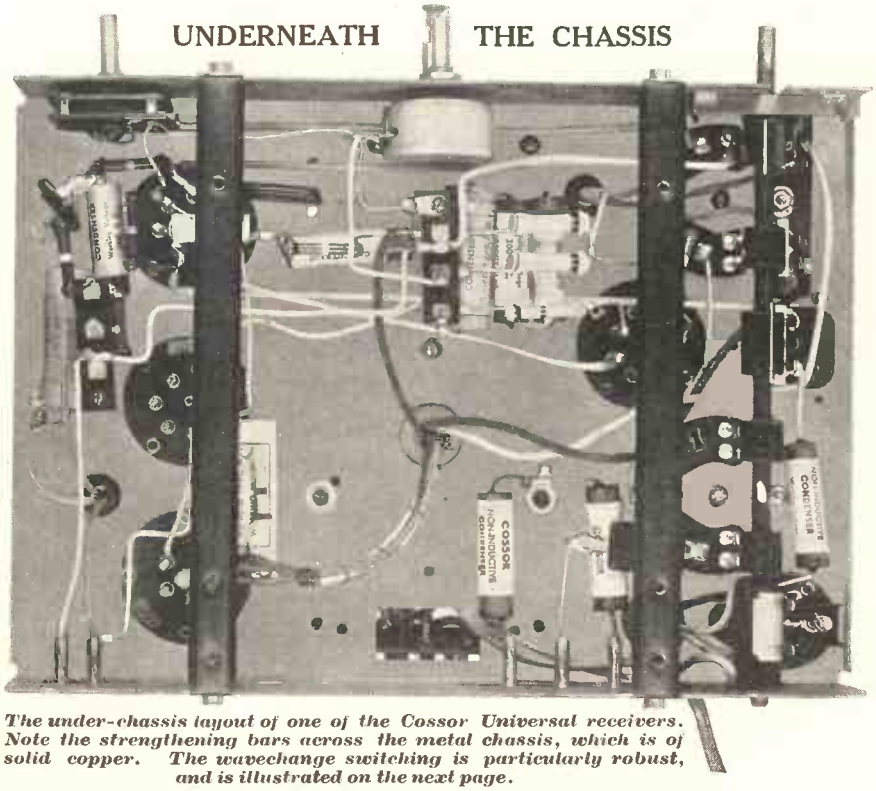
TONE CONTROL



Here is a tone control, used in one of the Pye mains receivers.

One point that is striking to the investigator of set design methods is the diversity of knobs used on the controls. The Pye T7 that we have just mentioned is fitted with an ingenious push-on type of knob which takes an extremely firm spring grip on a slotted spindle. There is no

UNDERNEATH THE CHASSIS



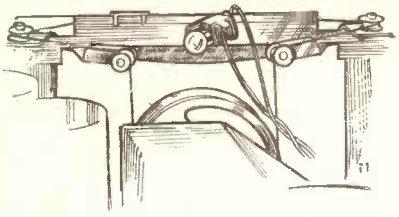
The under-chassis layout of one of the Cossor Universal receivers. Note the strengthening bars across the metal chassis, which is of solid copper. The wavechange switching is particularly robust, and is illustrated on the next page.

chance of the knobs rotating on the spindles for they are flatted, and it requires a pretty hefty tug to get them off.

The actual layout in commercial receivers varies a very great amount, of course. There is one Ekco set that uses a sort of semi-circular design so that the components and valves are grouped round the loudspeaker. Heavy sets have the speaker well away from the rest of the receiver, while others use a more standard arrangement of the speaker butting into the set above the variable condenser.

H.M.V. and Marconiphone use unique layouts for their radiograms, for here the tuning and other controls are on the motor board and so the whole set chassis is fitted up one side of the cabinet. The power pack is usually separate in such an instance and is fitted on the floor of the cabinet, the speaker being a little to the front of it on the front of the set.

DIFFUSED LIGHTING



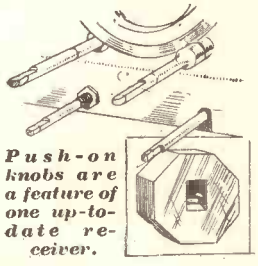
A card reflector is used to diffuse the light through the Ferranti "Lancastria" scale.

A Common Scheme

As a matter of fact most of the Console models in common with large radiograms split the radio from the power pack section of the set. This aids servicing.

One thing that is striking to the investigator is the numerous designs of scale and pointer control on the variable condensers. Many of the sets use Polar gang condensers; in fact, probably the majority of makers use one or other model of Polar gang condensers. But even so, it is amazing the number of variations of a three- or four-gang that one comes across. Many of these condensers are perfectly standard except for some slight difference in spindle length, or in the top cover, or again in the mounting.

RAPID FIT



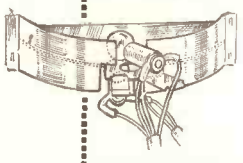
Push-on knobs are a feature of one up-to-date receiver.

But the main differences in condensers are to be found in the variations of drives. There are, of course, semi-circular, vertical and horizontal scales, but it is not so much in this regard that the variations take place. It is in the manner of getting the pointer to move along the scale. In three consolette sets we examined consecutively we found horizontal scales, but three different arrangements of pulleys and cords to convey the drive from the rotating member of the control to the moving pointer.

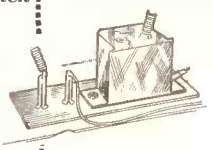
And the arrangement of lighting the scale varies considerably, too. In the Cossor Universal set, below, the scale lighting, illustrated below, is from the rear by means of two lamps, shielded from one another by a tin platform and backed by a reflector. The result is that one lamp can be used to illuminate the upper section of the scale and one the lower, thus providing that medium and long-wave markings shall be illuminated separately to denote to which waveband the set is adjusted.

A neatly placed knob extends from the back of the speaker in one receiver so that tone control can easily be obtained.

★ ★ ★



On the right is the "aerial box" of the Pye T7, which is completely screened. Shielded leads are taken from it to other parts of the circuit. On the left is a sketch of a double lighting system used by Cossor. It has two bulbs above each other and separated by a metal platform. One bulb illuminates the long-wave scale and the other the medium waves.



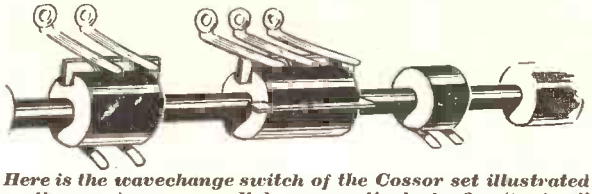
★ ★ ★

Rivets holding the valve holders of one well-known set are also used to provide anchorage for the elastic bands placed round the valves for safe travelling of the receiver.

Frontal Illumination

On the other hand, the Pye T7 uses frontal illumination of an opaque black scale. This has very clear white lettering and marking on it, and the white indicator slides along in front, controlled by a simple cord. The scale illumination is carried out by two lamps situated above it and protruding slightly in front of it. Thus a form of flood lighting is provided which makes the white markings stand up in very sharp contrast against the black background. This effect is enhanced by having the markings slightly raised from the surface of the scale.

STRONG AND SELF-CLEANING



Here is the wavechange switch of the Cossor set illustrated on the previous page. It has a particularly fine "wipe" action.

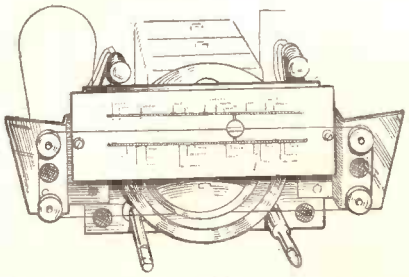
Another Method

The Ferranti horizontal scale on the Lancastria has another type of illumination. Here only one lamp is used, above and behind a translucent white scale. The whole scale is lit up no matter which waveband is tuned in and a white cardboard reflector is used behind the scale so that practically the whole of the light seen from the front of the set is that reflected from the paper. Direct light from the lamp is almost non-existent on the scale.

There is a novel feature in one receiver that deserves mention. It is the method of ensuring that the valves travel in situ with perfect safety while the receiver is being sent from factory to purchaser.

The valve holders are riveted to the chassis in the manner usual with chassis mounting valve holders. But under the heads of the rivets are metal hooks which are used as anchorages for the elastic bands used to hold the valves firmly in position. It is a small point, but it illustrates the attention to detail that is applied nowadays by the set manufacturer.

FLOOD-LIT SCALE



The Pye T7 scale is flood-lit from above, the scale being opaque and marked in white.

LOOKING INSIDE

HOW THE LATEST VALVES ARE USED

Here are some particularly interesting facts about modern commercial receiver design. G. Stevens has examined some scores of sets and shows how modern radio valves are being used.

IF you want to know the trend of modern receiver design look at the diagram of Fig. 1. The squares represent the valves used in all the varied types of receiver at Olympia, and their popularity is indicated by the areas of the squares. So we can easily see the most popular circuit—a superhet with octode frequency-changer feeding a variable-mu H.F. pentode as I.F. amplifier. The I.F. is then fed to the second detector, which is a double-diode in all cases. Whether the diode is separate or included with the output valve seems a matter of taste, and there is nothing to choose between them so far as the data shows. Returning to the frequency-changer stage, the triode pentode and the heptode run neck and neck for second place with the hexode taking fourth place as a comparatively new member of the frequency-changer family.

THE COMMERCIAL SUPERHET

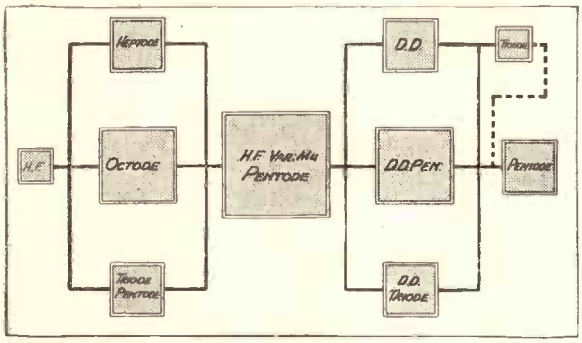


Fig. 1. This diagram shows the relative popularity among set makers for various types of valves in everyday superhets.

Whatever the type of frequency-changer used there is no alternative to the I.F. amplifier, which in every case is a variable-mu H.F. pen.

Three Main Types

Opinions of the leading set designers seem evenly divided between the heptode and triode-pentode, the octode being first in favour at the moment. This seems curious, as one would expect that the heptode and octode, belonging to the same class, would be equal in favour. On the other hand, there are designers who favour the triode-pentode to the exclusion of both the heptode and octode, on account of the absence of electronic coupling between the oscillator and H.F. sections of the valve.

There certainly seems to be good grounds for the preference, since there is less tendency for the oscillator tuning to drift in frequency under variations in the H.T. voltage. If, however, the H.T. supply has a good regulation, this point is not of such importance, since alterations in anode current due to A.V.C. action do not appreciably affect the H.T. voltage.

This is not the only point, however, as there are the additional factors of overall amplification, production of harmonics by the oscillator, and, lastly, the amount of noise produced by the valve in the process of frequency changing. Speaking generally, it is easier to arrange a suitable circuit for the electron-coupled class of F.C. than for the "separate oscillator" type, which may account for the predominance of the former.

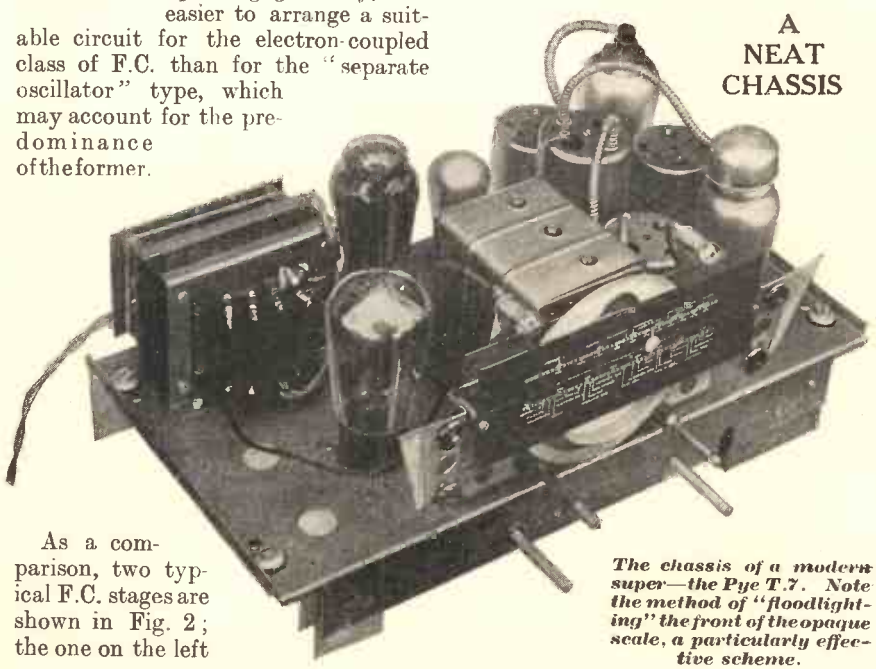
As a comparison, two typical F.C. stages are shown in Fig. 2; the one on the left being taken from the Mullard superhet, and the other employing the Mazda A.C./T.P. from the Pye T.21. The input to both valves is of the conventional band-pass type and is not shown. The main difference in the circuits lies in the oscillator portion. In the electron-coupled F.C.13 no components are necessary to mix the frequencies of the oscillator and signal, as this is done automatically inside the valve. In the Pye circuit the coil L.2 in the cathode circuit provides the link between the valve sections. This coil is critical in design, as excessive coupling will lead to "squeggering" on the lower wavelengths of either band.

A Unanimous Choice

The unanimous choice of the H.F. variable-mu pentode for the I.F. amplifier stage is dictated by the fact that only the overall amplification of the stage is involved. If A.V.C. were not as widely used as it is, there would be a second choice of a "straight" H.F. pentode, but the rapid growth of high-power transmitters necessitates the use of a valve with a large signal handling capacity.

