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Address
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REPORTS WELCOME
2,500 KILOWATTS!
MORE LICENCES
MALTAS RADIO

While keeping an approving eye upon the major developments of world broadcasting, do not let us forget that some of the little countries are making a very pretty showing. Estonia, for example, has doubled its listeners in twelve months, and is now warmed up for further efforts.

It is being decided to supplement the present Tallinn station by a big fellow of about 50 kilowatts or so, and it is expected that a site will be selected between Tallinn and Tartu. By the end of next year it is hoped that a new Broadcasting House will be adorning the Baltic water-front, and providing you and me with a cut about 50 kilowatts or so, and it is expected that a site will be selected between Tallinn and Tartu. By the end of next year it is hoped that a new Broadcasting House will be adorning the Baltic water-front, and providing you and me with a cut of some of Estonia's radio joint.

In Paris.

AFTER the new Paris PTT station has thoroughly settled down to its full 120 kilowatts, the old station in the Rue de Grenelle is not to be scrapped, but is to be kept on as a stand-by.

The new station at Villemombe-Yvette is eventually to be joined by Radio-Colonial, the French Empire station, which has long been wanting to change its quarters.

Incidentally, overseas readers who pick up Radio-Colonial on short waves need never fear they will be wasting their time if they write reception reports to the station director. He loves to know how his programmes are getting round and about. The address is Service de Radiodiffusion, 103, Rue de Grenelle, Paris.

Every listener to foreign programmes must have noticed how, in the past couple of years, the Russian stations have loomed larger and larger on long, medium and short waves. Now comes the news of a super Soviet effort, the largest station in the world, a star of all the Russians.

It is being erected some 25 miles east of Moscow, at Chadinka, and will have transmitters to cover all the wavebands.

The total power will be 2,900 kilowatts, and the director of this super-propagandist will be Dimitrov, the Bulgarian who figured so prominently in the Reichstag fire trial.

Plays are completed, and it is expected that the tests will be heard by next autumn.

Bottled Speeches.

This new idea of giving a speech without the bother of attending the meeting is one that has many advantages.

It is going to be employed at the opening of the new radio service to wool-growers in Sydney, N.S.W., on October 31st.

On behalf of the British Wool Federation, Sir Frederick A. Aykroyd is going to "broadcast" from Sydney, but Sir Frederick has already delivered that speech in London, where it was "bottled" and dispatched to Australia in time to arrive on opening day. You cannot believe how his programmes are getting round and about.

The late lamented summer of 1935 was a keen disappointment to some of the B.B.C.'s detractors, who hoped and avowed it would show a decline in broadcasting's popularity. Instead of that, the licence figures obstinately increased, and Britain is now well on the way from the seventh to the eighth million. At ten bob each licence, this represents an assured income from broadcasting alone which is greater than some States can get from their tightest squeeze of taxpayers!

Even in the month of August, when the seaside landlady swoops upon the unready pocket, there was a steady increase of about 1,000 licences per day, and the month closed with a paid-up total of 7,175,116 licences in force.

Maltese News.

It's an ill wind that does not make somebody smile, say the men of Malta.

For a long, long time their broadcast entertainment was a European medley of other people's programmes. But then the Italians, from just across the water, began sending out Maltese items in English, which naturally commanded an attentive audience.

To counter this the Government is now kindly arranging for the wireless station at Rinella to pick up the B.B.C's Empire broadcasts, which will be relayed locally, loudspeakers being installed for the purpose in cinemas and places where they sing and dance. A great change this from the days when nobody cared a couple of hoots about the Maltese listeners!

Hall and Farewell.

You remember the Irishman who, speaking at the old school's speech day, said: "I now see before me many absent faces with whom I used to shake hands"? That will be the frame of mind of many a listener this year, for though we get our new stations coming along, we also get some notable casualties.

Huizen has gone for ever. No more will his double-Dutch announcements be found at the top of the long wavelengths—where he was supposed to be—nor on Hilversum's wavelength, where he habitually spent half his time.

And now, owing to a Paris rehash, Radio L.L. has gone from 210-7 metres. Though not powerful, L.L. was a likeable chap, and British listeners respected him for...
pronouncing his L's exactly like we do, so that he was readily identified. He has resigned in favour of Radio, who is to perform on 290-9 metres. Tiraspol, the Russian, is allotted to the same wave-length, in order to give those two dancing partners get on well together.

An Idea, But... M UCH as I hate this talk of radio uses in war-time, there is no blinking the fact that there are many indications of wireless being regarded as of great strategic importance. My regretful note on the fact that Germany had censored television has been followed by some frank Press comments on the possibilities of this form of scientific warfare.

One writer visualises television-equipped planes scanning the attack from above, and relaying back to General Headquarters a moving picture of the enemy's resistance. The only bright aspect of this gloomy situation is that, if it were tried with existing aerials, the loudspeaker would prove a useful thing. Half an hour he told them of the advantages of radio to the audience from his own home, Mr. Pollard, did not attend the meeting of the Shields Amateur Radio Club. The occasion was that, if it were tried with existing aerials of 5-metre work, the loudspeaker would prove a useful thing. Half an hour he told them of the advantages of radio to the audience from his own home.

Radio TOPICALITIES Following the success of the Stanelli String Parties and others, the thanks of the ladies have been demanded that they shall be given an opportunity to display their talents at the microphone. A distinguished example of this is to be assembled on October 17th in the National programme.

The party will follow the lines of its successful predecessors, all the entertaining and amusing being done by the ladies themselves. Here is an opportunity for those lady listeners, who follow the fun of radio entertainment in their homes, to appreciate to the full the persuasive of the alleged stronger sex. It is a simple appearance where the plans are finally removed.

The Radio Follies return to the Midland programme on October 11th, following a successful engagement during August at Bath. Michael North and Richard Spencer will present this concert party.

British radio telephone service. Searching sorrowfully he scarce can find another country to stick a flag into. Not long ago his eye brightened at the sight of Oceyl, but he did not telephone to Oceyl. "Oh, can't you?" said the engineer, and they ended up Poona by beam wireless and arranged for some overland lines and a submarine cable to be hooked up from Poona to Colombo. In future, if you want to talk to Oceyl, you will be able to do so at about 32 per minute. And now the flag-sticker, trying to find other spaces, is coming up against Alexander's problem—no more worlds!

Old Timers. T H E S E young fellows who chase around the globe making scientific investigations are no respecters of national pedigrees. When, for instance, Mr. Kirke, the B.B.C. engineer who is selecting a site for a proposed broadcasting station in Newfoundland, was asked what he thought of the island, he shook his head very dubiously.

The strength of radio, he affirmed, depends partly on the geological strata underlying the point of reception, and Newfoundland, being an old formation geologically, could not expect such good reception as if its formation were of later origin. Moreover, the report from St. John's states Mr. Kirke cited Scotland and Cornwall as similar old-timers—much too ancient for really good radio reception. Picts, Scots and Celts are going to have something to say about this!

Bad Language. T H E poor old B.B.C. is in trouble again with the bad language people. Not with the people who use bad language, of course, for they are generally of the take-it-easy type whose bark is so much worse than their bite that they wouldn't hurt a fly. No, it is the Pure English enthusiasts who are causing the bother, for, as you know, they would sooner split your skull than split an infinitive.

It seems that the crime of the B.B.C. was to issue a notice in which occurred the phrase "musicians who wish to be auditioned." That last word has caused much shudders as have not been known since the famous film director said "No," or rather since he should have said "Not," but actually murmured "Nothin' doin'. I tinks we better don't."

Stoke's Radio Show. S T O K E-ON-TRENT'S third annual radio show will be held in the Victoria Hall, Hanley, from October 9th to 12th. Special competitions are being held for visitors and wireless sets are to be given away each day. It is hoped to make the whole week a local "Radio Week," and a radio ball is to be held at the Grand Hotel, Hanley, on the Monday evening.

It has been suggested that a free wireless set should be offered to the visitor bringing the oldest-vintage set to the exhibition. So resurrect your old "P.W. Combination Set," and it may prove, once again, that there's nothing to touch it!

From Cradle to Maa. A BOLD bid for the honour of being the world's youngest broadcast talker has been made by Miss Carol Rowe, daughter of a doctor in Creston, Iowa. Carol is only twenty months old, but she already has a vocabulary of about six hundred words—five times as many as most young ladies of her age.

She can say not only such things as "B.O.W., meow, moo, whoa, gidnap, and hy-de-ho," but long words like "hippopotamuses." Her latest words are "Arkansas" and "Pebbleful."—"That's an insect and nothing to do with "What Katy did at School!"

ARIEL.

LOOKING FOR COUNTRIES TO CONQUER BY RADIO
CONTROVERSY will add spice to many of the talks planned by Mr. Charles Siepmann and his department for the coming "season." Not that any of the talks need be dull. The subjects and their approach, I feel, are now right. But we need to make the talkers study that microphone manner.

Up to now the B.B.C.'s efforts to infuse the controversial note into talks have met with a somewhat mixed reception. Entirely unrehearsed debates have tended to be halting-if not, on occasion, simply awkward. Rehearsed debates, on the other hand, have smacked too obviously of unreality.

Mr. Siepmann hopes to overcome this problem by assembling an audience in, say, the concert studio to hear eminent men of affairs discuss questions of universal interest.

That he pins great hopes in the drawing of the controversial note into talks have met with a somewhat mixed reception. Entirely unrehearsed debates have tended to be halting—if not, on occasion, simply awkward. Rehearsed debates, on the other hand, have smacked too obviously of unreality.

The talks in the mornings, for instance, are for women in the home. Those at 7.30 p.m. are intended to be educational, while I am reserving the big feature talks for much later in the evening—say, 10 o'clock.