Diodes are seldom used as full-wave rectifiers of H.F., although it is possible to obtain a much higher output by

A NEAT CHASSIS



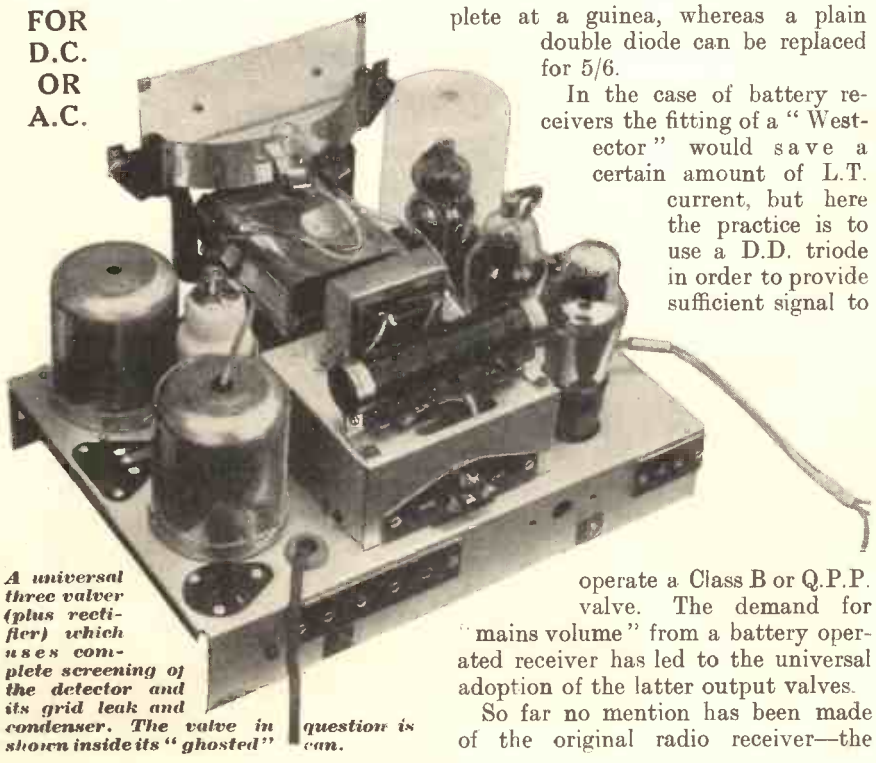
The chassis of a modern super—the Pye T.7. Note the method of "floodlighting" the front of the opaque scale, a particularly effective scheme.

this type of circuit. A far better use for one of the anodes is to provide A.V.C., which is not so much for the purpose of counteracting fading as for the biasing of the intermediate amplifier to handle strong signals. Admittedly a single diode could be used for the double purpose of detection and A.V.C., but this would not allow of any delay to enable weak signals to be accepted. It is after this stage that the manual volume control is applied, in distinction from the "straight" receivers in which the volume control is always applied to the H.F. valve.

In radiograms, the volume control is also in the correct position for varying the pick-up input, which is connected to the triode or pentode grid following the second detector.

The Popular Pentode

The use of a triode for the output stage of receivers has fallen into disuse, mainly owing to the greatly increased sensitivity of the pentode and the improved circuit conditions which enable this valve to be used with no trace of distortion in the upper frequencies. Further, the modern pentode is so sensitive that it will develop its full power output of some 3 watts with an input signal of three or four volts. Examples of this type are the Mullard Pen 4 V.B., Mazda A.C./2 Pen., Cossor 42 M.P./Pen., and Marconi and Osram N.41. In some receivers these are used by themselves following the diode, and in others the diode is included in the same bulb.



A universal three valver (plus rectifier) which uses complete screening of the detector and its grid leak and condenser. The valve in question is shown inside its "ghosted" can.

One or two noteworthy cases, such as the Murphy A.24, have used a triode between the diode and the output pentode. This, of course, makes a very sensitive combination and enormously increases the range of the receiver. Any fear of overloading the pentode is avoided by keeping the input to triode grid very low and using a low value of anode resistance.

It might be wondered why some manufacturers prefer to fit a separate double diode, when it is possible to save space by using the combined D.D. Pen., but the question of replacement is an important one. The failure of one of the diodes in a multiple valve involves the cost of a new valve complete at a guinea, whereas a plain double diode can be replaced for 5/6.

In the case of battery receivers the fitting of a "Westector" would save a certain amount of L.T. current, but here the practice is to use a D.D. triode in order to provide sufficient signal to operate a Class B or Q.P.P. valve. The demand for "mains volume" from a battery operated receiver has led to the universal adoption of the latter output valves.

So far no mention has been made of the original radio receiver—the battery set! There is not so much scope here for originality in design since the main consideration is economy in H.T. consumption. Nevertheless, double-diode-triodes and the three types of frequency changer are all found in this range. The demand for quality has led to the universal use of moving-coil speakers, which in turn have led to the development of Q.P.P. and Class B circuits.

TYPICAL UP-TO-DATE FREQUENCY-CHANGING CIRCUITS

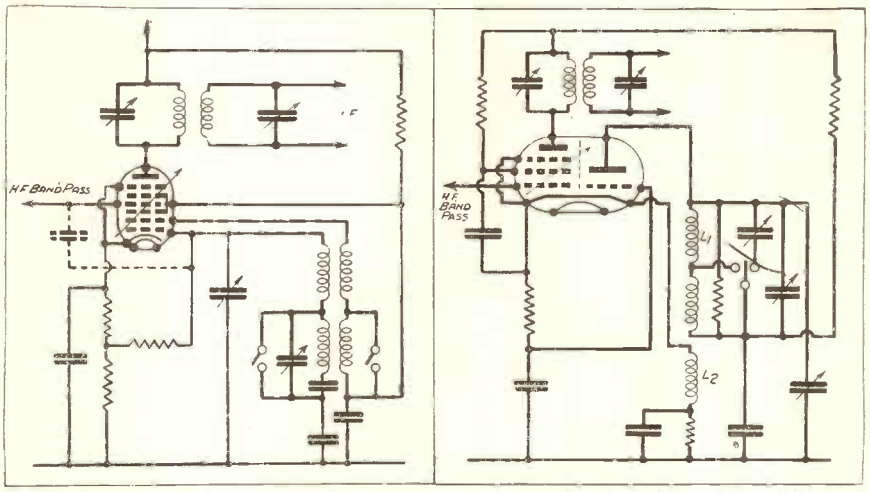


Fig. 2. Above are two diagrams of frequency-changing or mixer circuits, showing how the octode and the triode-pentode are employed.

Speaking generally, the trend of design of the battery receiver is following closely on that of the mains receiver, although it is handicapped by the inferior performance of battery valves compared with their mains equivalents. The coming short-wave developments in both television and sound broadcasting will tend to relegate these valves still further into the background, since the rapid improvements in special valves for short-wave reception have resulted in the all-wave mains receiver. This is a definite encroachment on a field which was hitherto only occupied by the battery user.

Quality Will Improve

We have a lot to look forward to—the wider use of midget valves, the introduction of "acorns," and the universal appreciation of the fact that the user looks for quality—both in the production and in the reproduction!

Quality will undoubtedly take up a more and more important position in set design and loudspeakers will receive a great deal of attention. How far good quality will be obtainable on the short waves—as distinct from the ultra-short or television waves—remains to be seen. The field below 50 metres is still largely unexplored, at any rate by the radio set manufacturer.

LOOKING INSIDE

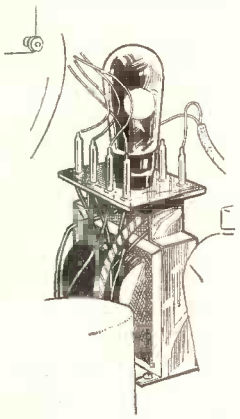
SUPPLYING THE POWER

This article gives some inside information as to how British set manufacturers arrange their power supplies.

THE problem of power supply for commercial receivers has been solved in several ways. At the moment there are three main types of sets on the market: the battery operated, universal, and A.C. models. There is a fourth, rapidly dying out as its place is taken by the universal set—that is, the D.C. variety.

COMPACTNESS!

The battery-operated receiver is naturally limited in its design by the fact that anode-current consumption must be kept down to reasonable limits. To ensure this the special Q.P.P. valve was designed and has become exceedingly popular. This valve or an "economy pentode" (low consumption valve) is almost invariably employed in battery receivers.



Placing the rectifier valve on top of the power transformer combines efficiency with saving of space in one 1936 design.

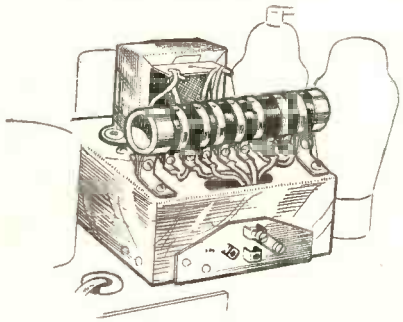
But most manufacturers concern themselves mainly with all-mains receivers, either of the universal or A.C. type. The former cover both D.C. and A.C. mains and are becoming as popular as the A.C. only type. No mains transformer is required, but the H.T. voltage is thereby limited to a maximum corresponding with the mains supply voltage. This automatically restricts the output power of the set, though with modern pentodes a maximum of some 2·5 watts can be obtained—unless push-pull is used.

The Power Pack

On another page we have mentioned the fact that in large console sets the power pack is often completely divorced from the radio chassis. This is so where A.C. sets are concerned, but as a rule with universal receivers the power pack and the radio chassis are integral. There are cases, of course, where this is not so. One well-known make fits the radio chassis at the top of the console, below it the power pack and its rectifier, and then below that there is a vast space for the loudspeaker.

The rectifier in a universal set is kept in position in most cases whether or not the set is working on D.C. mains. And nowadays reversible electrolytic condensers are made so that no matter if the polarity applied from D.C. to the set is wrong—the power plug being inserted the wrong way round by the user—no harm to the condenser can result. This is important where no rectifier is used on D.C. mains.

SCREENED MAINS



Here is the mains "box" of a Cossor Universal set.

Mains field loudspeakers are universal in mains sets, the anode current of the set being fed through the speaker field, which applies a modicum of smoothing besides being energised. In the event of an extension speaker being used instead of the speaker in the set, the field of the set speaker is, of course, still kept in series with the anode current.

One of the neatest methods of providing for external loudspeaker use is that adopted in the Pye T7. In this case the speaker speech transformer is fed from two sockets on the back of the chassis. Into these sockets fit two plugs attached to the transformer on the speaker. If an extension speaker only is required the two plugs are removed from the sockets, cutting out the set speaker, and two more plugs are inserted attached to the extension speaker.

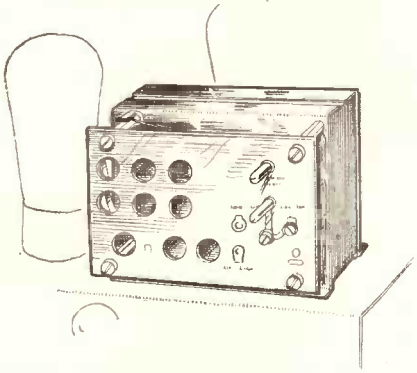
If an extension speaker is required as well *as* the set speaker, the extension speaker plugs are inserted in the holes in the tops of the speaker plugs which remain in the sockets on the chassis. Thus the extension speaker is connected in parallel across the high impedance side of the set speaker.

No Fixed Rule

There seems to be no fixed idea among manufacturers regarding the shielding of the various points on the power pack from the rest of the set. Sometimes the power transformer is completely shielded—sometimes it is naked and unashamed; usually the latter. Heater wiring is sometimes shielded, sometimes wired with twisted flex, and sometimes with straight busbar. This latter is usually the case only when the leads from valve holder to valve holder are short.

In superhets especially great care is usually taken to screen all sorts of parts from the power wiring as well as from other parts. In the Pye T7 the aerial input is completely enclosed in a metal box. There is some sort of selectivity device inside, and this is thereby kept screened not only from H.F. coupling with the rest of the set

THE VOLTAGE TAPS

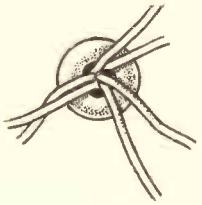


Neat voltage regulation taps are fitted on most modern sets. Here is a typical example.

but also from any A.C. field from the heater wiring or valve sockets.

The Cossor Universal set, Model 369, uses universal valves in which the control grids of the detector and output types are taken to the top cap of the valve. In the case of the detector the lead from grid to grid leak and condenser is screened from the rest of the set by the simple expedient of screening the whole lot, valve, lead, grid leak and condenser, in a large can. This prevents motor-hum pick-up, and L.F. and H.F. pick-up as well, and is a scheme strongly to be commended. The mains section on the same set is wholly screened, except the input resistance and the rectifier. A metal cover is used which goes right over such things as smoothing condenser, voltage potentiometer and the feed from the mains input connecting terminals to the power resistance on top of the box. This resistance has to be well exposed in order to allow of heat dissipation.

SAFETY FIRST!



Careful bushing of mains and heater leads that go through the chassis is carried out in one well-known set.

The mains voltage adjustment on most sets is remarkably simple nowadays. Just a matter of a few screws, perhaps just a couple of straps to fix between certain points. The ordinary listener has no excuse to go wrong, especially as the voltage setting is described at length in most of the manuals accompanying the sets.

A commendable safety measure that we came across in one set was the bushing of the mains cable where it passed through the chassis going into the set, and also of the heater lead cable passing through the chassis from the power resistance in the case of a universal receiver. The bushing was carried out by means of really stout rubber, and completely obviates any possibility of contact between the cable—itself strongly insulated—and the metal chassis.

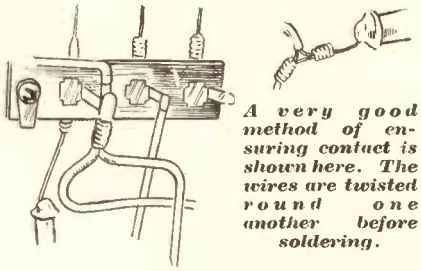
Switch Design

Though it is not to do with mains and power packs, we would like to remark on the diversity of wave-change switch design in commercial receivers. This is a weak point in many cases, and trouble from noises due to poor contact in the wave-change switch is by no means unknown.

One switch, however, which we illustrate on another page, should never give any trouble. It is a clean, heavily sprung contact with plenty of really hard wipe. It is a design that might well be copied by some of the firms that use less certain methods of obtaining their long-wave coil short-circuiting.

The use of thermal delay switching in A.C. sets has practically dropped right out, for indirectly-heated rectifier valves have obviated the danger of high-voltage peaks arising due to the H.T. voltage being applied to "unwarmed" A.C. valves.

SECURE CONNECTIONS

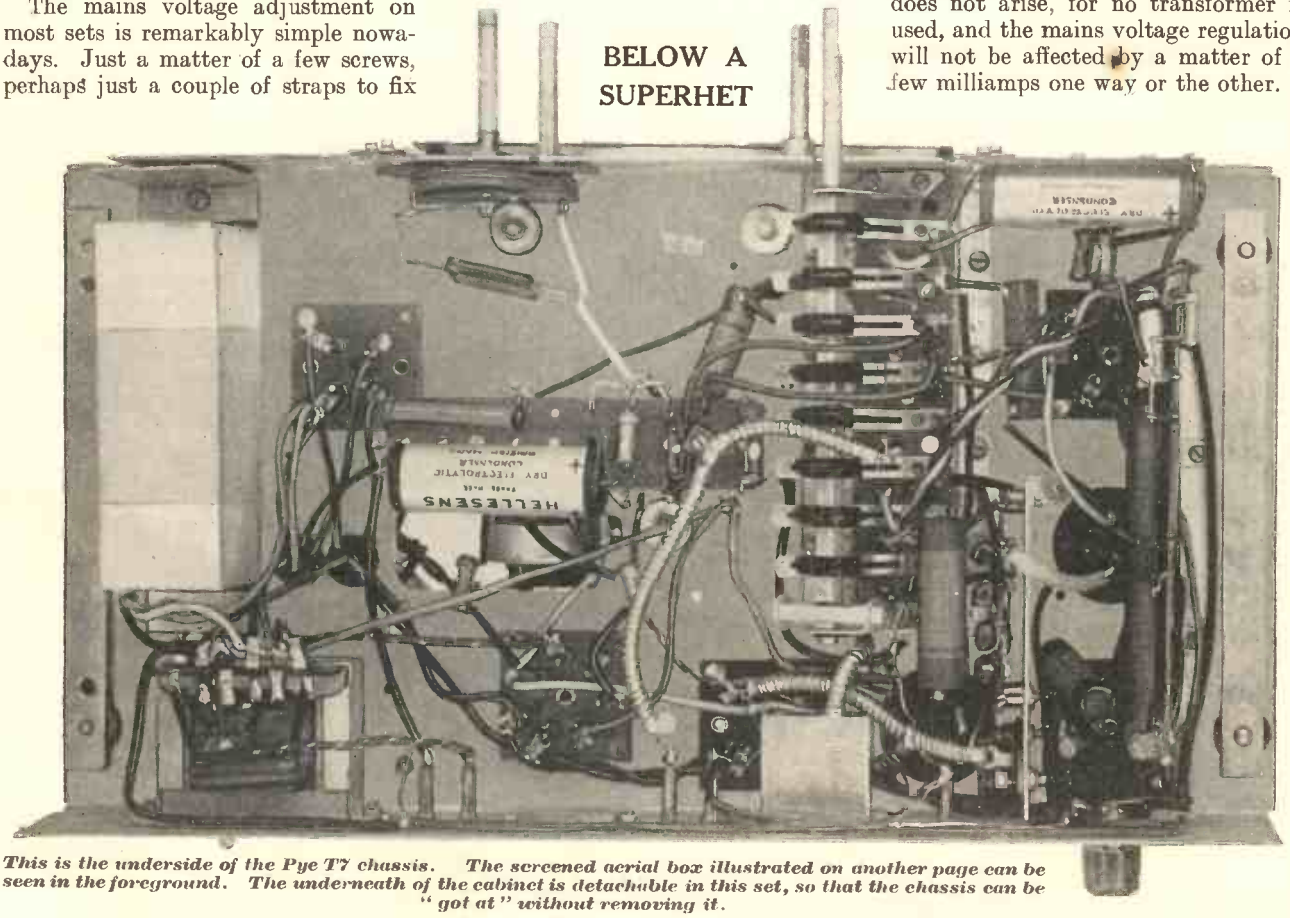


A very good method of ensuring contact is shown here. The wires are twisted round one another before soldering.

In large radiograms the use of directly-heated output valves also assists in this regard, and makes the employment of directly-heated rectifiers possible, still without the aid of thermal delay switching.

Where universal or D.C. receivers are concerned, the question of large voltage rise due to low anode current does not arise, for no transformer is used, and the mains voltage regulation will not be affected by a matter of a few milliamps one way or the other.

BELOW A SUPERHET



This is the underside of the Pye T7 chassis. The screened aerial box illustrated on another page can be seen in the foreground. The underneath of the cabinet is detachable in this set, so that the chassis can be "got at" without removing it.

Television To-day

THE PRESENT SITUATION AND FUTURE POSSIBILITIES OF TELEVISION IN THIS COUNTRY ARE HERE DISCUSSED

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

WHAT is exercising everybody's mind now is: When is the B.B.C. television going to start? We have heard so many rumours, first that it was going to start in the Autumn, then that it was going to start in the New Year, and then that it had all been put back and would not start for a couple of years, that many people have begun to wonder if it is ever going to start at all. But, as stated elsewhere in this issue, it is now expected to commence round about Easter.

It must be admitted that it was most unfortunate for the radio trade at the time of the announcement of the television committee that an impression should have been created which reacted on the sale of ordinary radio receivers. It was not the fault of the P.M.G. who, as a matter of fact, went a good deal out of his way at the time to make it very clear that the public need have no hesitation in going on buying ordinary radios, as the position would not appreciably be affected for a long time to come by the advent of television.

A Necessary Safeguard

Sir Kingsley Wood, who was then the Postmaster-General, as you remember, is an exceedingly shrewd and able man, and it was quite evident that he foresaw some interference with the regular radio trade, and did everything in his power to forestall it.

Nevertheless, due to no fault of anybody in particular, the result was as I have indicated above, and we have since witnessed the unfortunate state of affairs in which the radio trade has been obliged to do its utmost, so far from helping television forward, to keep it in the background, if not, indeed, off the map altogether. Those of you who went to the last Radio Show will remember that there was no sign or mention of television in any shape or form.

But although the radio trade was obliged to do this, it must not be supposed that it was solely and simply for its own needs, or that it was the only section of the community to benefit by the campaign. In point of fact, most sensible people will agree that the radio trade did the only right and proper thing in the circumstances, and that it is just as much to the benefit of the radio public that they should not be allowed to become completely bewildered by all these confusing reports as to the coming of television.

The radio manufacturers made a valiant effort to clear the situation and to let the public understand that for the present, at any rate, it is radio sets that are to be considered, and that just as soon as television is really a practical possibility, in the sense the public understands by that term, then the radio trade will be there ready and willing to supply the need.

I mention all this because some people have got the idea that the radio manufacturers acted in some sort of selfish way, but I think you will see that they acted really in the best interests of all—including themselves, it is true—and that the situation now is relatively clear, whereas before it showed every sign of becoming completely chaotic.

PROGRESS IN GERMANY

A glimpse inside the German television station at Berlin from which ultra-short-wave high-definition transmissions are sent. The top photograph illustrates a portion of the transmitting equipment, while that on the right shows the control apparatus.

IN THE CONTROL ROOM

The Arrangements Made

Turning now to the question as to where television really stands, we are told that the B.B.C. is starting high-definition transmissions in April, 1936. I understand that the arrangements between the B.B.C. and the Post Office, on the one hand, and the Baird and Marconi-E.M.I. Companies on the other hand, are based on the transmitters provided by the latter companies being installed and ready for operation in plenty of time by the above-mentioned date.

Another part of the arrangement was that the two leading Television Companies just mentioned should provide all necessary technical information and data to the radio trade to enable the trade to make preparations for the manufacture of home television receivers in time for the inauguration of the B.B.C. service.

TELEVISION AND HOME-CONSTRUCTION

This information has been released and is discussed elsewhere in this issue.

There is only one difficulty under which manufacturers labour at the present moment, and that is a serious one. The difficulty I refer to is that, although a certain amount of technical information is now in their hands, there are no dependable high-definition transmissions available on which they can test out their receiving apparatus.

It has been necessary for different manufacturers to set up television transmitters for themselves, to enable them to get along with their experimental work. This seems to me to be rather a pity.

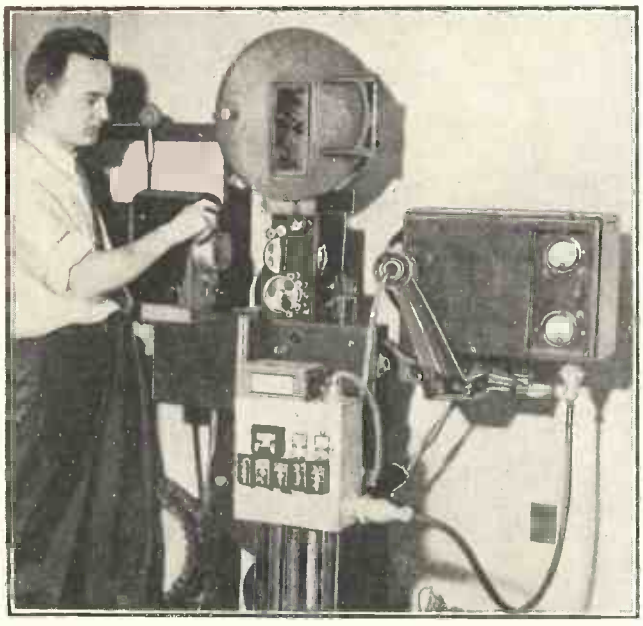
Possible Difficulties

The outlay involved in the setting up of such transmitters is not in itself such a serious matter to the larger firms, but I think there is a danger that, even with the technical information which has been supplied by the two leading companies, manufacturers may in some way or other misunderstand some details of the transmitting arrangements which are to be adopted, and this may involve them in difficulty sooner or later.

However, no doubt all these points will be dealt with as we go along. It is hardly to be expected that in an undertaking of the novelty and magnitude of this new television service no difficulties should be encountered. In fact, I think it can be said that, in all the circumstances, the proposition has been handled with considerable skill and foresight.

Having regard to the immense outlay which has been undertaken over a period of years by both the Baird and the Marconi-E.M.I. Companies, even though everybody recognises quite loyally that they are entitled to very special consideration, it is an achievement of no small magnitude to have brought negotiations between the various parties to their present stage with so little friction or opposition.

In the meantime, it is encouraging to note that Mr. J. L. Baird, the famous television pioneer, said recently, " By this time next year we expect that television will be in full swing. It will not be long before every wireless set will be equipped with a television screen and radio vision in the home will be as usual as ordinary sound radio reception is to-day. It should be possible to broadcast interesting outdoor events, and those at home will be able to see all the details as well as hear the spoken commentary."



FOR FILM WORK

Many different firms have been working on the televising of films. Here is the Farnsworth apparatus developed in America to transmit films by television. The well-known Farnsworth system of electronic scanning is employed.

When the television service *does* start it will be very interesting to see whether the boom in amateur construction revives once again. Many of you will remember the great wave of enthusiasm which spread throughout the whole country when the B.B.C. first started radio transmissions.

Will It Happen Again?

Many people predict that when television comes along the same sort of thing will happen all over again, and that we shall see a wave of home construction in television reception. There is little doubt that we shall see an immense amount of interest taken in the making of television sets, but whether the wave will equal that of a few years back remains to be seen.

Anyway, for those who are not interested in constructional work and merely want to look-in as well as listen, there will be no shortage of television receivers on the market at popular prices.

Cathode-Ray Tubes

I hear that cathode-ray tubes—the cathode tube is the most expensive single component in the receiver—are going to be greatly reduced in price, and that altogether it will be possible for a first-class television receiver to be turned out at a price not greatly above that of a present-day high-grade wireless set. It must be remembered, of course, that a very large number of valves are employed in a television set, and this alone is bound to make a difference to the cost of production.

Talking about amateur construction, it is to be hoped that a large number of people will throw themselves enthusiastically into television experiments. It has often been said that the march of radio, not only since broadcasting started but even before that, was largely due to the experiments of the amateurs.

In television there is no shortage of technical problems still to be solved; there is, in fact, a much greater field for experiment and research and for ingenuity of all kinds in television than in radio sound reception. There is little doubt that important contributions to the technical improvement of television will be forthcoming from what we believe will be a new army of home experimenters.

The Question of Brightness

Before leaving the point, I may mention just one thing which is really crying out for attention, and that is the question of the brightness of the received picture. For the improvement of the brightness we need a brilliant source of light which can be readily modulated over the necessary range of frequencies. Such things as Kerr cells and neon (or other types of) discharge lamps form a ready field for the experimenter who is anxious to try his luck.

I expect we shall discover other types of light sources capable of modulation in the required way, but the first line of attack would seem to

(*Please turn to page* 291.)

Questions and Answers by John Scott-Taggart

Q. 155.—Do you favour the parallel output feed system for loudspeakers? It seems to have been widely used.

A.—No, I do not think it is worth while on the whole. It is highly expensive, as you need a good choke and a condenser. Matching the speaker to the output valve has always been a hit-or-miss affair with this arrangement, while the modern arrangement of an output transformer as part of the speaker assembly enables the manufacturer either to fit a transformer designed specifically for the output valve used or a multi-ratio transformer to suit various valves. An extension speaker is often "parallel-fed," the primary of the existing speaker transformer acting as the iron-core choke.

Q. 156.—I am told that 150 volts will give much better results than 120 volts on the output value of my set. Is this so?

A.—It is almost sure to give very much better results. Even small increases over 120 volts will enable a much greater output wattage to be obtained. Do not omit to increase the negative bias on the grid of the output valve, and on the grid of the 1st L.F. if there is such a penultimate valve in your set.