Appreciation of Microphone Technique.

"Our aim is always to give talks about subjects people are really interested in. We want, too, to give them at such a level that normal people can understand them. This does not mean talking down to people, but it does mean a proper appreciation of microphone technique. Then, of course, we must be sure that we are giving the talks at times when the audience for which they are primarily designed can really afford to listen.

"Take, for a start, the morning talks. We have increasing evidence that thousands of women in the home appreciate talks not only on how to look after babies and home, but talks on travel and even politics."

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"Take, for a start, the morning talks. We have increasing evidence that thousands of women in the home appreciate talks not only on how to look after babies and home, but talks on travel and even politics."

"In the mornings we also appeal to the unemployed. For this autumn it is true there will be only one weekly period devoted to them, but you will find in the spring that at least three talks are being arranged for every week.

"Based on letters received from an enormous number of listening groups, we have arranged a series of twelve talks for the 7.30 p.m. period of adult education. These are intended to be followed by those who are seriously interested—sufficiently so to carry on right through a full course of twelve lectures.

"But perhaps you are more interested in the talks coming under the heading of Entertainment. We have spent a great deal of thought on this important section of our work, believing a vast audience is ready for them.

"One of the biggest in this series will be "I Knew a Man"—short biographical studies of famous people now dead as told by living people of distinction who actually knew them. This will be one of the highlights of the 10 p.m. talks.

"Another definitely entertaining series will be called "Re-visited"—where well-known broadcasters will revisit their birthplaces and then tell listeners of the many changes—social, industrial, and so on—that they observe after an interval of perhaps many years.

"To help revive the almost lost art of story-telling we have arranged a very interesting talks series for the 6.45 p.m. period on Sundays. We intend to broadcast original stories especially written for the microphone. These will include almost every type—not omitting the detective thriller.

"And now I come to a series very near to my heart. It is called 'Young Ideas,' and I am sure it will fill a long felt want. The scheme is this: We want to give adolescents a weekly period they can call their very own.

"An Experiment.

"We have chosen Fridays at 7.30 p.m. for this experiment. In the programme there will always be some kind of adventure story, something to do with sport, and also a news survey of the week, rather on the lines of the very successful efforts of Commander Stephen King-Hall.

"We want boys and girls to take a special interest in their feature. To write to us about the broadcasts. To take an intelligent interest in modern things and human affairs generally. To tune-in this weekly feature not as an educational duty but as an entertaining pleasure.

"Finally, let me mention some of the 10 o'clock evening talks. We have decided on two such periods, both to include the really big talking points of the week. Our aim will be to bring the 'key' men of the world to the microphone to talk on subjects of the widest possible interest.

(Continued on page 100.)
The self-biasing resistance of an output valve is, strangely enough, an evil. But it is a necessary evil. The disadvantage of the grid-bias resistance lies in the fact that it constitutes a coupling resistance. In resistance-capacity amplification we utilise the voltage set up across the anode resistance as the voltage to be applied to the following valve. Well, just as in the case of the anode resistance, the bias resistance acts as a coupling unit, whereby the anode current variations are transferred to the grid of the following valve, but, as we shall show, reduce amplification.

Figure 1 shows bias resistance in the cathode circuit of an indirectly-heated valve between the points D and G, as shown.

Main Valve Bias

Common to Two Circuits.

GDBAH constitutes the grid circuit and GDCEF the anode circuit. It will be seen that the bias resistance, GD, is common to both circuits. Therefore should the anode current vary the grid bias will automatically vary in unison. Now the anode current is caused to vary by the speech current. Thus any variation in the anode circuit current will set up a potential across the anode resistance. The grid resistance is thus at a negative potential as compared with the cathode.

Assume at the instant under consideration that the incoming signals are making the grid more positive. As the grid is becoming more positive the current through the valve is increasing and so the voltage drop across the bias resistance is also increasing. Thus, owing to increased anode current the grid is made more negative than that caused by normal grid bias. This is opposite to the effect the transformer is producing. The increased current is making the grid negative while the transformer is making it positive. Or, to put it another way, the positive voltage applied by the transformer to the grid is being nullified by the opposing voltage set up in the bias resistance.

Large Voltage Variations.

Upon reversal of the oscillation the grid is being made negative by the transformer, the anode current is falling, and so the normal grid bias is being reduced. The result is that the grid oscillations never attain their maximum swing.

Let us suppose that the steady current in the valve is 48 ma. and the normal grid bias is -33 volts. If the current rises to 80 ma. the variation from normal is 80 - 48 = 32 ma.

This voltage is causing the grid to become positive. The increase of 32 ma. is a voltage drop of 22. This voltage is causing the grid resistance to increase by that amount just as the reactive voltage is altering the grid resistance. The reactance of the grid is now 35 volts. This has moved the working point by 22 volts with a consequent reduction in amplification.

Adding a Condenser

In order to minimize the coupling effect of the bias resistance a condenser is joined across the points A and B, as shown in Fig. 2. This condenser is of very little help in short-circuiting the speech current. But if we use a capacity of 25 microfarads, the voltage becomes 4. A condenser of 50 microfarads would have reduced the maximum voltage to about 2.

We thus see that the condenser has almost short-circuited the voltage caused by the speech current.

The other method of decoupling is to allow the auxiliary voltage across the resistance to exist but to prevent its affecting the grid. This is done by the interposing of a suitable high resistance, R, as shown in Fig. 3. But as this resistance will now be in series with the grid circuit a condenser, C, is connected to by-pass the transformer oscillations. The resistance R in conjunction with C now forms a standard decoupling unit.
I THINK that all my readers are by now pretty well acquainted with the various bees that I harbour within my headgear. Some of them escape occasionally, to be replaced by others, but one that has always remained faithful to the old homestead is the "detector-bee."

The detector ought to be the best part of the whole receiver, whatever type of receiver it is; and it's often the worst. We have talked about detectors from the points of view of selectivity, sensitivity and stability; and it is the latter aspect that I want to carry on with just now.

"Electron Coupling."

Last week I showed, in response to a reader's query, an example of the circuit that has become known as the "electron-coupled oscillator." The virtue of the title is, perhaps, a little doubtful, since we think of electron coupling, in its truer sense, as something applicable to the hepatic acid. But it is the latter aspect that I want to talk about now.

The so-called electron-coupled oscillator does not depend upon electron coupling for the generation of oscillations; but the oscillatory portion of the circuit is coupled electronically to the output circuit, wherever that goes, and is therefore more or less unaffected by varying loads in that direction.

The same circuit makes a very fine oscillator, and has quite a bit to offer. Its operation is not affected by varying loads in that direction. The detector frequency will not "creep," and the screen voltage is half of the anode voltage, which will again necessitate a re-setting of the potentiometer.

The ideal state of affairs will probably be that in which the set just oscillates when the screen voltage is half of the anode voltage, and a variation of about 10 volts will be all that is necessary to give a clean, smooth reaction control.

The detector frequency will not "creep," as some circuits do; also the reaction control will not chase the signal about the dial and necessitate re-adjustment of the grid tuning.

A GOOD LAYOUT

Here is a suggested layout for those who wish to win up the circuit described on this page.

The main feature of the circuit is that a screened-grid valve is used as the detector; the screen, grid and cathode form the three elements of the oscillating portion; and the output is taken from the plate.

Special Coils Unnecessary.

Several years back I suggested, and used, a circuit with a screened-grid valve, the reaction being introduced into the screen circuit instead of the anode circuit; but the screen was "live"—i.e., at H.F. potential.

In this cathode-tap circuit the screen is at zero H.F. potential—it is earthed through a large condenser—and the cathode is "live." This implies a real screening effect between the anode and the other elements in the valve, and it is this alteration that makes such an extremely stable circuit of it.

There is no need to go in for special coils with a tapping on them. Take any ordinary commercial short-wave coil, join the low-potential ends of the reaction and grid coils together, and use that as the tapping-point, and you will be about right.

The sketch (Fig. 1) shows the layout that one would use for Eddystone coils. With any other four-pin coils the procedure is quite straightforward—the two pins that would normally be connected respectively to L.T.—and H.T. are, instead, connected together and taken to the cathode.

Note that the whole coil is tuned, and not just the grid-cathode portion of it. This means that a condenser of a given size will give you a much larger tuning range than you have been used to. That may be an advantage or otherwise. If it is otherwise, rip a few plates out of the condenser.

Indirectly-Heated Valve.

You will note that I have shown an indirectly-heated valve in the circuit diagram (Fig. 2). I am very much in favour of using one, even if you don't run the filament on A.C., since the use of a battery valve makes it necessary to put a choke in the positive leg of the filament. The filament, of course, is "live" in terms of H.F.—a condition it is not used to.

Furthermore, the battery valve has its negative 60V. fed to it up the smaller section of the coil, and the voltage will have to be pushed up somewhat unless the coil is wound with very thick wire.

The grid leak should be of a rather lower value than you are used to. I have suggested 1 megohm in the diagram, but sometimes it is advisable to come down as low as 5 or even 25-individual valves vary, of course.

It is important that the ratio between the anode and screen voltages should be just right, and I have therefore shown a potentiometer to give control of the screen volts. The 1-mfd by-pass condenser from screen to earth should be mounted right beside the valveholder, so as to get the shortest possible path.

The same applies to the .001 condenser from anode to earth, although that is not quite so important, and in some cases may even be omitted.

Definite Advantages.

So much then, for the actual circuit. Now what about its advantages? Well, first of all, the frequency at which it oscillates is practically independent of H.T. and L.T. voltage variations.

Reaction is controlled by a very small movement of the screen-voltage potentiometer, which must first be set so that the valve is just oscillating. The anode voltage may then be altered somewhat,
S. A. K. (Dorking) writes to tell me that he has read all my writings for years (brave man!) but never troubled to make a start on short-waves until just now. Now he has taken the plunge, and is kicking himself for what he's been missing all this time.

His set is one of my many single-valvers, and it seems to bring in plenty of assorted signals. He wants identification, by the way, of a fairly strong station on about 50 metres which plays dance music and announces now and again in English: "Calling Africa."

**Hand-Capacity Effect.**

S. A. K. has some coils wound on Paxolin tubes and finds that he can bring up the strength of certain stations enormously by inserting his finger in the tube! Surely an ordinary hand-capacity effect? Try a little more critical tuning and you'll get the same improvement without resorting to such nefarious methods.

H. F. (Preston) is puzzled about what the amateurs mean by a "tuned-plate tuned-grid" circuit. He draws one and asks if that's it. Yes, H. F., it is. If you tune both the plate and grid circuits no coupling between them is necessary to produce oscillation. It is modulated in the same manner as any other circuit.

H. F. then asks how far away one should speak into a microphone coupled to a 2-stage 3-watt amplifier. Suit yourself—speak as close as you can without producing overloading or " blasting."

Lastly, if there is any kindred spirit, or any short-wave club in Preston, will he, or it, please get in touch with Mr. H. French, The Briars, Cottam Hall Lane, Nigal, Preston.

J. M. (Sherborne) reports reception of X E B T (Mexico) on about 50 metres, Y N I G G (Nicaragua) on about 49, T I E D (Costa Rica), on about 44 metres, and F O C C (Santiago de Cuba), on about 45 metres. There are four unusual stations for someone else to go out for.

G. W. G. (Ipswich) doesn't think much of conditions, but I find that they have improved since he wrote his letter. He is still using valves that have previously been in a broadcast receiver for about eight years, but I won't be sarcastic and couple that with the "bad conditions"! He is rather keen on super-regenerative circuits for ordinary short-wave work, and hopes to see one soon.

**On the Ultra-Shorts.**

D. W. (Penang) is interested in ultra-short-wave receivers, but has never yet seen one. He enquires whether the ordinary types function well on the very short waves. Well, D. W., I haven't yet met a modern valve that didn't, but some types are certainly better than others. Practically all the battery H. L. types are good, and don't require de-basing.

H. F. (Blackpool)—two H. F.'s this week—wants some advice on putting up a good aerial, as he is moving his receiver to a "shack" in the garden. As he wants to listen mostly on the amateur bands he is wondering whether to erect one of the various types of Hertz aerials.

I suggest that his best plan would be to put up what the amateur calls an "end fed" Hertz—i.e., a wire 33 or 66 feet long, including the load-in. This will give high efficiency for reception on the 20 and 40-metre bands, as well as being a convenient length for other short-wave listening.

He also wants to find a fellow-enthusiast. His full description is Mr. H. Fenton, 26, Abbey Road, South Shore, Blackpool.

S O S from E. A. C. (Maindenhead). He has a short-wave set with plug-in coils, and (need I say it?) finds difficulty in producing reaction with the two smallest ones, all the rest being O.K. Layout, E. A. C.—that's what it is. Shorten your wiring to the coil-holders and condensers, and I should think everything is sure to be O.K.

As far as screened-grid detectors are concerned, I like them immensely and have never come up against trouble with them. I think you should try one out for yourself.

R. D. E. (Standon) forwards some more news, including details of reception of quite a lot of South American "hams." He also mentions the new Cuban C M C D, "La Voz del Aire," on about 48-9 metres. For the benefit of readers who are hearing O A X 4 D and O C J (Lima, Peru), R. D. E. tells me that their proper address is "All-America Cables Co., Casilla 2336, Lima, Peru."

**STATION  G 6 M D**

This amateur transmitting station is located at Ruthdens, Scotland. On top of the receiver, to the right, is a "D X. Hold." E.

L. E. L. (Bolsole), having played with single-valvers for a long time, wants a set that will bring in "those little low-power stations that are unintelligible on a single." Not so easy, L. E. L! If your single-valver is good, the only thing that will beat it for distance-getting, in my opinion, is really excellent superbhet. He suggests, however, that it would be interesting to play with H. F., especially as he doesn't mind how many knobs he has to twiddle.

He also asks whether the H. F. pentode is vastly superior to the ordinary S.G. No. L. E. L., I haven't found it so. Try an ordinary tuned S.G. stage, and don't couple the aerial too tightly, so that you flatten out the tuning. Possibly such a stage may even reduce the percentage of interference you get from your pet nuisance. (But I think you'll need a single-signal super, all the same!)

**Have you Heard Prague?**

A station that is attracting a good deal of attention from listeners who occasionally tune above 50 metres is Prague, OK - 1 M P T, on 58 metres. Reports are to hand from South Africa and Australia, both commenting upon the excellent transmission.

H. A. T., Budapest, is now working on 32-8 metres and may be heard every Monday from about 11 p.m. onwards.

The new transmission from Rome on 49-3 metres is, I am told, specially intended for North America and radiated from a special beam aerial. Other transmitters in Rome are "beam'd" on South America and the Far East.

Hong Kong (Z B W) is now being heard irregularly on 34-3 metres during the late afternoons. The station is on the edge, but conditions for the Far East appear to be improving.

Forcoming events in the programme of the A.A.R. & T. S. include a special transmission to them from Y V Z R C, Caracas, Venezuela, on October 15th, and a meeting of the West Middlesex and East Bucks branch on October 30th. "P.W." readers will be welcomed on that date, but they should apply first to Mr. Leslie W. Oron, Kingshorpe, Willowbank, Uxbridge, for further particulars.

Another new broadcasting station working outside the recognised bands is Tela, Honduras (H R M), on 20-71 metres. Several readers have already reported this station, although his hours appear to be irregular.

**5-Metre Work in U.S.A.**

Contrary to expectations, the ultra-short waves are not to be thrown open for commercial use in the U.S.A. for another year at least. They are to be regarded as strictly experimental, and, in any case, is all to the good when one considers what chaos might result from wholesale commercial use of them for short distance communication.

More record-breaking 5-metre transmissions are reported from the U.S.A., but I don't propose to enlarge upon them until full particulars are available. W. L. S.
I do not suppose the heading will convey a great deal to the majority of listeners nowadays, but to those gallant enthusiasts who knew the magic name of "Writtle" and the early days at Marconi House it will bring back memories of those pioneer times when "pioneer" applied both to the listener and to those at the transmitting end.

First of all I had better explain how I came to get mixed up with this broadcasting business at all, back in the dim and distant days of 1922. In those days all the big wireless firms were experimenting with broadcast gear—microphones, transmitters, etc.—and to get data on their experiments they gave occasional broadcast concerts. These were listened to by their own experts, and by the few enthusiastic amateurs who were able to pick them up.

The First Musical Director.

At that time I was working with the Marconi people on the business side. When I came back from the war in 1919, I had returned to the Royal College of Music to finish off the remaining three years of my organ scholarship, but two and a half years in the East had not improved my nerves, and I found I couldn't settle down.

However, when I heard that the Marconi Company were to transmit experimental concerts, I thought I had better find out what was going on. I went up one afternoon to the small demonstration cinema at the top of Marconi House, where the concerts were held, and found to my horror that the fare for the afternoon consisted of half a dozen sopranos, one after the other.

Six sopranos taken next is nobody's idea of entertainment. I suggested that it might not be a bad idea to have a musician in charge of such endeavours, and my employers agreed. So there I was, Musical Director of the Marconi Company in 1922.

Rather an extraordinary situation, to be musical director of a wireless company. However, that was my title. What real good fun those early days were! As far as concerts were concerned I was not overworked, as we never transmitted more than two or three in a week. Each concert was given on behalf of some charity or other, and one postcard received from the author of this article will be well known as "Uncle Jeff" to listeners of the early days of broadcasting. In this, the first of three special contributions he takes you behind the scenes at the studio at the top of Marconi House.

began a certain Peter Eckersley, was giving wireless concerts from Writtle—and what concerts! I heard two of them, and for sheer spontaneity and humour they compared very favourably with some of the programmes nowadays over which so much trouble is spent. He, as you know, was the first chief engineer of the B.B.C.

Peter is a fountain of wit and great company. One of his great stunts in the later days was to imitate a singer (generally a soprano) broadcasting a "cod" French "art" song with a "background" of noise and howling from a local set all performed by himself, while I supplied a languid "art song" accompaniment on the piano. I supplied him with gramophone records from Marconi House for these Writtle concerts, and still wonder why so many were not returned as "broken experimentally."

My first concern in my new job was to get in touch with artists and to get them interested in the new idea. Unfortunately artists were not paid for broadcasting in those experimental days, so it was rather like trying to make the proverbial bricks without straw.

My first concert was recruited from the Royal College of Music. These concerts usually lasted half an hour, and they were transmitted from the little demonstration cinema at the top of Marconi House. The walls and ceiling were draped with butter muslin, and in a little recess in the wall was seated the engineer on duty wearing a pair of phones to listen during the intervals for any S.O.S. from ships in distress. For this reason also there was an interval of three minutes in each concert having close down for three minutes in every ten in these days of long plays and symphony concerts.

That first studio was not large, and amongst other things it contained two desks, three telephones, a piano and a few music stands, and microphone junk.

"Result Was Pandemonium."

The granules packed very quickly, so the offending microphone had to be banged into working order again. The three minutes' intervals came in handy here. The room I have already tried to describe, with just enough room to swing a small cat; now add to this the following noises to create the necessary atmosphere—typewriter, telephone bell, engineers testing a new type of microphone in that exasperating way they have of calling out the numbers up to ten, then the days of the week, followed by the months, with an occasional chromatic scale on the piano from the bottom to the top for frequency purposes.