The quality of reproduction is also improved by increasing the H.T. voltage, and if 150 volts is applied throughout, the sensitivity of the whole receiver will probably increase considerably—although reaction, if used, may become a little fierce.

Q. 157.—Why does one read of D.C. current when the C. of D.C. *means* current; and of I.F. frequency when F. already stands for frequency? And why "A.C. voltage"?

A.—Because we are sensible people and not pedants; convenience and commonsense often triumph over strict logic, while idiomatic usage transcends all. Once you get fussy over things like this—approved by quite the best scientific people—you will spend the rest of your life bemoaning the English language, which is riddled with illogical words. Actually abbreviations like D.C., A.C., I.F. have become adjectives which conjure up certain electrical ideas; they have ceased almost to be abbreviations and might be regarded as X, Y or Z, since we do not think of each initial and worry our little pedantic souls to see if the second initial will clash with the next word.

Often we say "I.F. frequency" because "I. frequency" would look and sound odd and confusing, while "intermediate frequency" is too long and "I.F." too naked; actually we are really meaning "I.F. current frequency" or the frequency of the I.F. circuits.

Each month Mr. Scott-Taggart gives authoritative replies to queries selected from the many hundreds sent in. Those which appear on this page have been chosen from his most recent postbag because of their wide general interest.

Q. 158.—I have a mains unit which gives 18 milliamps, but seems less efficient than a battery when used with the same set, which is a screen-grid four. Can you suggest any reasons for this?

A.—Quite a lot. Mains units seem to be designed for the most part not by modern receiver designers, but by a special branch of engineers best known as mains unit specialists. They expect set designers to design sets which will work with their units instead of vice versa. Moreover, the mains unit field is commercially highly competitive, which means that the unit must primarily be cheap rather than good.

The result of this situation is most interesting. I think I am right in saying that mains units, or "eliminators," are used almost solely with home-constructed receivers. Such sets are designed almost solely by gentlemen like myself, who write for the radio papers. But I never heard it whispered that the Press has ever been consulted by mains unit manufacturers. Nor am I surprised, for, if we had our way, mains units would be better and therefore dearer.

The chief reason for this is that the mains unit consists of a rectifier, a transformer, and a system of condensers and resistors which smooth the current, alter its voltage and tend to prevent the low-frequency oscillation known as "motor-boating." Any economising in the unit will usually result in poorer smoothing, and therefore more "hum" in the loudspeaker; also "decoupling" (see my "Manual of Modern Radio," page 136) will be less. The manufacturers have "passed the buck" to the set designers. If the constructor complained to the manufacturer of hum or instability, the latter would reply that the set was badly designed!

The Question of Cost

As there are enormous quantities of cheap mains units in the hands of readers, the designer of the receiver must do his best to make the set work with these units. All my own sets are designed to work with even a thoroughly poor unit; this is annoying to me, and involves some greater expense to the reader, because the condensers and resistors for decoupling (and incidentally smoothing) need not be as costly—and might often be omitted entirely—if you knew the set was to work only off batteries or a really good mains unit. In other words, the set designer must compensate for the poorness of the mains unit.

Unsuitable Voltages

But our complaint goes further than this. Mains units very frequently are utterly unsuited as regards the voltages supplied. The output voltage is usually O.K. The S.G. voltage is usually between 60 v. and 80 v. if the unit is designed for an S.G. valve set; this is reasonable enough in most cases. There is then a tapping for the detector anode circuit. Here is the worst design feature: its voltage is intended to be about 60 volts to 90 volts. This makes it very difficult to decouple properly (using a large resistance) and still obtain a sufficiently high voltage on the actual

(*Please turn to page* 290.)

The Spirit Signal

A Story of the Occult

By J. D. Strange

(Author of "The Price of Victory," "The Master Spy," etc.)

"WELL, we asked for trouble, and we've got it." John Hale raised his massive shoulders and stared gaunt-eyed at his companion.

Christopher Manning's dark, almost foreign-looking face registered something which his friend found it hard to define. But Hale had never really understood the other properly. Manning said nothing. Rising, he staggered across the echoing boards of the empty hotel and stared sombrely out through the windows at the racing clouds which drove past him, seeming to skid over the virgin snow in a procession of grey shapes of doom. For six long weeks, now, that veil of cloud, sometimes moving, sometimes still and silent, had hidden the Rhone Valley from the two men's view.

Eight thousand feet below lay the town of Montreux. John Hale joined his friend at the window and thought of the town which lay hidden below them under the clouds. Montreux, with its hotels and pensions. Inhabited hotels and pensions, with sleek waiters carrying food to sleek guests. FOOD!

"We were crazy to take old Jacquard at his word!" Hale muttered harshly.

In November they had been stopping at the "Pic Chaussey" hotel, a building occupying one of the most lofty sites in the whole of Switzerland. They had wanted to stay on longer, because they liked the situation, but the proprietor, Monsieur Jean Jacquard—a strange mixture of cynical old Swiss hotelier and scientist with a bent for modern electrical research—had informed them that at the "fin de saison" it was customary to close down the hotel and descend the 8,000 feet to the valley until the spring sunshine opened up the impassable snow and brought visitors to the altitudes again. From November until May the hotel remained closed, empty—a husk set in the eternal snows.

"Unless, of course, the Messieurs Anglaise would care to spend the winter 'tout seul' on the mountain top?"

Old man Jacquard's remark had been made jestingly. And it did not help John Hale to bear his present discomforts when he reflected that *he* had been the one to suggest taking the hotelier at his word. Six months on the mountain top—alone. Glorious. He had put the idea to his friend. Christopher was a student of many things. Here was a chance to indulge his research into such vague subjects as the Transmigration of Souls, Psychic Control, and the Occult. Not that Manning discussed these matters with his more robustly constructed friend. Christopher Manning said very little at the best of times. Deep in his heart, John Hale thought his friend a little mad, but this in no way lessened the deep affection he bore towards the reserved, studious young man.

Manning had listened to the arguments which had been set forth as to why Old Man Jacquard should be taken at his word. Solitude—far from the maddening crowd—peace—time for reflection—the novelty of having spent six months completely isolated from one's kind. There were books in plenty—books, even, which dealt with the Black Arts, a veritable fund of learning for the student. There was plenty of firing on hand, material brought up by the "funiculaire" which ran almost to the mountain top in summer. Snow would provide all the drinking water they needed. There remained only—food.

Old Jacquard had refused to discuss the matter seriously at first. But Hale, the enthusiast, had produced plans. Tinned food, fowls—to be kept in the covered yard—eggs and then the fowl's flesh. A pig, too—and even live trout kept in the hotel's miniature aquarium, for most Swiss hotels have their own live trout from which to draw.

Hale had spent a few weeks on the coast of Greenland. This would be vastly easier. He was rich, and had offered to pay liberally for his six months' imprisonment in the changeless snows. Finally old Jacquard had shrugged, muttered something about "Ces fou Anglaises ci" and had departed amid a whirl of excitable shouts and instructions, taking with him his staff, bag and baggage, leaving John Hale and his friend in sole possession of the great echoing hotel.

That had been three months ago.

At first things had gone swimmingly. Manning had occupied himself with reading and study. Hale had spent his time eating and sleeping, with an occasional venture out among the rocks in the immediate vicinity of the hotel.

Then things had commenced to go wrong.

The winter snows had come in earnest, making all chance of adventure outside an impossibility. Added to this, a thick cloud of mountain mist had descended, enclosing them as in a blanket, visibility being reduced to a few inches on some days, and never more than twenty yards on others.

THE LAST SEARCH FOR FOOD

In the mist the pig had somehow found its way out of the covered yard and disappeared in the snow. They had been unable to go in search of it. Then the fowls had begun to die off—one by one. What killed them, neither of the two young men could determine. Perhaps it was just altitude. Anyway, they died. And the trout, regarded at first as an extra, had assumed an important place on the day's menu. But they had not lasted for long.

Christopher Manning had been the first to observe that a serious situation was developing. If the clouds would only clear away, they might be able to signal for help to the valley below. Somebody would almost certainly observe their signals of distress sooner or later. And guides, with proper climbing apparatus, would rescue them. Or, there was always a possibility of getting a Swiss 'plane to drop them supplies so that they could hang on until the route to the valley was opened up.

The matter was not yet serious, of course. But into the minds of each of the young men there crept a tiny, uncomfortable little word. Starvation. They laughed at it. But decided that it must be treated with respect. They must live on their tinned food, carefully rationed. The mist, they told themselves, would soon lift.

The mist—as all who have lived for any extended period in the Swiss altitudes in winter know it can do—remained where it was. It did not lift.

ONE day Manning was taken ill. The tinned food was suspected, and on examination it was found that half the tins were bulged and rusted. The choice lay between ptomaine poisoning and possible starvation. They threw the suspected tins out into the snow.

What remained had been rigorously rationed. For three weeks they had drawn in their belts and indulged in semi-starvation. The mist *must* lift.

"Galvanised into life he picked up a stool and hurled it through the window."

The last of the tinned food went. And the mist remained. For nearly a week, now, neither of the men had eaten anything. The situation had become desperate.

Hale staggered back from the window and fell into one of the comfortable chairs which well-fed guests occupied in the summer season. His huge frame was a bag of bones.

"We've got to arrive at a decision now," he muttered only a little above a whisper. "Another day of this and our last chance will have gone. We shall be too weak to stand!"

His companion opened his mouth in a yawn induced by lack of food and not weariness.

"The mist isn't going to lift, Hale," he observed, and his eyes, bright and feverish, looked unnatural in the leaden dullness of his swarthy face. "What can we do?"

"Get out yonder and take a chance of reaching the valley."

Manning grunted.

"It wouldn't be a dog's chance," he retorted, and his companion knew he spoke the truth. Outside, the snow lay thirty feet deep in places, covering crevices and chasms which would engulf a man without warning. And even the most expert ski-er would have found difficulty in negotiating slopes which he hardly knew at all and which at times were nearly vertical. Without ski, a climber could not have moved five yards.

In addition, avalanches rattled down the mountain side at frequent intervals, while wild winds and biting snow-storms spelt frost-bite and death. Experienced Swiss guides who knew the mountain like a book, armed with rope, snow-shoes, axes, and working in a large party, might have stood some chance of accomplishing the descent. For the two Englishmen to attempt it in their present weak state would be nothing less than suicide. Both knew it. Yet something had to be done.

Manning shuffled falteringly back across the room.

"Stay here we starve," he croaked. "Get out, we die. Take your choice."

"There's a one-in-a-million chance that one of us might reach the valley——" Hale shook his broad shoulders as if by so doing he sought to convince himself of the feasibility of his argument. "You please yourself, Manning. I'm going to have a stab at that chance."

Manning thought for a few moments, then he nodded.

"Very well, Hale," he agreed. "I'm with you. We'll tackle it at once—together."

The pair stared slowly round the room, at the fire which still burnt brightly in the open fireplace, then at the cloud-swept wildness outside. The wind was rising again, a biting blast which would freeze exposed flesh as soon as it touched it. But it was now or never. Another day would see them too weak to hold themselves upright.

Hale shambled to the swing door, and after one or two efforts managed to drag it open. In the corridor, however, he paused.

"Better have one last look round," he mumbled. "Might have missed a crust or something. Anything to help us over the next few hours."

Manning knew that any foodstuff remaining would have been discovered in previous searches, but he nodded. Perhaps because he was too weary to argue.

"Right—you take this side, Manning; I'll take the other," said Hale, and without waiting to see what his friend did, he reeled off down the corridor, kicking open doors and examining rooms as he went.

A SHORT-WAVE MESSAGE

MANNING waited a few moments, then he turned and moved off in the opposite direction. The flush had deepened on his sallow cheeks—at that moment his mind was occupied almost entirely with thoughts of Hale, for there was an odd bond of friendship between these two so dissimilar men—his eyes had become glazed, and as he walked down the corridor his breath came in quick, panting gusts. He moved like a man in a trance, and his appearance had now become wholly un-English. With his dark skin and raven-black hair he looked like some Eastern mystic.

He walked to the end of the passage, then turned right-handed until he was brought up short by a door. Opening this, he entered and found himself in a long room in which was a huge table and many chairs—obviously the main dining hall. He walked slowly round the table, but if he was looking for food, his method of procedure did not suggest it.

Presently he came to a halt, then suddenly, as if spurred by some vital thought, he strode across the room and tugged at a curtain which came half-way down the panelling at the far end. The curtain came away in his hand, exposing to view a small doorway. Like a man walking in his sleep, the young Englishman grasped the handle of the door, opened it, and moved through into the tiny room beyond.

The room was lined with test tubes, Bunsen burners, bottles and other impedimenta which a scientist might have used, whilst a small table in the centre was littered with wireless material. Manning paused, as if uncertain what to do. Then, gliding forward, he sat down in the chair before the table and remained staring into space for several moments.

Suddenly his right hand slid forward until his fingers touched a small object on the table. His fingers started to move up and down on this object in a series of rhythmical movements, pressing and depressing a moving part of the thing on the table.

Presently, however, the young man's fingers grew still. For several moments there was a deep silence.

Suddenly Manning started up in his chair, a stifled cry issued from his lips—the next moment he had crashed forward across the table, where he lay motionless, as still and as silent as the instruments among which he lay.

AT the other side of the building, Hale completed his tour and shambled back to the point where he had left his friend. Here he sat down on the floor to await Manning's return. But Manning did not return.

"Wonder if he's cashed in on his grub trek?" The thought came suddenly to Hale, bothering him, for he knew that Manning's physique was not as good as his own. Muttering to himself, he rose and made his way unsteadily down the corridor. Presently he came to the great dining hall, and at once spied the small door open on the far side.

"Queer——" he stared at the door, then round the "salle à manger." "Never spotted that before. Chris! Chris——!" He raised his voice in a shout.

No sound answered his call.

"Manning——" his voice grew sharp, strident. "Manning!"

Still no sound.

A faint gleam of fear entered Hale's eyes. He drew himself up, hesitated, then ran across to the small door opposite. Here he came to an abrupt halt, and as he stared into the room beyond, the fear that had been in his eyes crystallised into sudden panic.