Occasionally the room was required for its original purpose, and then we had to work in the dark or watch a demonstration film that I had seen many times before. By way of retaliation I would hold one or two auditions. The result was pandemonium.

Here is a true story that shows you how easy it is to get used to noise and distracting sounds. There was half an hour to go before a concert. The phone bell rings: "Please, sir, there's a gentleman to see you. He wants an audition and he's come a long way and didn't know he had to make an appointment." "Send him up." I am signing letters and generally clearing up at the end of the day. In he comes, with his accordion, a most soulful instrument. I ask him to start and, apologising to him, go on signing my letters. In comes an engineer: "Come on, you've only a minute to go." I informed him that I was ready but he pointed to my poor, gentleman friend still playing his accordion.

Mr. Stanton-Jefferies can be seen in this photograph at the piano accompanying Mr. Kenneth Ellis and Miss Olive Sturgess, who are singing into separate "hand" type microphones mounted on stands.

A SCENE AT THE OLD 2LO

(Continued on next page.)
He had had a non-stop run of quite 23 minutes. Such is enthusiasm on the one hand and a "deaf" ear on the other.

It has a pretty sound, too. I read this little narrative in the second number of "The Radio Times," and received no lesser than four letters from people in different parts of London all claiming to be our unfortunate friend and asking what I intended to do about it.

The Famous "Uncle Arthur."

Such were the early conditions of experimental days. There is one figure I shall never forget in conjunction with microphones and all appertaining thereto, one named Round, rather a little man with a happy twinkle in his eye and a keen sense of humour, a clever and keen engineer. Many times have I stayed with him working until the small hours of the morning while he smoked innumerable Egyptian cigarettes, lighting the new one from the old, the cigarette eventually to hang from his upper lip in a most haphazard fashion.

My immediate superior in the early days was Arthur Burrows, known to many, as "Uncle Arthur." He was head of Marconi Publicity, a charming man, easy to work with and encouraging. He became Director of Programmes at the inauguration of the B.B.C. in November, 1922, and eventually went to Geneva as head of the International Wireless Bureau.

We were the first announcers, and he nearly always helped during the "Wireless Concert" age. A mellow voice that was particularly suited to the old O'Connor microphone.

The "Soap Box" Arrives.

Yes, I thought someone would be wondering what all these wandering reminiscences have to do with a soap box.

Returning to Round, the head of the Research Department. He brought in a new type of microphone, a magnetophone; very heavy in weight but excellent in quality, or so it appeared after the other type of microphone. In his usual casual manner he had this perched on top of a large box resting on a trolley affair on wheels.

The microphone itself was kept precariously in position by means of straw, though why it didn't fall I don't know, as apart from the small matter of fixing the microphone itself the box wasn't fixed to the trolley and had a nasty habit of tilting over. The trolley also took it into its head to go off in a direction contrary to the one decided on. The box was very much the same in that it would either go backward or sideways. At last I managed to hang it "soap box," and soap box it was.

Finest Organisation of its Kind.

On looking back at those early days I marvel that such rapid strides have been made. During my twelve years with the B.B.C. I have seen a gradual but sure-and-sure improvement day by day both in the technical and in the programme side.

For these early days we were beset with many (and godliness knows how many) difficulties, but they were initial problems.
HAVING decided to go on a tramping and camping trip through Berks and Wilts, it was thought that some interesting facts concerning radio reception in the country might be discovered if a small portable receiver were taken along. The route lay from Reading to Bath, more or less parallel to the main Bath Road and just to the south of it. The conditions of the trip settled the design of the receiver without much trouble. The most important thing was that the set should be as small and as light as possible; no Regional station was situated anywhere near the route, so that the receiver need not be at all selective. Under these conditions it was decided that a simple two-valve receiver, with a portable power supply, would be adequate.

A Dry Battery For L.T.

The receiver was housed in a very thin-walled wooden box of inside dimensions 10 x 3 x 3½ in., a three-volt torch battery being contained in a box with the set. The high tension consisted of about thirty volts of the flat type of torch battery, stuck together to form a single unit. The phones were probably the most troublesome part of the whole equipment when it came to packing everything away in the rucksack.

The aerial consisted of a reel of D.C.C. wire, a pair of egg insulators and a collection of string, all this being packed away in the space above the variable condenser; when the receiver was in use this space was used to take the swing of the moving vanes. The whole equipment was packed up in three units.

Owing to the small size of the box no space could be wasted in packing away the components, which were as small and light as was consistent with reasonable efficiency. The tuning condenser was a well-constructed midget with air dielectric; a solid-dielectric type that had been tried as a tuning condenser, but had proved rather erratic in use, proved quite suitable as a reaction condenser, for which purpose it was no doubt originally intended. The coils were wound on a piece of 1-in. six-ribbed former, the number of turns being adjusted until a satisfactory wide band was covered with the 0.006-mfd. tuning condenser.

The Filament Resistance.

The intervalues transformer, although intended to be used in a parallel-fed arrangement, was used, or rather misused, direct to the anode circuit of the H.L.210 detector valve. The telephones were connected in the anode circuit of the L210 low-frequency valve. Since a three-volt dry cell was used for the low tension supply it was necessary to make up a 5-ohm resistance for insertion in the filament circuit. There are many features in the receiver which are not above the criticism of the careful constructor, but in spite of all its faults the receiver served its purpose quite satisfactorily.

In London the performance of the receiver was admittedly bad, as was to be expected; due to the smallness of the coil and its proximity to other components it had a high resistance, and the resultant selectivity was very pronounced. It was considered that this disadvantage would not be at all serious in the West, and this assumption proved to be correct.

Results Obtained In London.

The location in London in which the receiver was tested was definitely not good for radio reception; the district consisted almost entirely of houses, with the usual crop of aerials of all sorts and sizes, in addition to a goodly number of telephone wires. The aerial in use was better than most of the locals, being a single wire some sixty feet long going straight up to a forty-foot pole; this represented a far better aerial than it was found possible to erect at any of the field situations.

With this equipment and the local stations silent, a number of the more powerful Continental stations were well received. Almost anything that could be heard on the three-valve all-mains set could be picked up, or at least be heard on the three-valve all-mains set; German, French and Italian stations comprised most of the signals heard.

Reception conditions in the West proved to be vastly different. It was usual to employ an aerial about eighty feet long and only ten feet off the ground in most of the locations, and the earth connection consisted merely of a skewer stuck into the ground. Some surprise was caused by the number of signals received and also the great strength, the average level being a hundred per cent above that at London.

Strong Continental Reception.

The loudest medium-wave station was the West Regional, this being so throughout the trip. Many of the German stations were received at great strength, some of them louder than the London and Midland Regionals, which was a marked contrast to the state of affairs in London. "Parisien" was also a noteworthy signal. The most interesting observations were made on low-power stations, which were received in great numbers. On the first evening we were surprised to tune-in at good strength the Dublin station, which we had not heard for six years.

This station was heard at reasonable strength and with very little fading, providing real programme value. Numerous other low-power stations were heard throughout the trip, including a number of Spanish transmitters, and a host of German relays, most of which were not identified.

(Continued on page 102).

A FINE EKCO SET

"Miss England" trying the features of one of the attractive Ekco eight-stage superhet receivers which the makers have designed for the 1936 season.
**"FIVE HOURS BACK"**

This popular B.B.C. series is being revived on Saturday, October 5th, and below our special correspondent describes something of the work carried out by the B.B.C. engineers to ensure successful re-transmission of these American broadcasts.

**WHAT is this fascination in "hearing America"? I have never been able to decide exactly. A fascination there certainly is. Short-wave fans will testify to that. So, I imagine, will listeners with ordinary broadcast receivers who picked up any of last season's very successful "Five Hours Back" relays.

These programmes are starting again on October 5. Every Saturday we shall be able to hear a typically slick American programme emanating from the New York studios, or other far-flung point in the continent-wide network of the National Broadcasting Company.

These half-hour interludes from the other side of the Herring Pond will be timed at a rather more convenient period than last time—say 1.30, 2.30, and 3.30 p.m. G.M.T. That is to say, from 12.30 mid-day onwards in Eastern Standard Time.

First, you will want to know how our B.B.C. engineers propose to put back the clock: five hours, to annihilate time—as well as 3,000 miles of space!

Of thing to pick up, say W 2 X A F on a home short-wave, to bring in the family to listen with gaping mouths and popping eyes to the slightest result. But it is quite another thing to risk putting such a signal through a broadcasting chain—or even through just one transmitter.

**Tremendous Amplification.**

The "gain" needed to bring up such a long-distance signal to the level suitable for impressing on a carrier wave is very great. Indeed, a signal sounding perfectly wonderful on a home short-wave set might be a hopeless roar perfectly wonderful on a home short-wave is very great. Indeed, a signal sounding perfectly wonderful on a home short-wave set might be a hopeless roar if it were re-broadcast. That is why, in spite of the relatively easy way amateurs all over the country succeed in their efforts to pick up America, the B.B.C. has to go to considerable trouble to obtain anything like a service grade of signal.

I have been to Tatsfield, the B.B.C.'s listening post on the Kent-Surrey border, seeing just how they have improved the short-wave gear. Believe me, Mr. Griffiths and his merry men down there are now hot stuff with superhet's going from 12 to 80 metres. There are now four superhet's. Where there were only two last year's "Five Hours Back" relays. All these have most effective automatic volume controls, which can be interlocked. This ingenious system not only keeps the signals up but the background down. Otherwise, I may remind you, the set handling a fading signal might easily have a nasty background noise on the set getting a non-fading signal—for the outputs are all merged, of course.