Sprawled out in the chair, his head and arms flung across a table littered with coils, valves and other apparatus, his friend lay without movement.

"Chris!"

Christopher Manning never stirred.

Hale's hand flew to his lips. He turned, as if about to bolt from the room, for there was something in the atmosphere of the place, a something he could not define, but which sapped at his courage so that he longed to rush away from it. With a mighty effort, however, the young man pulled himself together. Two strides carried him to the table, and reaching forward, he laid his hands on the shoulders of the man in the chair and dragged the limp figure back off the table. Christopher Manning's head came back as though it were attached to a rag body by a rubber pipe.

"Heavens above!" Hale stared into the wide-open, glassy eyes of his friend. "Dead!"

Something in the living man's heart seemed to snap. He straightened up, a look of frozen horror in his eyes. Then, uttering a cry which was scarcely human, he turned and rushed from the room of death—out into the echoing passages and corridors of the empty hotel. Like a man possessed he fled back to the room he had left only a short time ago. He and Manning.

Alone—alone—alone! The rising storm outside whistled through every crack and crevice of the building, throwing this refrain back in his face. Alone—alone!

Hale reached the fireplace and stood swaying backwards and forwards like a man drunk or drugged. Then, with dramatic suddenness, abused nature took command. John Hale slid forward to the floor in a dead faint.

HOW long the young man remained on the floor, he could not have said. It must have been one, perhaps two hours. Then something seemed to penetrate the depths of his unconsciousness. A steady, regular droning sound. He lay there listening to the noise for a time in a stupid, muddled sort of way.

Suddenly he roused himself to his knees, then to his feet, and swayed over to the window. The clouds still obscured the valley below, but the wind had dropped and above him was clear sky.

The strange droning sound had increased in volume. The next moment a choking cry issued from the starving man's lips as he saw a tiny shape moving through the sky towards him.

"A 'plane—a 'plane!" he croaked. Pressing his face to the window-pane, he glared at the airplane as it came speeding towards him out of the void. Then, galvanised into life, he picked up a stool and hurled it through the window.

He tore down a curtain and leaning out through the broken window, waved his improvised banner at the oncoming airplane.

The machine rose a little, then came swooping downwards. The next moment something detached itself from beneath the undercarriage and came floating slowly towards the spot where the watcher stood.

Hale stared at this object with burning eyes. It hit the ground less than fifteen yards in front of the hotel loggia. He swung about and scrambled out through the door, down the passage and out into the snow. Two minutes later he was back in the room dragging behind him a large packet attached to a parachute.

The machine which had dropped the packet dipped as if in salute, zoomed up in a steep climb, then swung about and disappeared from view. In front of the fire, Hale

(*Please turn to page* 292.)

NEXT MONTH

In "Wireless and Television Review"

"BRITAIN BROADCASTS"

A unique compilation of intimate articles which personally conduct you through the corridors and studios of the "Big House," and round the Research Departments and Transmitting Stations of the world's most wonderful broadcasting organisation. You will meet the artists, announcers, engineers and control men as you explore with us every aspect and stage of broadcasting from manuscript to station aerial.

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Your Station Guide

ALL THE LATEST NEWS ABOUT BROADCAST TRANSMISSIONS ON EVERY WAVEBAND THAT WILL HELP YOU TO MAKE THE MOST OF YOUR LISTENING

Notes on the "Top" Band

Deviations of long-wave stations are few and slight these days. Moscow 1 has recently been a tiny bit higher than usual, having gone up from 1,724 metres to 1,744 metres. This brought him nearer to Lahti, but at the same time gave him a separation of 10 kilocycles from Radio Paris instead of only 8 before, which proved beneficial in the clear reception of the powerful Frenchman.

* * *

Tiflis, another Union of Soviet Socialist Republics station, has also been working a little higher than his official setting.

* * *

Kaunas, the highest-wave European station, should be very easy to identify definitely. True, it is only 5 kilocycles above the 100 kilowatt Dutch station of Kootwijk, but it has easily-picked-out announcements, and also a long interval signal of five or six bars of music.

The call is, "Allô! Allô! Radio Kaunas! Lietuva, Lithuanie!"

STATIONS ON THE LONG WAVES

Station	kc.	Metres	Power
Kaunas (Lithuania)	155	1935	7
Kootwijk (Holland)	160	1875	100
Brasov (Roumania)	160	1875	150
Lahti (Finland)	166	1807	150
Moscow I (U.S.S.R.)	174	1724	500
Radio-Paris (France)	182	1648	80
Istanbul (Turkey)	187·5	1600	5
Deutschlandsender (Germany)	191	1571	60
Droitwich (Gt. Britain)	200	1500	150
Irkoutsk (U.S.S.R.)	200	1500	35
Minsk (U.S.S.R.)	208	1442	35
Reykjavik (Iceland)	208	1442	16
Motala (Sweden)	216	1389	150
Novosibirsk (U.S.S.R.)	217·5	1379	100
Warsaw (Poland)	224	1339	120
Luxembourg	230	1304	150
Ankara (Turkey)	230	1304	7
Kharkov (U.S.S.R.)	232	1293	20
Kalundborg (Denmark)	238	1261	60
Vienna Experimental (Austria)	240	1250	0·5
Leningrad (U.S.S.R.)	245	1224	100
Tashkent (U.S.S.R.)	256·4	1170	25
Oslo (Norway)	260	1153·8	60
Moscow II (U.S.S.R.)	271	1107	100
Tiflis (U.S.S.R.)	280	1071·4	35

LOOKING FOR GOOD SPOTS

Engineers of the Estonian State broadcasting service during the investigation of possible sites for the new 60 kilowatt national transmitter. They are here seen with the car used for the field strength measurements. Note the circular frame aerial on the back of the car.

Items of Interest

It is the aim of our Empire Broadcasting System to provide a two-hour programme in the evening (local time) in all parts of the Empire.

* * *

In Holland, any Minister of the Crown has one or both of the Hilversum stations available for his use at any time for the purpose of broadcasts concerning his department of the Government.

* * *

Austria has established her first television station at Vienna, and it has cost about £2,000. No details of transmissions are at present to hand.

* * *

Australia is dropping call-signs consisting of letters and numbers for the ordinary broadcasting stations. In future the terms National and Regional, following the name of the town, will be used to identify the stations. Some stations will also be put on a common wave.

* * *

Poland has now been transmitting radio programmes for over 10 years. The total aerial power at present is roughly 210 kilowatts.

THE "B.H." OF ROME

This is Rome's Broadcasting House, and is the studio centre of the South Italian stations. The aerial is that of Rome III, the local Rome station which broadcasts an alternative programme with 1 kilowatt.

The centralisation of broadcasting is becoming more and more common in European countries. Here is the imposing "Broadcasting House" of Yugoslavia at Belgrade.

News About the Medium-Wave Stations

Paris P.T.T., which works on 431·7 metres, has a special half-hour programme for children, at 4.30 on Tuesday and Friday, during which singing lessons are transmitted. This is one instance of the increasing attention being paid by the French broadcasting stations to educational broadcasts.

* * *

Leipzig, which has recently been working on temporarily reduced power, should be a very good station with its 120 kilowatts and new aerial of the anti-near-fading type. A new type of 300-kilowatt water-cooled valve has been installed in the last stage of the transmitter. The station still works on 382·2 metres.

* *

Sottens is due for a power increase about the time you get this number of WIRELESS. He is going up from 25 kilowatts to 100 kilowatts, and if you have not already noticed an improvement in his reception you should keep an eye (or rather, an ear) on him, as the increase should make him a valuable station.

No wavelength deviations have been noted recently on any of the more powerful or well-received medium-wave stations. As a matter of fact it would be hard for a station's authorities to find a better wavelength than the official one allotted to them.

* * *

Should you receive a station on 240·2 metres, be careful you do not wrongly ascribe it to the French station, Juan-les-Pins, which works on this wavelength. If the transmission you hear is in German, you can take it as pretty certain it is the temporary Saar transmitter.

The present power is a mere ·7 kilowatt, but this is to be increased to 1·5 early next year. The permanent station, when it is completed, will work with 17 kilowatts.

* * *

The L'Ile de France station, which works on 222·6 metres, and used to be Radio-Vitus, is to employ the Marche des Trompettes by Michel Strogoff to begin and end future transmissions.

* * *

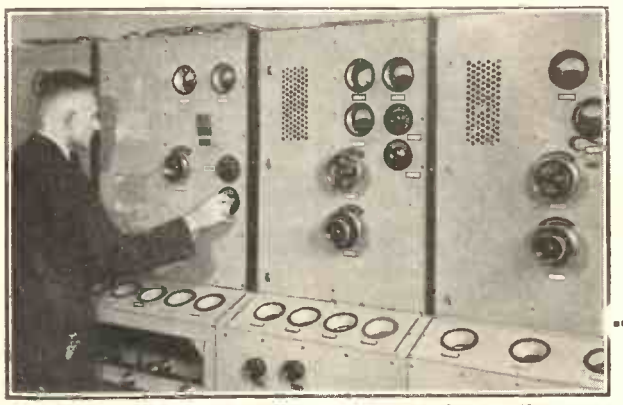
Marseilles, the P.T.T. station on 400·5 metres, has been rebuilt, or, rather, an entirely new station has been erected. If he is not already on the air by the time you read these notes, it is quite certain you will not have to wait very long for him. The power is 120 kilowatts, which will lift him from the realms of just "a possible station" to a good alternative programme.

* * *

Interference on British stations, due to powerful foreigners on adjacent channels is practically non-existent these days, largely because none of them has a really powerful foreigner on the immediately adjacent channels. The only three with powerful foreigners "next door," are Scottish National with Rennes (40 kilowatts), West Regional with Milan (50 kilowatts), and North Regional with Cologne (100 kilowatts).

But in all three of these cases the kilocycle separation is 10 instead of the usual 9. What a confirmation of the theory that 10 kilocycle separation between channels is the only sound basis for a wavelength plan!

A TELEVISION TRANSMITTER



The Witzleben ultra-short-wave vision transmitter

THE BEST MEDIUM-WAVERS

The stations in the list below represent all those with over 5 kilowatts of power.

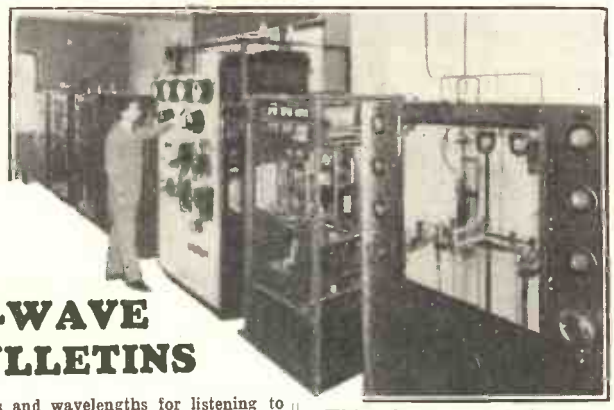
Wavelength	Power	Station
569·3	10	Viipuri (Finland)
559·7	16	Wilno (Poland)
549·5	120	Budapest (Hungary)
539·6	100	Beromünster (Switzerland)
531	60	Athlone (Irish Free State)
522·6	100	Stuttgart (Germany)
514·6	15	Riga (Latvia)
	15	Grenoble (France)
506·8	100	Vienna (Austria)
499·2	25	Rabat (Morocco)
	10	Sundsvall (Sweden)
491·8	20	Florence (Italy)
483·9	15	Brussels I (Belgium)
	20	Cairo (Egypt)
476·9	20	Trondelag (Norway)
	20	Lisbon (Portugal)
470·2	120	Prague I (Czechoslovakia)
463	90	Lyons (France)
	10	Petrozavodsk (U.S.S.R.)
455·9	100	Cologne (Germany)
449·1	50	North Regional (Gt. Britain)
443·1	25	Sottens (Switzerland)
431·7	7	Paris PTT (France)
426·1	55	Stockholm (Sweden)
420·8	50	Rome (Italy)
415·5	36	Kiev (U.S.S.R.)
410·4	5·5	Seville (Spain)
	20	Tallinn (Estonia)
405·4	100	Munich (Germany)
395·8	12	Katowice (Poland)
391·1	50	Scottish Regional (Gt. Britain)
386·6	10	Stalino (U.S.S.R.)
382·2	120	Leipzig (Germany)
377·4	7·5	Barcelona (Spain)
	16	Lwów (Poland)
373·1	50	West Regional (Gt. Britain)
368·6	50	Milan I (Italy)
364·5	12	Bucharest (Roumania)
360·6	100	Moscow IV (U.S.S.R.)
356·7	100	Berlin (Germany)
349·2	10	Simferopol (U.S.S.R.)
	35	Strasbourg (France)
345·6	16	Poznan (Poland)
342·1	50	London Regional (Gt. Britain)
338·6	7	Graz (Austria)
335·2	10	Helsinki (Finland)
331·9	100	Hamburg (Germany)
328·6	10	Dniepropetrovsk (U.S.S.R.)
	60	Toulouse (France)
325·4	32	Brno (Czechoslovakia)
321·9	15	Brussels II (Belgium)
318·8	12	Algiers (North Africa)
	10	Göteborg (Sweden)
315·8	100	Breslau (Germany)
312·8	60	Poste Parisien (France)
309·9	10	Odessa (U.S.S.R.)
304·3	10	Genoa (Italy)
	24	Torun (Poland)
301·5	60	Hilversum (Holland)
298·8	13·5	Bratislava (Czechoslovakia)
296·2	50	Midland Regional (Gt. Britain)
291	100	Heilsberg (Germany)
288·5	10	Leningrad II (U.S.S.R.)
	40	Rennes-Bretagne (France)
285·7	50	Scottish National (Gt. Britain)
283·3	20	Bari (Italy)
278·6	30	Bordeaux-Lafayette (France)
274	10	Madrid (Spain)
	10	Vinnitsa (U.S.S.R.)
271·7	50	Madona (Latvia)
269·5	11·2	Moravská-Ostrava (Czechoslovakia)
	10	Radio-Normandie (France)
267·4	6·2	Nyireghyháza (Hungary)
265·3	10	Hörby (Sweden)
263·2	7	Turin (Italy)
261·1	20	London National (Gt. Britain)
	20	North National (Gt. Britain)
	20	West National (Gt. Britain)
257·1	15	Monte Ceneri (Switzerland)
255·1	10	Copenhagen (Denmark)
253·2	10	Kharkov II (U.S.S.R.)
251	25	Frankfurt (Germany)
247·3	60	Lille (France)
245·5	10	Trieste (Italy)
238·5	10	Kuldiga (Latvia)

A general view of the transmitter at Bari, which works on a wavelength of 283·3 metres.