Two kinds of diversity aerials they have down there. The simplex diversity system is used for the reception of two different stations doing the same programme. When this is not possible the ordinary diversity system comes into action, whereby two sets pick up the signal on spaced aerials. When there's nothing doing at all it's adversity of course.

This Ingenious System

Which system the engineers choose depends largely on conditions, which vary so much from night to night that they have arranged their gear for the maximum elasticity or, in plain amateur language, "mucking around."

**Tatsfield and the P.O.**

Under the best conditions the engineers are optimistic about their ability to reduce both fading and distortion, especially the kind of distortion due to selective fading. The new aerials will see to that particular bugbear of short-wave reception.

It will be interesting to see how the B.B.C. reception at Tatsfield compares with the Post Office relays of the admirable Mr. Raymond Swing's talk on the transatlantic telephone circuit. Sinister-minded readers may ask why...

**BROADCASTS REGULARLY**

**REGINALD KING**, whose orchestral programmes of light music form a popular B.B.C. feature. At the age of seven he appeared as pianist at Queen's Hall, and at sixteen won a scholarship for pianoforte and for composition of a piano concerto at the Royal Academy of Music. Was elected an Associate of the Royal Academy of Music in 1932.

Raymond Swing had to come over the Post Office transatlantic phone service to Baldock while the "Five Hours Back" relays are handled by the B.B.C. But the reason is quite simple. And not a bit sinister.

You see, Raymond Swing was talking to us—and us alone. Not to us and U.S. (Sorry!)—his talks, so succinctly weighing up the American scene for us, were flashed out from the American side in a strong directional beam on Baldock. I believe I am right in saying that the P.O. signals have a decibel level of round about 40, whereas the Tatsfield signals are, for several reasons, much lower in level—say 10.

But, then, it must be understood we are, so to speak, eavesdropping when we listen to "Five Hours Back." That same snappy programme is probably heard by millions of housewives in America—for it is their lunch hour.

This ingenious system makes use of a simple, directional array in our favour. W 3 X A L,—another of the channels through which Tatsfield operates—uses just a horizontal half-wave dipole, of which my short-wave fans will recognise immediately as nothing terrific as short-wave practice goes.

"A Sort of Side-Line."

My only point in mentioning this is to make you appreciate that Tatsfield has, right from the start, a lot to make up on the Post Office, partly because the transmission itself is not so favourable, and partly because, well, Tatsfield's real job in the B.B.C.'s present scheme of things is to check wavelengths—it's short-wave relays are a sort of side-line.

Possibly when the " Five Hours Back" and other American programme relays arouse even greater interest than they have done, the B.B.C. will see fit to extend its Tatsfield short-wave activities. I hope so, for they have some very keen young engineers on the job, who I am sure are just aching for the chance to put in some neat panels.

As it is, the Saturday afternoon relays are certainly a spur to engineering activities on both sides of the Pond. This is a point that was well emphasised to me when I went along to the genial Fred Bate, N.B.C. representative on this side.

"Here you have two huge organisations co-operating to improve transatlantic relaying," he urged. "The fixture on Saturdays gives the engineers an incentive to make experiments, to try all kinds of new aerials and other short wave devices."

"A Sort of Side-Line." programmes provide them, in other words, with a yardstick on which they can measure improvement.

World-Wide Programmes.

"What is the object in N.B.C. sending you these programmes? Very simple. We aim to range the world, not only in giving programmes but in taking them.

"You know, we get a vast variety of programme material from different parts of Europe. We are only too glad to reciprocate by sending you American programmes.

The 'Five Hours Back' relays will give English listeners a fair idea of the sort of light entertainments broadcast in America round about noon.

"There is just one little point you might like to be reminded of," added Mr. Bate, "and that is the fact that for the first of these relays my compatriots in America are actually Six Hours Back—owing, of course, to your British Summer Time being an hour ahead of G.M.T."

It is such subtle points as these that make one always have a gap in girding the earth, may annihilate space but cannot go. Which is definitely to-day's bright thought, don't you agree?

A. H.
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NEW POWER TRIODES

TYPE PX25A

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The success of the system depends on the characteristics of the valves and on the design of transformers employed. Full particulars are available on application.

OSRAM PX25A is a Power Triode designed for use in pairs where a maximum H.T. voltage of 400 is available. The rated dissipation of the PX25A type is 25 watts.

OSRAM DA30 is a Power Triode for use in amplifiers where a greater output is required and where a maximum H.T. voltage of 500 is obtainable. The rated dissipation of the DA30 type is 30 watts.

WRITE FOR NEW OSRAM VALVE GUIDE

OSRAM VALVES—DESIGNED TO ASSIST THE DESIGNER

FALSE FADING

It is not right to assume every time the strength of a station goes up and down that it is the work of the Heaviside layer. It may be due to causes at the receiving end such as those described in this article.

By J. F. STIRLING

FADING is a radio evil which has not yet been entirely eliminated and which, indeed, may never be completely finished from radio-dom. For the cause of fading lies beyond the control of the receiving set, owner and, also, of the transmitting station. In commercial working fading may become an intolerable nuisance, more especially as it is more frequently encountered on the shorter waves. Hence commercial stations, both sending and receiving, have to take special precautions in order to minimise the effects of bad bouts of fading.

Although the phenomenon of fading has shown itself to be unmanageable, it is a trouble which usually seldom comes the ordinary amateur's way. True, the enthusiastic long-distance station seeker will experience attacks of this radio nuisance in his reception, but, then, of course, such hindrances are expected and—for the greater part—put up with.

Sulphated Accumulators.

When the average radio amateur, however, comes up to you with a story concerning the shocking amount of fading which he experienced with his set “the other night,” it is very possible that you will find yourself listening to a detailed account of that which may be termed “false fading,” of a species of fading which had its origin not from without the receiving installation but from within it.

Suppose, for instance, that the accumulator of a battery-worked set has experienced too much of a rest during the summer, it plates may possibly have got into a sulphated condition. The internal resistance of the accumulator will, therefore, be considerably greater than it should be, because, owing to the presence of sulphate deposits upon the accumulator plates, current cannot traverse the cell as freely as it ought to do.

Now, an accumulator which has been allowed to get into this condition, if it was originally a first-class article, may, when hitched up to the set, endeavour to do its best and to deliver up the necessary steady current to the filaments of the valves. The interfering sulphate deposits, however, will, usually severely hamper the accumulator's work, and instead of getting a steady current the valves will be fed with a current which either flows in periodical jerks, in which instance “atmospheres” (of the home-made variety) will be present in the reception, or else with a current which ebbs and flows; a current which swells up to a maximum and then diminishes in intensity.

In this latter instance, “false fading” will be set up in the reception. And, usually, the better and the more sensitive the set, the more noticeable will the false fading be.

The reason for the above effect is, of course, to be gathered from the fact that the accumulator is not supplying a steady current to the valve filaments. Consequently the filaments are not being steadily heated. Their electron emission varies in accordance with the current supplied to them, and this difference brings about a variation in signal strength of the reception, which, rising and falling periodically, may very well account for the genuine variety of fading.

Further Possible Causes.

An H.T. battery, when it is about to “give up the ghost,” usually signalsise that fact by giving rise to a lengthy series of cracklings and other unwanted noises in the reception. H.T. batteries, however, have been known to give steady fluctuating currents when their ends are approaching, and these wave-like currents may, again, induce a species of false fading into the reception.

The same type of false fading, again, may occasionally be set up by a transformer whose insulation is defective. Under certain conditions the defective insulation between the windings of the transformer may act as a leaky condenser, becoming charged up by the current and then discharging itself of its accumulated electrical energy. Usually this sort of thing becomes manifest by noises in the reception rather than by a species of fading. Nevertheless, the production of false fading has been traced to such causes long before for the genuine variety of fading.

Perhaps the best recognised causes of false fading lie in the conditions under which the aerial system of the receiver is working. As is well known, a swaying aerial, when charged up, will induce into the reception a periodical raising and lowering of signal intensity and, usually, the more sensitive and finely-tuned the set, the more pronounced will this false fading effect be.

The reason underlying the above effect is known. The aerial wire and the ground form two plates of a large con-}

condenser. Now, by varying the relative positions of the plates of an ordinary radio condenser one readily alters the signal strength of the reception since, by this action, the capacity of the circuit is undergoing alteration.

In precisely the same way the swinging aerial of a receiving installation causes the capacity of the circuit to be varied. The aerial continually alters its distance from the ground. The capacity of the large condenser formed by the aerial-earth system is rhythmically varied and this induces into the reception the periodic rising and falling of signal intensity which is characteristic of fading.

A Capacity Effect.

An aerial which is perfectly straight may also give rise to the same effect. In all such instances, however, it will be found that a large tree, a clump of trees, or even an entire hedge are, under the influence of the wind, swaying heavily and thus altering their distances relative to the aerial wire. The capacity of a condenser depends to a certain extent upon the influence of surrounding objects, and if these objects are constantly changing in proximity the condenser's capacity will tend to vary in sympathy with their motion.

Hence, at times, when a properly adjusted aerial wire is situated above or near a swaying tree, bush or hedge, changes of capacity may possibly be introduced into the aerial-earth system in accordance with the swaying of the foliage and these will be sufficient to set up a semblance of fading in the reception attained by a finely- tuned set.

It will be remembered, also, that during the finer months of the year when the foliage is thick and abundant upon the trees, such objects are capable of acting as fairly efficient absorbers of radio-transmitted energy. Thus a tree in the garden may be providing quite a screen for the oncoming radio waves.

Alterations in Volume.

When such a tree is set into regular motion by the wind, its screening effect upon the aerial will be altered. Thus, the signals received will vary in strength according to the position of the tree's foliage relative to the aerial. When the foliage moves away from the aerial and out of the path of the oncoming radio waves, the signals will be louder, whereas, conversely...
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£6.17.6 or (½-badly torn) TELL ME ABOUT THE NEW REALISM IN RADIO

NAME....................................................
ADDRESS...............................................
In a cathode-ray receiver the electron stream is sprayed, line by line, over the fluorescent screen by synchronising voltages applied to the scanning-electrodes. So long as no picture signals are present, this merely produces a uniform illumination of the viewing-screen, without any gradation of light and shade. In a sense, it may be regarded as a method of preparing the background or "canvas," on which the received picture is subsequently "painted.

In practice, the incoming picture-signals may be impressed on to this "canvas" in different ways. They may, for instance, be applied to the control-grid of the tube so as to vary the density at which the electron stream strikes against the fluorescent screen. The brightness of the fluorescent spot increases with the number of electrons, and so reproduces the light-and-shade values of the original picture.

Producing the Picture.

But, in addition to varying the speed of the electrons, the signal voltages—when applied in this way—are liable to affect the correct focusing of the stream, which in the modern "hard" type of tube is determined by the voltages on the anode and control grid. Accordingly there is a tendency for the spot of light to change its apparent size on the screen from time to time, thus reducing the clearness or definition of the picture at the parts affected. Another well-known way of "painting the canvas" is to vary the velocity at which the electron stream sweeps across the fluorescent screen. In the first method the forward speed of the stream is controlled as it moves from the anode towards the screen, whilst in the second method the variation in speed occurs as the stream moves from side to side of the viewing-screen.

Causes of Blurring.

In order to secure this "transverse" control, the incoming picture signals are usually applied to the line-scanning electrodes. However, they are superimposed on the original scanning-voltages, and so, as shown in Fig. 1, have the effect of slightly advancing or retarding the spot from its proper position on the screen, to another spot, such as AI. This naturally also tends to blur the picture.

The second method is really based upon the tendency of electrons on which strike against a given spot on the screen in a given time. As the stream sweeps more rapidly across the screen it is clear that the number of effective electrons will decrease, and the brilliance of the light produced falls accordingly. As we have seen, both systems tend to give rise to some distortion of the picture, and attempts are now being made to overcome this drawback by applying the picture signals at a point some distance away from any of the usual control electrodes of the tube. For instance, if the incoming picture signals are applied only to the electron stream at a point near to or close to the fluorescent screen, any displacement of the spot of light from its proper position on the screen will be insignificant as compared with the "shift" produced, as shown in Fig. 1, by the same voltage applied lower down the stream.

"Close" control.

The new method of "close" control is used in combination with a special form of viewing-screen, which is made up of narrow bands of fluorescent material interleaved with narrow bands of opaque or "dead" material.

The arrangement is illustrated in Fig. 2, which shows an enlarged section of the "striped" fluorescent screen, and of the control grid G. The latter is located just in front of the screen, and consists of a similar series of strips, each half the width of a scanning line.

The idea is to make the incoming signals "paint the picture" by deflecting the stream as it passes through the grid, thus controlling the number of electrons which strike the screen in a given time. The use of alternate strips of fluorescent and non-fluorescent material, and the corresponding form of control grid, serve to reduce the value of the signal-voltage required to control the stream at this point. Unless the control is divided up in this manner the voltage required would be too high to be practicable.

The stream of electrons (corresponding to one full scanning-line) is first reduced to half that width in passing through the grid G; this will be so for any position of the stream, including the particular position shown on the sketch.

The received picture-signals are then applied to the grid G in such a way that for a point of maximum brilliance the whole of the emerging stream falls directly on to an "active" or fluorescent strip of the viewing-screen. On the other hand, for a point of minimum brightness, the beam is deflected downwards (as shown by the cross-hatched portion) so that it falls on to a "dead" or inactive strip.

Better definition.

For values of light and shade between these two extremes, the deflection is regulated accordingly. The modulating voltage is of course so limited that the maximum deflection cannot sweep the ray beyond the cross-hatched position shown in the figure. In other words the deflected ray must not pass over into the space belonging to the next scanning-line.

The deflecting strips of the grid are of metal foil, one-fiftieth of a millimetre thick, one for each scanning-line, the strips being biased in opposite directions so as to reduce their overall capacity effect.

A thin sheet of frosted or translucent glass, placed between the screen and the observer, diffuses the light evenly over the viewing-surface, so that the "dark" strips are not seen. Although the brightness of the picture is slightly reduced, this is more than offset by the corresponding gain in definition, and by the absence of any blurring.

THE NEW METHOD

With velocity modulation there is a tendency for the picture pulses to alter the position of the spot of light as well as to vary its speed across the fluorescent screen, this alteration being indicated by the distance A, AI in this diagram.

In this system tiny opaque strips run across the fluorescent screen in line with the picture lines. Brilliance is altered by varying the amount to which the spot overlaps these strips.

Naturally, owing to the fixed positions of the lines, the tube has to be constructed to suit one particular method of transmission. Thus for 240 lines scanning the cathode-ray tube would have to be divided so as to give 240 fluorescent lines on the screen. Interlacing could be carried out provided a suitable number of lines was used, but the number of these would have to be varied, and the tube is not flexible in this way. For the forthcoming British Television Service, with its two systems, the new tube would not be suitable.
I am probably going to annoy quite a number of people who read this article and raise, perhaps, not a few arguments among constructors. But that cannot be helped. The set which is illustrated in these pages is the result of requests for something which will provide good clean reproduction and first class quality from the local stations, and which will bring in a really large number of foreigners at full volume.

Reception Strength.
I have italicised the word full because I want to stress it. So many people talk glibly about the strength at which their sets will bring in distant stations and so many use the term "full volume," that one is apt to lose one's sense of proportion. When a set is operating at "full" volume only one thing should be meant; that the set is working at the maximum volume which the output valve is capable of giving. In other words if the set is a battery one and the output valve is of the 350 milliwatt type full volume will mean a 350 milliwatt peak. Or at least that is what the term should be used to convey. In the case of a mains set with a 2.5 watt output valve, full volume should mean 2.5 watts of peak sound output. Thus in regard to this 1936 Ferro-Power receiver when I say that the set will give full volume on a large number of foreigners I mean that the undistorted output peak is 5.5 watts.

Peak Output.
It sounds a lot, perhaps, but it must not be forgotten that a peak output of 5.5 watts means a mean level of perhaps under one watt. The remaining 4.5 watts have to be kept "up one's sleeve" in order to deal with sudden crescendo passages of music and peaks and transients. But a 1-watt level is ample for most people, and too much for any but an outsize in rooms. So with this latest set of mine one can afford to keep it well in check, even on distant stations.

This is an advantage that needs to be experienced to be realised. It means that one has plenty of reserve for really weak foreigners, while on those stations that provide real programme value one can get the high quality that is associated with a big power reserve and with an output valve that will deal with heavy peaks in the modulation without overloading.

Avoiding Overloading.
That is why I chose the valve I have used. One does not need an output of 5 watts or anything like it as a general rule. In fact you could not stand it, and heaven forbid that I should be the means even of hinting by describing this set that one should ever run it at anything above, say, a one-watt, or slightly average level. But one does require a peak carrying power of 5 watts to avoid overloading on every occasion. Many sets with output valves capable of 2 or 3 watts will deal faithfully with quite a large number of programmes at a fairly good average strength level. But sooner or later there comes a big bang on the drum, or a clash of cymbals which momentarily overloads the output valve, and an "edge" is given to the music. For me that spoils the whole thing. I do not like a set ever to overload, when it is being properly used. And to use it properly means to run it well within its full loading margin. To do this and still get good volume on the weakest passages one must have at least 5 watts available in the output valve.

Great Sensitivity.
I have explained why I have used a large output valve. Now let me get back to this question of full volume on foreigners. That means in this case a one-watt level on a large number of them. And... (Continued on next page)
The 1936 "Ferro-Power"

(Continued from previous page.)

that means considerable H.F. and L.F. sensitivity. That sensitivity I have included in the design of the 1936 Ferro-Power.

It is easy enough to pick up, say, 20 Continental stations and to get sufficient strength out of them to load a 2.5 watt output valve. It is not so easy to pick up those 20 stations and to load fully a 5-watt valve. And it is more difficult still to pick up 40 stations or more and to load that 5-watt output valve to its capacity.

Dozens of Foreigners.

But that is what I am aiming at in this set. Those who want a first class set for the locals only are advised not to build it. They will not require either the H.F. or L.F. side of the set, and detector and amplification are sufficient. But it needs intelligent operation. The set is a lifter, however, saying that they find foreigners as full strength locals by turning a knob. That is the only way to get a sound level that will give nigh perfect quality on the stations.

But to those who want not only a docile set but also a lifter, those 20 stations and to load fully a 5-watt valve. And it is more difficult still to pick up 40 stations or more and to load that 5-watt output valve to its capacity.

Linking the Set with the Mains

This is the circuit of the power-supplying unit which provides the link between the receiver chassis and the mains.

Valves and Loudspeaker

- V1 & V2: Cossor M.V.S. Pen
- V3: Cossor 41 M.E. (Mel.)
- V4: Cossor 41 M.P.
- V5: Marconi or Osram P.3.B.
- Rectifier: Marconi or Osram N.1.4

Loudspeaker: W.B. "Sleuthman," type E.M.W.

I do not want builders of it to write to me after, however, saying that they find the set "easily overloaded." Of course it does. It is not tricky to handle in any way, but it needs intelligent operation. The set contains sufficient H.F. amplification to overload the detector valve on a large number of stations and the detector and L.F. side have sufficient amplification to overload the output valve on even more stations.