SHORT-WAVE NEWS BULLETINS

The table below gives the latest times and wavelengths for listening to foreign news bulletins which are transmitted in English.

Station and Country	Times and Wavelengths
Zeesen (Germany)	02·15 on 25·49 and 49·83 metres. 10·30 and 13·00 on 19·74 and 31·45 metres. 14·45 and 17·15 on 19·63 and 31·38 metres. 20·00 and 22.15 on 25·49 and 49·83 metres.
Radio-Colonial (France) ..	01·20 on 25·6 metres 11·00 on 19·68 and 25·23 metres. 13·30 on 19 metres.
Radio-Espana (Spain) ..	00·35 and 23·15 on 30·43 metres.
Moscow (U.S.S.R.)	22·40 (except Tuesday, Thursday and Saturday) on 25 metres. Also 12·00 and 16·00 on Sundays on 25 metres and 12·00 on Wednesdays also on 25 metres.
Rome (Italy)	Midnight on Monday, Wednesday and Friday, a news bulletin is usually to be heard on 31·13 metres.
Radio Nations (Switzerland)	23·30 on Saturdays on 31·27 metres.
W2 X A F (U.S.A.)	23·30 on 31·48. There are other American news transmissions, of course, but this seems to be the best from the point of view of people in this country.



This photograph hails from Australia and shows the transmitter at Sydney, whose call sign is V K 2 M E.

The Various Bands

The greater part of the short-wave band from, say, 12 to 90 metres, is devoted to commercial stations, the majority of which work on telegraphy with C.W. It is not therefore to be wondered at that the newcomer to short-wave work should be rather bewildered by so much Morse and wonder just where all the stations he has heard about have gone.

Actually, the only bands in which he is likely to be interested are the broadcast and amateur wavebands.

If the approximate wavelengths of these are known, once the set is calibrated no time need be wasted in unfruitful listening on wrong parts of the dial.

There are five broadcast bands which are around the following wavelengths: 16 metres, 19 metres, 25 metres, 31 metres and 49 metres. In the case of amateur transmissions, there are three principal bands, namely 20, 40, and 80 metres.

BERLIN'S TOWER

Many people of aesthetic taste would claim that the modern radio tower is anything but beautiful. But in this case it is offset by the beauty and attractiveness of its grounds.

AT THE MAIN CONTROL DESK

This photograph is typical of German efficiency, and was taken in the Berlin control room. The main control desk is seen in the foreground, while a special indicator, which shows which studios are in use, is visible in the background.

On The High Frequencies

Some of the programmes sent out on the Empire short-wave transmissions are specially produced for this service, and you may sometimes hear some good titbits by tuning in to the Empire station wavelengths.

* * *

Listeners interested in news bulletins issued by foreign countries in English should make a note that Zeesen sends out such transmissions at six or seven different times daily. The various transmissions are, of course, on different wavelengths.

* * *

For those who may wish to know the proper address of the V K 2 M E station at Sydney, it is as follows: Amalgamated Wireless Ltd., Wireless House, 47, York Street, Sydney, Australia.

* * *

A short-wave broadcasting station has recently been opened in Iceland at Reykjavik. And an experimental programme from this transmitter has already been successfully relayed by the National Broadcasting Company of America.

* * *

There is a new station in Guayaquil, Ecuador, for you to look out for. The power is only 15 watts, but an increase may take place, and he has been heard well in North America. His wavelength is 35·7 metres, and call H C 2 A T.

OVER THE COUNTER

A monthly résumé of the Radio Industry's most important activities, and reviews of the latest catalogues.

By G. T. Kelsey.

MY wanderings round the Trade bring me into touch with a lot of important matters which it is in the listener's interest to know. I get to hear of forthcoming price changes, of impending developments and of facts in general concerning Industrial Activities which ordinarily do not filter to the customer's side of the counter.

Much of this information I am not always able to pass on, for a confidence once lost is never again respected. But facts in my possession more often than not enable me to sum up the general situation, and there is no breach of confidence in generalities although they are sometimes of inestimable value to the listener—the potential customer.

Without seeking, therefore, to reveal anything of an essentially confidential nature, it will be my intention in these monthly jottings to give as much helpful advice as I can, both to the constructor and to the ordinary listener, and as part of this service to readers I propose not only to review outstanding radio literature, but to enable you to obtain it in the simplest manner possible.

I shall from time to time review instructional catalogues, which can be obtained free of charge, and at the conclusion of each review I shall include a key number. Readers requiring any or all of the catalogues thus mentioned will be able to obtain them merely by sending me a postcard giving the number or numbers of those in which they are interested.

This service is, of course, quite free, but applicants are asked particularly to note that we cannot send off literature unless we have an address to which to send it! Believe me, this almost facetious remark is well meant, but as experience has taught me, it is usually the most obvious thing that gets overlooked.

All applications for catalogues under this heading should be addressed to me at John Carpenter House, John Carpenter Street, London, E.C.4, and the catalogues will be available for one month from the date of issue of this magazine.

Next month I shall be starting off with my trade topics, but as so much of my space this month has of necessity had to be devoted to an explanation of the purpose of this feature, I feel that I cannot do better than to conclude with some catalogue reviews.

A Marconi Highlight.

Valves interest everybody. Whether you are a constructor or a listener with a commercially-built set, there is bound to come a time sooner or later when you will have to replace your valves.

The 48-page booklet in which the complete Marconi range of valves is described is therefore of interest to all. But it is something far more ambitious than an ordinary catalogue, for it contains a mine of really useful information. In addition to many useful circuits showing how the latest valves are employed, it gives a table from which it is possible to tell at a glance the correct Marconi valves for practically every make and type of commercial receiver. There is, too, a useful section devoted to valve-base diagrams. Altogether, it is a booklet that is well worth having. **(W.1.)**

Ohm's Law Made Simple.

The Dubilier booklet of condensers and resistances is perhaps of most interest to constructors because of the detailed and very helpful information that it gives concerning the products of this famous firm. It is, however, of interest to all who are troubled with "man-made-static" interference troubles because it contains a chapter devoted to this topic.

But what particularly gladdens my heart about this well-produced Dubilier effort is the inclusion of a resistance abac—a skilfully prepared chart which solves all your Ohm's law problems in about two seconds. If anybody removes the Dubilier catalogue from my desk, there is likely to be a minor revolution about it! **(W.2.)**

For the Battery User.

I am certain I do not need to dwell upon the fallacy of buying cheap batteries of doubtful manufacture. It is false economy with a vengeance when all the leading makes can now be obtained so very reasonably.

It pays over and over again to buy a battery of reputable make such as, for instance, the celebrated Drydex range manufactured by Exide. And it pays, moreover, to know exactly the type of battery you want when you go into the shop and not to have to be vague about your requirements.

This you can do by having handy a copy of the latest Drydex battery brochure which gives details and type numbers of batteries for every possible requirement. **(W.3.)**

QUALITY RADIO

A FINE RANGE OF INEXPENSIVE BATTERY AND ALL-MAINS RECEIVERS

The Peto-Scott Screened-grid Battery Three retails at the extremely moderate figure of £6 12s. 6d. complete and ready for use.

In the minds of many enthusiastic listeners, the name will be familiar in connection with high quality components and kits of parts in addition to complete radio receivers. Actually, of course, Peto-Scott has been —and still is—the foremost firm in the country specialising in the supply of parts for home-constructor designs. Whenever a component for a published design is required, one can depend upon Peto-Scott's to supply it.

But our purpose is not to enlarge upon this side of the firm's business, but rather to describe something of Peto-Scott's activities in the manufacture of complete receivers.

For 1936 Peto-Scott are listing a very fine range of real value-for-money battery and all-mains designs, and we may say that each receiver is covered by a generous guarantee and is available on deferred terms.

Remarkable Value

The least expensive set in the range is the "Straight Battery Three," a simple set incorporating a moving-coil loudspeaker, which sells, complete with valves and batteries, for £4 19s. 6d. This is, indeed, remarkable value.

At slightly higher prices are two other battery models, a Screened-Grid Battery Three and a Band-Pass Battery Class "B" Four. The Screened-Grid Three is equipped with a pentode output stage, and is supplied, ready for switching on, in a most attractive two-tone walnut veneer cabinet, with sycamore inlay, for £6 12s. 6d. The Class B Four is, of course, a more powerful set, and includes a variable-mu H.F. pentode, the Class B output giving 1¼ watts of undistorted power at 120 volts.

This receiver is a table model, and there is no need to mention that, like the other receivers, it incorporates a moving-coil speaker. The price is 8 guineas.

The mains user is particularly well catered for. There is, for example, the Band-Pass Screened-Grid Four, as well as the de luxe A.C. radiogram, in the range. Either of these sets can be relied upon to give absolute satisfaction under all normal circumstances.

A Radiogram Model

The Band-Pass S.G. Four is a table model selling at £7 12s. 6d., while the radiogram, which is priced at 12 guineas—and is excellent value—is equipped with a 12-inch electric turntable and constant speed motor, together with a sensitive pick-up. Those who like beautiful cabinet work cannot fail to appreciate the exquisite finish given by the inlaid walnut veneer panels of the cabinet. The radio side of the set is similar to that of the Band-Pass S.G. Four, and includes a variable-mu H.F. pentode and pentode output.

Those who are looking for a moderately priced all-mains receiver which will give first-class quality and a wide selection of programmes are well catered for in these two designs.

And we must not overlook the very latest addition to the range. This is the Super A.C. Band-Pass Four. It is a splendid example of modern design and you will find an illustration of it on the last page of this issue.

Here are a few brief details of the specification. First of all the circuit comprises a variable-mu H.F. Pentode, detector with reaction, and Pentode Output. Valve rectification is employed.

Calibrated in Wavelengths

The tuning scale is wavelength calibrated, and it goes without saying the radiogram switching is incorporated.

The set is equipped with a Celestion moving-coil speaker, and combined volume control and "on-off" switch. The undistorted output is three watts. The cabinet is a beautiful piece of craftsmanship being finished in walnut veneer.

Bearing in mind that the price of this receiver is only £8 12s. 6d. it is indeed remarkable value for money.

WE who listen day in and day out to the wide variety of B.B.C. and Continental programmes, which are served up for our delectation, are apt to take things very much for granted. A slight turn of a knob instantly gives us another programme, and whenever we choose to switch on —no matter what time of the day— there is always entertainment of some kind "on tap."

"Those Pioneers"

Radio has become so much of our everyday life that we rarely spare a thought for those pioneers who made this remarkable state of affairs possible, and yet this present-day perfection—the somewhat monotonous reliability and astounding simplicity in handling which is the hall-mark of 1936 radio—is due entirely to the spade-work of these pioneers.

Among the pioneer companies associated with the commencement of broadcasting is that of Peto-Scott, Ltd. Born with the industry a year after the war, this company was among the first to be granted a Marconi licence.

SHORT-WAVE DEVELOPMENTS

—*continued from page 239*

efficiency was wanted most of all.

Nowadays we have some very "low-loss" switches, and we also have manufacturers who see the wisdom of using a separate short-wave converter which comes into operation when the ordinary wave-change switch is moved, rather than several sets of coils that have to be tuned by a common condenser.

A Motor-Car Analogy

There are still many people, however, who simply have no conception of the kind of performance that a really efficient, small short-wave set will put up. They hear stations on their nine-valve superhet-cum-short-wave converter that thrill them to the marrow, but they quite fail to realise that many keen owners of one- or two-valve short-wavers receive these same stations nightly and think nothing of it.

When it is possible to design a really big set with the same inherent simplicity and efficiency that one can get into one of these "simple toys" (vide a well-known designer), then one will have contributed towards the biggest short-wave development of all.

Take the familiar motor-car analogy. The Americans are quite consistent—their cars are provided with large engines, and give the same performance that our small, high-efficiency motors do, but with infinitely more comfort (and expense). Their short-wave receivers use eleven or twelve valves, and are certainly easier and more comfortable to handle than our little hotted-up twos and threes, but they don't really deliver any more goods in the long run, except from the point of view of audio output.

Single-Valve Converters

When someone turns out an eleven-valver, every section of which is as "hot" as a single-valver needs to be to get anything at all, then we shall have a set that simply can't be confined within four walls!

Fig. 6 shows the schematic layout of one of these big outfits. You will see that precisely the same job could be done by a four-valve short-wave converter and a biggish broadcast receiver; but no one seems to smile at the idea of a four-valve converter, which is rather like a man-size job all on its own.

Our converters usually take the form of a single heptode, or, in some terrible cases, an autodyne frequency-changer. Adequate pre-selection, preferably with two ganged H.F. stages, is necessary if a really high level of efficiency is maintained throughout the set, otherwise fifty per cent of the output will be second-channels, image signals and parasitics of all kinds.

Smaller superhets, consisting of a heptode frequency-changer, one I.F., second detector, and one or two L.F. stages, are deservedly popular on account of their stability and ease of handling, but it is rather questionable whether their level of performance is any better than that of sets of the S.G.-V.-2 type.

Nineteen-thirty-six will undoubtedly bring us a long list of additions to "Short-Wave Developments." No one can prophesy what may happen, but I have a distinct feeling that we shall gradually be able to wipe out the effects of the "conditions" bogey, until we find short-wave work as reliable and consistent as the medium-wave broadcast.

How this is going to be achieved I don't know, except that I am certain that most of the improvements will be at the transmitting end.

WATCHING OSCILLATIONS

This is the second part of our article on cathode-ray-oscillograph work, the first part of which appeared last month. Further time-base circuits are dealt with, including one which gives a "static" scan in the form of an ellipse.