That is the only way to get a sound level "service" such as that which is my aim.

But because this overloading can take place there is no reason why it should. The set incorporates a perfectly good volume control, which is meant to be used. That control will keep down the magnification to comfortable proportions when using even a big aerial on a local six miles away. I have tried it.

But alternatively that volume control will so release H.F. amplification that the set will overload on scores of foreigners. I have experienced that, too.

Between these two points of volume-control one can obtain clean, pure reproduction, and that is the object of the set. Someone will say at once "there is no A.V.C." There is not. To hold down the volume of a set like this on more than two-thirds of the stations it can receive, the A.V.C. would have to consist of the amplified variety, and that type of A.V.C. is admittedly not easy for home-constructors to get going. So much depends on its adjustment for each individual A.V.C. valve that it is almost impossible to give reasonably simple working details.

Valve Tolerances.

The performance of success with that type of A.V.C. with modern valve tube and high-frequency tubes is so low, that unless valves of characteristics within extremely narrow limits could be guaranteed to the home-constructor.

I speak, of course, of the double-diode triode type of valve.

Manufacturers can get amplified A.V.C. going if they choose to pick their valves, rejecting those that come outside the required narrow limits, but the home-constructor cannot do that. I do not include A.V.C. at all. For ordinary unamplified A.V.C. is useless with a set of this caliber. And here I am going to throw a small bomb into the camp of the constructors and manufacturers. It is a pretty technical achievement for keeping the level of signal strength constant. But here, in my opinion, the true essence of A.V.C. ends to those who want a set that is to give good programme, and is not to be merely a station-getter. Its anti-fades properties are so often mentioned and abused.

The Aim of the Set.

Quality reception is the aim of this set. I want those who build it to get scores of programmes at a strength worth listening to, and with a quality that is worth hearing. That is possible from a large number of foreigners.

Many do not fades the quality often suffers whether you have A.V.C. or not. A.V.C. will bring up the volume but inevitably also the accompanying mush. It will not restore the quality, So the 1936 "Ferro-Power" does not include A.V.C. It is what can be called a straight set in every sense of the term. It was made to do certain work and it does it. There is nothing tricky about either the construction or the operation.

The Components for the H.T. and L.T. Supply

1. Valve power transformer, type E.P.38.
2. Tubular double-electrolytic condensers, 3 and 4, type 9003E.
3. Wearite L.F. chokes, type H.T.A.
5. T.M.C.-Hydra 1 mfd. condenser, type 75.
6. Bolgin 1,000-ohm power resistance, type V.P.R.
7. Bolgin 20,000-ohm power resistance, type V.P.R.
8. Bolgin 20,000-ohm power potential divider, type F.D. 2.
10. Bolgin combined main plug and fuses, type F.I.S.
11. Bolgin 16-inch fuse, type F.I.S.
15. Graham Varic "Pep" terminal block.
16. "Metapal" baseboard, 16 in. x 16 in.
17. Coll.B.S.G. "Quicks" connecting wire.
18. Screws, etc.

The Power Pack

One-knob tuning, no reaction, no Stunts, and real volume and quality. A set for the enthusiastic programme listener as distinct from the station searcher.

It is not cheap. But no set that is capable of giving first class quality and large volume is cheap. It cannot be, whether it is a battery or mains design.

Many readers will remember that nearly two years ago I described a set under the name of the "Ferro-Power Five." In our sister journal Wireless (then the Wireless Constructor). This set has been a great success among many quality enthusiasts, and it is to provide something even better that I have designed the 1936 model.

It is founded largely on the principles that I have just mentioned, but though the L.F. side.

(Continued on page 94.)
Choosing a Pick-up?
—better have a B.T.H. and have the best.

Everybody knows you can't get a better pick-up than a B.T.H.—so, when you can get a B.T.H. for as little as 21/- why put up with a second-best? The B.T.H. Minor compares favourably in performance with pick-ups costing very much more. A volume control is incorporated in the tone-arm pillar. All radio dealers can supply.

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THE 1936 “FERRO-POWER” (Continued from page 92.)

is similar it has a greater overall gain and, among other things, the output valve has a steeper slope. The H.F. side is very much more efficient, for two variable mini screen pentodes are employed with Ferrocart coils.

Band-pass intercalve coupling is used to provide a really high degree of selectivity which, with the enormous gain possible with pentodes and Ferrocart coils, makes the set comparable with an up-to-date superhet, except in one respect. That is quality and silence of background. The 1936 “Ferro-Power” is, in my opinion, far better than a superhet. It is superior in quality, for the background is very much quieter than that of any super I have heard.

It is better in station-getting for that very reason, for the noise level being low the weak stations sound loud. They are not drowned by those rushing noises generated by the mixer valve and became immediately, which usually denote a super when it is going “all-out.” It is very much easier to build and get ganged. And it is cheaper.

Inexpensive “H.F.”

A super with no double-channel troubles and with reasonably good quality would require a pre-mixer valve or a band-pass input, and intermediate transformers of wide frequency response. These would not be as cheap to obtain as the H.F. stages of the 1936 “Ferro-Power,” and would still be inclined to be noisy.

The circuit of the set is shown in these pages and also that of the power pack that goes with it. Attention is paid to decoupling, with the result that the set goes over to records.

Resistance-capacitor coupling is used throughout the L.F. side of the set, giving an excellent response curve and good reproduction of transients. This is essential for good quality, for too many sets fail in this regard, lacking attack and having smudgy high notes.

Full and Clean Bass.

The bass provided by the Ferro-Power is clean and full, and the set is capable of going down well below 40 cycles without aural loss of strength.

THE COMPLETED RADIO ASSEMBLY

THE PARTS EMPLOYED IN THE RECEIVER-CHASSIS SECTION

There is no need for that. The L.F. amplification is such that the succeeding valves will overload before the detector, so there is no sense in making that valve capable of carrying a greater input.

And by arranging the values of anode voltage and the resistances in series with the valve, as I have, not only do I get long life for the valve, but also, when the valve is switched over to gramophone and becomes an L.F. amplifier with grid bias, the rise of anode voltage is hardly appreciable, and does not exceed the 200 volts maximum for the valve. This obviates the need for switching in an extra voltage breakdown resistance when the set goes over to records.

Using an Energised Speaker.

In the power pack you will see a resistance of 1,000 ohms marked at its ends X and Y. This resistance is necessary to break down the voltage from the rectifier to below 500, so that the electrolytic condensers will not suffer damage or allow the output valve to receive its proper voltage. The other stages receive their power through various resistances.

The marking of the 1,000 ohm resistance X and Y is for the benefit of those who want to use a mains energised loudspeaker with the set. Such a speaker should have a field winding resistance of 1,000 ohms and the field winding is wired in place of the 1,000 ohms resistance shown.

A suitable speaker is the W.B. Stentorian type EM/W, which is capable of excellent quality and will deal faithfully with the power and frequency range supplied by the set. The net deserves a good speaker—not spoil it by using an inferior type or make.

Wide Wave-Range.

One point I may mention here is the extremely wide wavelength range of the set. From Budapest, at the top of the medium-wave band, it goes down well below 200 metres, while on the long waves the lowest point on the tuning scale comes somewhere round the 2,000 metre mark, and the highest is above 2,000 metres.

Thus the great majority of Europe’s broadcasters come well within the tuning scope of this set, and with the set’s sensitivity, enables an exceedingly large range of stations to be obtained. And the selectivity is such that with a full 100 ft. aerial within a few miles of Brookman Park the “spread” of the locals is a matter of but one or two degrees on either side.

But more about this receiver next week, when I shall deal with the construction and a few more points of interest.
Diverting Dice!

Strange, the fascination of six little white cubes. Ingenious mind that first conceived such a simple yet wholly absorbing pastime. Comes ALFA-KUBES, basing itself on a game of chance that has stirred with excitement the peoples of every nation in the world, brings it smash bang right up to date with a new twist, a modern word-building notion of extreme fascination—and educative value. Better than ordinary dice—better than cross-words. A simple, sound and stimulating combination of both—a game that all can play and enjoy—anywhere at any time. A set costs a shilling. Is compact, neat and handy. You need never suffer another dull interlude—depend on these diverting dice.

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News and Views from the "Big House"

Mr. Paley's Visit.

Mr. W. S. Paley, President of the Columbia Broadcasting System of America, who is now in London, has initiated important negotiations with Sir John Reith and the governors of the B.B.C. with a view to closer co-operation. Indications are that Columbia and the N.B.C. of America wish to form a common front with the B.B.C., particularly in the field of news broadcasting.

Mr. Aylesworth, the head of the N.B.C., and Mr. David Sarnoff, President of the Radio Corporation of America, are also in the picture. The three-cornered combination of the B.B.C., N.B.C., and C.B.S. will pretty well dominate the world of broadcasting.

The Noisy Latch.

By special resolution of the Drama department of the B.B.C., a new noiseless latch has been fitted to the door between Studios 7B and 7C. The previous fitting had disturbed several drama transmissions. Incidentally, this disposes of one of the mythical "ghost noises" that have inducted disturbances into the Drama of B.B.C. staff make hits such as this.

Max Kester's Success.

In a recent "Air-do-Wells" programme, Max Kester introduced one of his own unpublished lyrics, entitled "She Is Only A Mother." It caught on at once. There were hundreds of requests for copies of the lyric which, I understand, is shortly to be published. It is not often that the writings of B.B.C. staff make hits such as this.

Captain MacCulloch Better.