By ARTHUR TOWNSEND

THE gas discharge triode, or G.D.T., is an alternative to the neon tube, and a time base employing it has the advantage of being able to "lock off" and also to provide a greater voltage sweep in the time direction which is, of course, necessary when working with relatively high gun voltages.

Locking off should not be confused with locking, as it is entirely different.

A SIMPLE GAS-DISCHARGE CIRCUIT

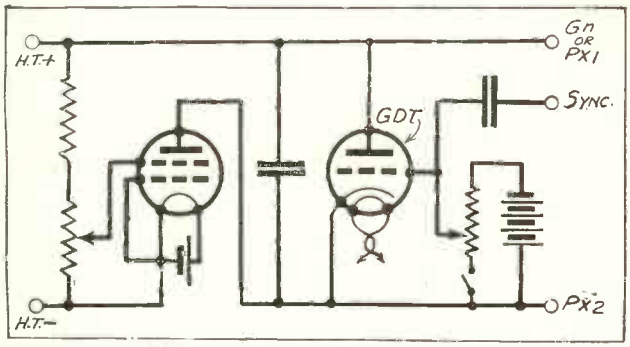


Fig. 6. Gas-discharge triode time base. The screen-grid valve is acting as the constant current device.

When a time base is locked off, the beam is unable to move in the time dimension, as the G.D.T. has a fraction of a volt too much bias, preventing it from discharging; this fraction of a volt is neutralised by the "work" so that the time sweep takes place immediately a potential starts to develop from the source under observation.

Transients Observable

In this manner a transient may be observed or photographed in its entirety provided the time-base sweep does not take place in less time than that taken to complete the wave form of the transient.

It is convenient to use a G.D.T. with an indirectly-heated cathode, so that it may be run from the mains as the filament current required by a directly heated type is somewhat heavy. In the G.D.T. time base used by the writer the screened-grid valve is used as the constant current device with the filament driven by the same accumulator that supplies the C.R.O. tube. The screened-grid valve used is a Cossor 220S.G., which will work happily without any grid-bias, and the grid is, therefore, returned to L.T.−.

The G.D.T. time base is shown at Fig. 6, from which it will be observed that battery bias is employed. This is preferable in many ways, and is the only practical means of locking off, as bias cannot be obtained by automatic means when no current is flowing. The circuit is self explanatory and calls for no comment, except to draw attention to the fact that synchronisation is obtained by adding a fraction of the "work" voltage to the grid of the G.D.T.

Puckle Time Base

Fig. 7 is a skeleton circuit of the time base manufactured by Messrs. A. C. Cossor, and serves to show the principle employed, which is unique, as no gas discharge valve is used, its

THE PRINCIPLE OF THE COSSOR SCHEME

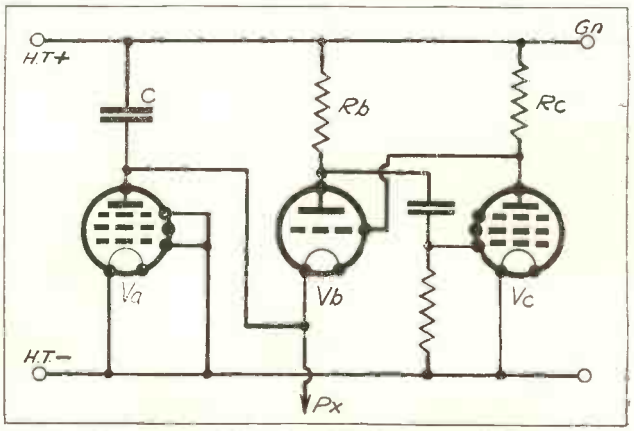


Fig. 7. A skeleton circuit which illustrates the principle of the Cossor time base.

WATCHING OSCILLATIONS

(Continued from previous page.)

place being taken by two high vacuum valves.

Among other features, the time base is characterised by the stable working associated with hard valves, and also by the wide frequency range. This time base is due to Mr. O. S. Puckle, of the organisation responsible for its manufacture.

The manner in which this time base works is very interesting, and was

ELLIPTICAL SCANNING

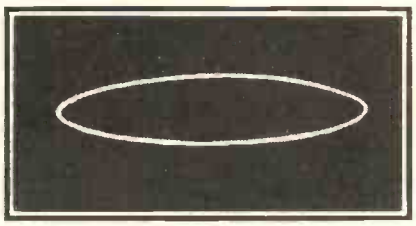


Fig. 8. An elliptical time base as seen on the screen of a cathode-ray tube.

described in WIRELESS for September, 1935, on pages 165 and 166.

There is one other form of time base, known as the elliptical time base, which is a valuable addition to C.R.O. technique, and, furthermore, is both cheap and simple to arrange.

Shape Adjustable

The appearance of an elliptical time base as seen on the C.R.O. screen is shown by the actual photograph Fig. 8. It will be observed that the ellipse is somewhat narrow, but this is adjustable from a straight line to a complete circle to suit the particular work under observation.

The use of a circular ellipse is for making such comparisons as those between two frequencies, where each is connected to one pair of cathode-ray tube deflector plates.

WITH "WORK" APPLIED

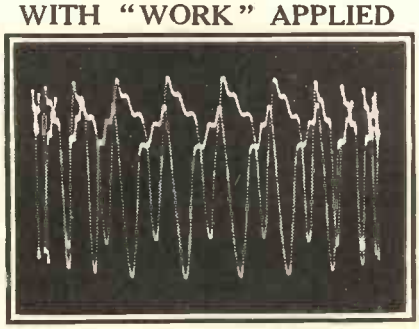


Fig. 9. Frequencies of 1050 and 50 cycles on the elliptical time base shown in Fig. 8.

Unless something were done to prevent it, the oscillograph would appear as an elaborate criss-cross pattern which would be almost, if not quite, unintelligible; but by the use of an elliptical time base the backward and forward oscillogram is separated as in the manner clearly indicated in the photograph Fig. 9, which shows a comparison between 50 cycles and 1,050 cycles. It can easily be imagined how muddled the oscillogram would be if its horizontal axis were a straight line, instead of an ellipse.

Fig. 10 shows the simple connections for an elliptical time base. Assuming that the time base is to be derived from 50 cycle mains, a suitably stepped-down voltage is imposed upon Px_2, and an out-of-phase component, the amplitude of which is variable, is imposed on Py_1, while the frequency to be observed or compared is connected to Py_2, the spare plate Px_1 being shorted to the gun. There are alternative connections, but these will do.

The ratio of the transformer should be such that the voltage sweep in the 50 cycle direction can be conveniently accommodated on the screen. Since the sensitivity of a C.R.O. tube varies with gun voltage, the actual output from the transformer will be dependent on the former.

If convenient, a tapped secondary may be used. With the standard Cossor C.R.O. tube 150 volts maximum will

(Continued on next page.)

WATCHING OSCILLATIONS

(Continued from previous page.)

be adequate if gun voltages much in excess of 1,000 volts are not used.

Regarding the relative values of R and C in Fig. 10, any desired ellipse may be calculated from the knowledge that the base will be a circle, when

$$R = \frac{1}{wC}$$

when R is the resistance of " R " in ohms,

$w = 2\pi f$ (f = frequency of mains supply).

C is the capacity of " C " *in farads.*

An Example

Take an example. Suppose that the condenser is ·1 microfarads, and to produce a circle R must be 31,400 ohms, approximately. Consequently, bearing in mind that if R equals 0, a straight line will appear, it follows that any shape of " ellipse " between a straight line and a circle may be obtained if R is variable between 0 and 31,400 ohms.

THE CIRCUIT USED

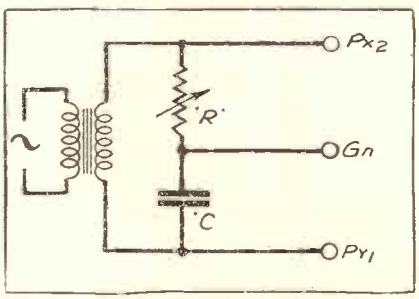


Fig. 10. A circuit for an elliptical time base: P×, is shorted to gun and the "work" is connected to Py, and gun.

For practical purposes, 31,400 ohms would be both unobtainable and uncertain, since an ordinary ·1 condenser may be plus or minus a reasonable percentage. It is not essential, but it is desirable, that the condenser should be non-inductive.

Spacing Important

In the elliptical, as in other time bases, it is essential to keep the various accessories properly spaced and leads properly arranged, as any voltage variation from time base circuits induced into the work circuits will result in amplitude distortion.

WEARITE UNIVERSAL COILS

The ranges of the Wearite Universal and Uni-gen coils are from 200 to 550 metres and from 800 to 2,100 metres. We call readers attention to this fact because the ranges of the Universal coils were incorrectly given in the Wearite Advert. on page 177 of out October number.

WIRELESS AND WARFARE IN ABYSSINIA

—*continued from page* 226.

It is a kind of flat sound, and you hear it repeated faintly from the hills miles away.

"What does that mean?" I asked a native. "Fighting," he said laconically. But I don't believe he really was able to interpret the message. Certain it was I heard nothing of any fighting at that period either then or within the following weeks. It is my view that western literature has given these drums of war a somewhat overrated mysticism. Natives such as use drum-telegraphs are simple fellows (and I speak with five years' solid experience of Africa and not as a holiday-maker or sporadic hunter), and if in cases they have managed to develop the drumming into something of a code, I believe that mostly it is used only as a primitive expression of emotion.

A Natural Impulse

Even more civilised peoples want to bang things and generally make a noise when (1) they are extremely happy or (2) when they are enraged!

Applying this principle, you can easily follow that if all the units of all the tribes of a certain area start banging away at their drums the excitement will quickly spread over the country, and to the African native of the less-advanced nature there can be only one interpretation of intense and widespread excitement. Alarm! War! But I must not give the learned anthropologists and adventure story writers any further cause to descend en masse upon me as a heretic and destroyer of romance. Let us go back to Addis Ababa.

I have had a peep at the radio station there. It was built by the Italians under a communications concession from the Emperor. I nearly purchased a concession myself. That I didn't makes me something of an exception among pretty well all the visitors to Addis Ababa during the period of which I am speaking. The Negus was selling concessions across the counter, as it were, for all sorts of things from mining anywhere and everywhere in the country to merchandise importation.

A Shrewd Move

But I will say this. The Emperor is a shrewd chap, and there was sound common sense behind his methods. Abyssinia wanted money for development purposes, and apparently his idea was to get both cash and the direct advantages of European and American industrialism in the single transactions.

However, when the radio station had been built, a trim three-and-a-half kilowatter, something happened. There are various stories. Some say the Emperor regretted his bargain, others that the Italians tended to overstep the limits of the concession.

Very Little Radio

But whatever it was, the Emperor wanted to obtain control of the station. There were discussions. The Emperor threatened to erect another station next door to it, or sell a concession for some other national to do so. Finally, it was arranged that the station should be handed over to Abyssinia.

And after that you could hear it pretty well every day on 39·37 metres telling the world all about Abyssinia's point of view in queer broken French. And, to make it quite international in appeal, the chief engineer is a Swede, Mr. Hamar!

There isn't much other radio in the Ethiopian Empire, although the larger centres are gradually being connected up. Harar, for example, has a station. The Italians say that this station is now housed in a building disguised as a hospital with big red crosses painted on the roof. They, the Italians, go further and say that from the air you might think there were five hospitals in Harar judging by the red crosses, whereas in fact there are only two buildings which can legitimately be described as hospitals.

Bad Conditions

The conditions for radio in Abyssinia are not good. The Italians may well find that the mountains will cast severe shadows over the ultra-short-wave apparatus which Italy is reputed to possess. Also, on the medium and long waves, atmospherics sometimes cause terrible interference.

It has been stated that Americans are considering sending over portable short-wave outfits for on-the-spot reporters to carry so that they could report for relaying their experiences and impressions of the fighting.

It has been further stated that the B.B.C. might consider doing that, too, and that all such mobile radio stations would be under the protection of both sides. But you can take it from me that anyone who hikes about Abyssinia with a radio machine on his back now that the war-drums have sounded will want *some* protection. I'd rather take a dinner of underdone steak into a den of hungry lions!

GERMANY'S TOWER OF BABEL

—continued from page 244.

natives up jungle-bounded rivers to the nearest post, and months later the broadcasters learn how much their programmes have been appreciated; north-woodsmen in Canada, whose lonely lives are made less secluded, and whose existence seems less confined when in touch with events across the ocean, write that they have come to include these announcers among their closest friends. There are at least two radio enthusiasts below the equator in South America who write that they are saving constantly so as to be able to make the trip to Germany some day, and see for themselves the station that has given them so much pleasure.

Radio in Germany is subsidized by the Government. Through it the State is trying in a small way to solve the unemployment situation in the country. A plan whereby all musicians of merit are given an equal opportunity to receive their share of radio work, and none is favoured over another, is now helping many of the orchestra men who have known more prosperous days before the "Holocaust" to keep their heads up and remain at the work they love best. For the service they receive, German radio owners are taxed two marks a month, and this levy is applied against station operations and artists' salaries.

Modern Studios

Many prominent members of the opera, stage and orchestras volunteer their services as a patriotic gesture to the Government.

The studios of the Rundfunk are extremely modern in design and construction. The largest is equipped to house an orchestra of 100 players, and to accommodate 500 visitors. There are numerous others of smaller and more intimate proportions. Walls are lined with an acoustical material designed to prevent reverberation of sounds, and some are even doubly insured against this with velvet hangings. Nearly all, however, are light and airy.

A Carefree Spirit

In contrast to the very methodical and efficient way the programmes go on and off the air according to schedule is the jovial and carefree mood of the entertainers. The programme is carried on with such an air of camaraderie and light-heartedness that some of this spirit is almost certain to be imparted to the listeners thousands of miles away. Maybe this is why the fan mail runs to such a length.

THE "SPANSPACE"

This photograph shows how the short-wave design described by Mr. G. T. Kelsey on pages 254-257 of this issue appears from the front.

THE B.B.C.'s TELEVISION TRANSMISSIONS

—continued from page 250.

of successive lines, and the 10-lines interval between successive frames are minimum intervals used at the transmitter. During the initial development of the transmitter, certain transmissions may have longer intervals between lines and between frames, which lengthened intervals correspond to the transmission of a black border round the picture.

The 30 per cent carrier is the black "level" below which no vision signals exist, and above which no synchronising signals extend. The mean black level of any transmission will be 30 per cent plus or minus 3 per cent of peak carrier. The black level during any one transmission will not vary by more than 3 per cent of peak carrier from the mean value of that transmission.

The residual carrier during the transmission of a synchronising pulse will be less than 5 per cent of the peak carrier.

The line frequency and the frame frequency will be locked to the 50 cycle supply mains, and therefore will be subject to the frequency variations of the mains.

EXPLANATION OF METHOD OF INTERLACING

The method of interlacing is demonstrated in Fig. 2, which represents the top and bottom portions on the scanned area with the distance between the lines very much enlarged. The lines show the track of the scanning spot, which moves under the influence of a regular downward motion (frame scan) with quick return and a regular left to right motion (line scan) with very quick return (not shown in drawing). The combination of these motions produce the slightly sloping scanning

(*Continued on next page*)

THE B.B.C's TELEVISION TRANSMISSIONS

(*Continued from previous page.*)

lines. Starting at A, not necessarily at the beginning of a line, the spot completes the line A B, returns to the left and traverses line C D, then E F and so on down the " dotted " lines on the drawing. At the bottom of the frame the spot travels along line G H, and then starts at J and travels to K. At this point the return stroke of the frame motion begins and returns the spot to L at the top of the frame. A complete frame scan has now been made since leaving A, so that 202·5 lines have been completed, and the point L is half a line away from A. The downward frame motion now starts again, causing the spot to travel along L M, completing a single line motion J K L M. The spot then returns to the left and traces out line N O, which due to L being half a line ahead of A, will lie between lines A B and C D. Similarly the next line P Q will lie half way between C D and E F. The spot now traces down the chain dotted lines to R S, and finally traces out T U, at which latter point the frame return causes the spot to rise again to the top. When the spot reaches the top it will have completed two frames, since leaving A, and as two frames occupy the time of exactly 405 complete lines, the spot will return exactly to A, after which the cycle begins again.

From the foregoing it will be seen that the complete picture is scanned in two frames, but as each frame contains an integer number of lines, plus a half, the two frames will interlace. The system does not require the short return times shown for the line and frame scans, nor need the lines begin in the positions shown. Provided the line and frame traversals are regularly recurrent and have the correct frequency ratio (two frames = odd number of lines), an interlaced picture will be obtained.

Frames and Pictures

If you have grasped the details of the Baird system you should have little difficulty in following the foregoing description of the Marconi-E.M.I. method. Note that only 25 *complete pictures* per second are shown; there being 50 half-scanned *frames* of 205½ lines each, making a total of 25 full frames of 405 lines each. Again, as in the Baird system, the full number of lines—405—are not seen on the screen. Certain time is taken up by the synchronising for the frame section of the time-base, and this time has to be deducted from the number of lines. The result is that there are actually 385 " active " lines per complete picture, or 192·5 active lines per frame.

Why Baird and E.M.I. have decided on 4 : 3 and 5 : 4 ratios for the pictures I do not know. They might just as well both be 5 : 4 or 4 : 3. It only adds to the complication of the designer of apparatus for receiving both systems. A slight complication, perhaps, but so unnecessary.

The interlacing is not a difficult matter. With a good time base it will take care of itself and the time base will not require alteration when changing over from Baird to E.M.I., except that the speeds of the picture and the line scanning will have to be increased. When changing from E.M.I. to Baird the speeds will have to be decreased. As long as the synchronising is properly applied a circuit can be devised to operate on both systems without radical alteration.

QUESTIONS AND ANSWERS

—*continued from page 273.*

anode of the detector valve. You cannot use the maximum voltage tap on the mains unit, because motor-boating will probably occur.

In a four-valve set especially, when you often couple the detector valve to the so-called 1st L.F. valve by means of a resistance of, say, 100,000 ohms, you require as much H.T. as possible on the detector valve anode, owing to the big voltage drop across the coupling resistance, and the decoupling resistance. The two often account for 150,000 ohms. There is also often—in fact usually—no provision on the unit for the anode voltage of the 1st L.F. valve. The set designer must either connect it to the detector tap or the maximum voltage—either system causing interaction. The 1st L.F. should have as much H.T. voltage as possible, so we usually wash out the idea of using the detector tap and "make do" with the "Max.", generously decoupling the 1st L.F. anode circuit.

I imagine that mains units were originally designed for the det. and 2 L.F. age, and then for the "S.G. det. output" three-valve era to which I contributed with the S.T.300 and which I have since consistently tried to terminate.

The enormous convenience of the mains unit and the usually excellent supply of H.T. current for the output valve do not leave behind sufficient merits to kill the H.T. battery which, if of adequate size and maintained voltage, is on technical grounds to be preferred. The ability to adjust the tappings on the H.T. battery often explains why better results are sometimes obtained when a battery is used.

The S.G. Condenser

You can very frequently dispense with decoupling when an H.T. battery is used—as long as you don't—as most people do, alas!—run down 120 volts to 60 volts before consigning the battery to the dustbin. Some designers take a risk on decoupling, to keep the price of the set down, and you may be using such a receiver.

If the set has no condenser across screen-grid and earth, you will on some mains units get a large drop in signal strength. If the loss of efficiency is due to the inability to get the right voltage from the mains unit, you must put up with the trouble, unless you experiment with the resistance of the decoupling resistors.

MAKING A SPEAKER CABINET

By F. W. HANSELL.

WITH the advent of kit sets, and ready-made cabinets, etc., the present-day wireless enthusiast has very little construction work to do for himself.

No doubt there are a great many wireless fans who, like myself, derive great pleasure in making as many components and as much of their set as possible.

It was with these thoughts in mind that I decided to experiment on a loudspeaker cabinet, and try to get

THE FINISHED JOB

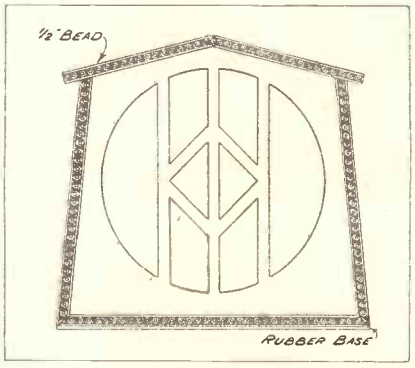


Fig. 1. How the speaker cabinet appears. Note the neat beading.

something that would give good results both as regards tone and volume. Also it would require to be easily constructed, and yet have a pleasing appearance.

The Parts Used

The following details of the cabinet, together with the diagrams, will be of assistance to anyone who wishes to construct a speaker of similar design, and who may have a little knowledge of woodwork and possess a limited number of tools.

The following is the list of the parts which I used for the construction of the speaker:

1 permanent magnet moving-coil unit. (Blue Spot used in original.)
4 ft. 6 in. × 7 in. × ½ in. Cypress.
4 ft. 4 in. of ¼ in. × 1 in. white wood.
3 pieces of 3-ply 14 in. × 13 in.
4 ft. 6 in. ½ in. bead.
1 old motor tyre inner tube.
1 piece fabric speaker cloth.
Stain, etc.

The fret is first cut out, the design being left to the constructor's own choice, but I think it is advisable to have a fairly open design, as it does not give such a heavy appearance to the speaker.

MAKING A SPEAKER CABINET

—ontinued from previous page.

Having cut the front out with the fretsaw, nail this to the base (the size of the latter is 14 in. × 6⅞ in.). The ends of the edges of the base can be bevelled to the corresponding angle of the front before nailing.

The ⅛-in. thickness of the fret makes the width of the base and fret 7 in. (see Fig. 2). The sides are then cut to 11 in. in height. It is to be noticed that the width of the sides is 7 in., that is ⅛-in. more than the base; this is to make the front fit flush with the sides of the ends.

There are now two pieces of wood, 10 in. × 1 in. × ¼ in., nailed on the inside of the sides. The front fret is then nailed to these; this makes the whole cabinet firm.

The cabinet is now ready for the top, which is cut to 14 in.; this is quite easily fitted in one piece by cutting three saw cuts at the centre, the centre cut being almost through the board.

The old rubber motor tube is now neatly cut to fit inside the top of the baseboard, and firmly glued. Note this is not necessary if the unit used does not sit on a base, but is screwed direct to the baffleboard.

A SIDE VIEW

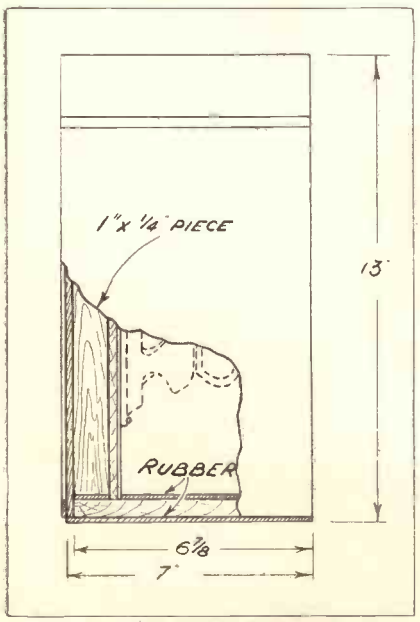


Fig. 2. In this diagram the side is cut away to show the internal arrangement.

The speaker is now ready for fitting the ½-in. bead to cover the join where the front fret fits flush with the sides. The speaker can now be sandpapered and stained and varnished. When dry, the inside of the fret is now glued and the tapestry design is fixed on.

Next fit the baffleboard. This should have a 7 in. hole cut out at the point where the unit is to be fixed. This is then cut to fit inside the cabinet, and nailed to the inside of the 1 in. × ¼ in. (see diagrams).

Next procure some good quality cardboard. The cardboard is then cut to sizes to fit the sides, top, and back

IN PLAN FORM

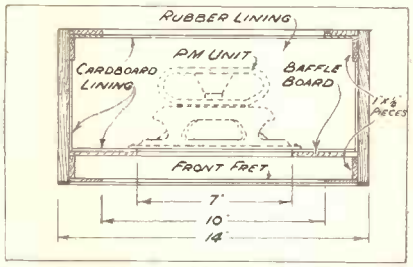


Fig. 3. This sketch clearly shows the general method of assembly.

of baffle. This should be very securely glued down. The unit is then fixed into place, and the back board cut to size.

It is advisable to have as large a hole as possible in the back, and a piece of fabric glued across the hole to exclude dust from the P.M. unit.

The bottom of the speaker is then glued, and a piece of the rubber tubing firmly fixed. This makes a shock-proof base, also eliminates any chance of scratching furniture, etc.

TELEVISION TO-DAY

—continued from page 272.

be in an endeavour to improve known devices so as to obtain greater brilliancy. You see that there is plenty of scope for the experimenter.

It is rumoured that when the B.B.C. television service is inaugurated, those responsible for the programmes will keep in view the fact that many listeners will tune-in to the sound transmissions on the ultra-short wavelengths without—at any rate, at first—receiving the pictures. For this reason they will endeavour to make the "sound" part of the programme interesting in itself, that is to say, it will not be so tied to the visual part that it beomes unintelligible or even uninteresting without it.

The sound broadcast will, as it were, from the backbone of the transmission, whilst the visual part will form an illustrated version of the same. Consequently, if you have an ultra-short-wave sound receiver you will be able to derive considerable entertainment from the sound side.

THE SPIRIT SIGNAL

—*continued from page 276.*

opened the package with fingers which trembled violently.

"Food! Food!" He snatched up a tin of biscuits, burst it open and crammed food into his mouth. He ate ravenously.

Suddenly he paused, his eye attracted by a sheet of thick parchment amongst the many small packages. The parchment bore writing, and, snatching it up, Hale read it through eagerly. It was in French, and translated, read:

"To Manning, Hotel Pic Chaussey, tout en haut. Received your short-wave S O S. at 11 hours, and communicated it direct to air-port, Lausanne. Air port sending supplies. Rescue will be organised as soon as conditions permit. Will listen-in on your wave-length for further details. Please transmit again immediately on receipt of this. Paul Delacroix, Poste de T.S.F.(amateur),Lausanne."

Hale stared at the note incredulously.

"Short-waves—— Please transmit *again?*"

He sprang to his feet. Rushing to the door, he made for the room he had left in such haste a short time ago. Entering, he saw that his friend lay exactly as he had left him. Hale's horrified eyes searched the table in front of the dead man's head. He saw that Manning's fingers still rested on the transmitting key of a small portable wireless transmitter. His eyes left the fingers of the dead man and travelled over the contents of the table. Hale was a wireless enthusiast, and he at once saw that the table held every component necessary for the transmission of radio messages—save one. One vital thing was lacking.

The transmitter was equipped with panels, coils, dials, transmitting valves—everything, in fact, which would enable it to send out distress signals which could be picked up by an amateur in Lausanne.

The one thing it lacked was—*batteries to drive it!*

The breath hissed out from between Hale's teeth in a sharp, tearing gasp. He gaped down at the contents of the table, then at the stiff fingers which still rested on the transmitting key.

He bent suddenly forward and peered into his dead friend's face.

Christopher Manning's features had relaxed. The drawn, haggard air had left him; he smiled gently, a smile pregnant with understanding and peace.

And at that moment it came to John Hale that his friend had now solved greater mysteries than the transmission of radio messages without electrical energy.

A VALUABLE BOOK

The Chronicle Wireless Annual is one of the most popular of yearly radio publications, and deservedly so, too. You can get the latest copy for one shilling from booksellers—and it is good value for money.

There are six long articles on short-wave subjects and these include four constructional items, one of which is an ultra-short-wave set. Other articles deal with television and explain cathode ray-tube work and high-definition principles.

Among the constructional matter are ordinary broadcast designs and a special insert carries easy-to-follow wiring diagrams of items described.

Many features of a general nature are included which make the book extremely valuable to every radio enthusiast and listener. Typical titles of the general articles include: "The O.B. Engineer At Work," "When the Set Goes Wrong," "Regional Talent 'Spotters,'" and "Aerial Mast Erection."

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