Captain Derek MacCulloch, head of the Children's Hour at Broadcasting House, has had to undergo a fresh operation, as the result of the recurrence of internal trouble due to war wounds. Captain MacCulloch was severely wounded, receiving the bulk of the contents of a shrapnel anti-aircraft shell in various parts of his body. Afterwards he was taken prisoner and his escape from death was little short of miraculous. Very skilful German surgery came to his rescue. After the war Captain MacCulloch had a series of operations, and it was hoped that he had put these troubles behind him. Recently he discovered that his cancer was recurrence; but the operation he has now successfully undergone contains the definite promise of permanent relief.

Discipline Relaxed.

One of the last matters attended to by Colonel Alan Dawney before he went back to the Army was to arrange for a general softening of office discipline in the B.B.C. He secured the "washing-out" of Saturday as a working day for all except those actually engaged on the week-end programmes. Holidays have been extended. Although juniors must still say "Sir" to seniors, it is no longer necessary for juniors to stand to attention when addressed except in the case of Sir John Reith and Admiral Sir Charles Carpendale.

Christopher Stone to Return.

Christopher Stone is considering a "come-back." I understand that his contract in commercial broadcasting is about to terminate; and rather than renew it he would prefer to resume with radio and the B.B.C. His return to the British "mike" would be an exceedingly popular event among thousands of listeners who have missed him keenly during his self-imposed banishment.

"Projecting England.

Sir Stephen Tallents and Mr. Gladstone Murray are to co-operate in "Projecting England." (Continued on next page.)

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England" over the short waves to the world. The B.C.C. has accepted the foreign challenge in short-wave programmes and will no longer follow a policy of reserve in matters of nations and imperial propaganda. Propaganda unashamed and fully avowed is the new order of the day. "Britain First, the Rest Nowhere" is the robust slogan that has superseded "Nation Shall Speak Peace Unto Nation"—and, in my opinion, high time, too!

**ON THE AIR**

Candid comments by our broadcasting critics on recent programmes.

I HAVE ceased to frown. Listening this week has been much more worthwhile because of the inclusion in the programmes of a few talks and some items carefully placed and not thrown together. Our reputation abroad, so we are told, is high. That reputation must have suffered lately, for the B.B.C.'s summer slackness is much too long for listeners who take their listening seriously. Such a listener told me the other day: "If this sort of thing goes on, in a few years time listening will be dead as mutton."

I have listened to most of the new talks this week. Here are my comments on two of them. Commenters areeditorial, but when Cloudesley Brereton compares the French with other nations, especially the English, it becomes interesting. Cloudesley Brereton didn't attempt to say whose comparisons are odious, but when Cloudesley Brereton compares the French with other nations, especially the English, it becomes interesting. Cloudesley Brereton didn't attempt to say whose comparisons are odious, but when Cloudesley Brereton compares the French with other nations, especially the English, it becomes interesting. Cloudesley Brereton didn't attempt to say whose comparisons are odious, but when Cloudesley Brereton compares the French with other nations, especially the English, it becomes interesting.

A Recorded Talk.

"The Genius of Spain" was the title of Dr. Pastor's talk. This talk was recorded and consequently accompanied by a gramophone record. This was a much more learned talk than Mr. Brereton's, and I fear that to many listeners it was less informative. Dr. Pastor gave a geographical and historical survey of Spain. He ended with a few extracts from a modern Spanish writer. This commented upon all the more that the talk would have been better appreciated by Spanish scholars than by students about to begin the study of the language.

There is pen with Hughie Green, but as there is cleverness with it, I applaud him. I really enjoyed his turn.

I wish there were more radio artists who sang at the piano. This particular form of entertainment has appealed to me ever since I first heard Ernest Harevix many years ago. It seems a thousand pities that the art was allowed to become old-fashioned. Now Lang is almost the only radio artist we hear sing at the piano.

Say what we may about synchronists, the brand is univalved among singers for clearness of diction. tomatoes, but to the public the name of George Whiteicy is synonymous with speech and musical renditions. I would like to hear the "Messengery Boys" Sineh."

Miehie-Longstaffe Variety.

The Miehie-Longstaffe variety turned out well. Recipes are usually something of a gamble, but this one was hit. It can run with a Longstaffe connection. This isn't suggesting that anything Miehie is doubtful. Miehie's a good harmonist and a word with a brand. Or it wasn't. It will be soon. I liked the way he controlled the show. He lays it down a bit, but perhaps this is ultra-pep.

Read this message from Mr. G. V. Dowding, Associate I.E.E., Technical Editor of "Popular Wireless."

"In the opinion of many "Popular Wireless" readers the +o-60 100 Watt, and cordless phone transmitter radio receiver is making a real stir in the field of outside amateur radio equipment. Readers will be interested to know that we are now offering a complete radio receiver that can be used in connection with a telephone. This receiver is a new development in amateur radio equipment and is particularly suitable for use with the +o-60 100 Watt, and cordless phone transmitter radio receiver. It is a self-contained unit and can be used with any telephone. The receiver is fully adjustable and can be easily tuned to any station. It is a rugged, compact unit and will stand up to the most severe conditions. The receiver is supplied with a full set of instructions and a complete set of parts for repair. We are confident that this receiver will prove to be an excellent addition to any amateur's radio equipment.

The receiver is supplied with a full set of instructions and a complete set of parts for repair. We are confident that this receiver will prove to be an excellent addition to any amateur's radio equipment.

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Questions and Answers

CURIOUS INSTANCE OF H.F. INSTABILITY.
W. L. (Gorton, Manchester).—"The set is now perfectly stable, and although I know exactly how it is that it is quite
accidentally, and I still cannot see why the alteration had any effect. Can you explain?"

The aerial tuning was well separated from the second tuned circuit by a screen, upright, between the two. This screen rests on the metallic baseboard, and is fixed thereto by two screws. Above half way up the screen there is a hole for a bolt, with nuts on each side of it."

"All that is necessary to stabilise the set is to remove one of the wires from this bolt — the wires from the moving wires of the second condenser — and take it instead to the baseboard, directly underneath the condenser itself. This makes the wire a little shorter, but the difference is only a matter of about an inch."

As the screen itself is earthed to the baseboard, I cannot see why the connection to the screen is not as good as the connection to the baseboard. But for some unknown reason the former connection gives trouble, but the latter arrangement is perfectly stable."

Yours is certainly an interesting example of what big differences can be made by a little alteration to high-frequency-stage wiring. And yet, small as the change is, it appears to be, there are several possible explanations for the marked improvement."

One possibility is that in its first position the wire was placed too close to one of the other components of the valve, causing electro-magnetic interaction, or feedback."

Another possibility is that although the points may have appeared equally good in both instances, the former earthing-point for the circuit was inferior to that provided by the new arrangement, and caused instability by introducing resistance. (It is not uncommon to find that a poor joint in an H.F. wire may cause a set very " touchy " and liable to instability.)

There is yet another possibility, not mentioned with the foregoing, and arising from the fact that common earthing-point to two circuits, though theoretically satisfactory, may cause interjection."

Just as the B.C.C. allows neighbours not to use the same earth, so the set designer often advises that the neighbours circuit should be spaced at a distance, to prevent mutual interference, in a power set. When high gain is used, so although the alteration in wiring appeared to be a small one it serves to show what big losses there may be in slight modifications of H.F. wiring."

BATTERY CHARGING BATTERY.
A. W. M. (Loughborough).—"Is it possible to ' ginger-up ' a wee wireless battery from the battery on a car in an emergency? If so, what are the connections?"

If the car is a late model, a small wireless battery can be charged from the car's battery. Usually the side lamp (or lamps) make suitable resistance. The important point to remember is that the two positive, of the batteries must be connected together. Not 1 of one to — of the other.

ALL THE VALVES BLOWN OVERNIGHT.
W. W. (West Ham, London, E.16).—"The set was going great guns overnight. Big Ben became out twelve midnight and set is switched off and off we go to bed."

"Next evening I switch on again, Dead silence. I look round — there are the gay O.K. Accumulator fully charged, and nobody — I know for certain — has touched the set since I switched off the previous Sunday."

"I check over the set with a 'Pico' meter, and still find nothing wrong. I take out the valves one by one and am about to test finding that all five valves are blown!"

"Every one of these valves was brand new one Monday, and has not been handled since."

Although I knew the set was O.K. I at once took it round to my dealer, and he pronounced it perfect.

NEXT WEEK

Full Details of the Baird and MARCONI-E.M.I. TELEVISION SYSTEMS

If the circumstances are exactly as you report, and further one of the set people that there is nothing wrong with it now, the only explanation that fits is that the circumstances is that one of the discarded valves was the cause of the trouble."

They may or may not be occurring (indeed, how one valve can result in a whole set of them becoming "blown") but we can assume that it may happen, and the only faulty valve causes the destruction of them all."

How this can occur will be explained if it is remembered that the H.T. and G.B. batteries are usually always left connected permanently to one end, and in the event of the set being switched off, the other end of the filament is disconnected.

The valves are all wired in parallel, so a connection from the battery at one point involves all the valves in the set. And in such circumstances all that is necessary to blow the whole set of valves is that the H.T. and G.B. batteries may be momentarily connected together."

It is unlikely that the H.T. would cause the trouble, because it is not possible that the filament wire with the filament, since the set is now working well, has any insulation between the H.T. and G.B. batteries."

So negative bias to the grid and positive bias connection makes that unlikely."

But it is a different story with the G.B. As you know, the grid inside the valve is next to the filament, and — in the case of the octave, very close. The small space between the two electrodes is sufficient to cause filament and grid electrode to touch."

So negative bias to the grid and positive bias connection makes it impossible for the valves to be destroyed by the G.B. bias, and it is highly likely that the filament does not matter — unless it... (Continued on next page.)

Popular Wireless, October 5th, 1935.
CHARGING FROM THE D.C. MAINS.

S. K. P. (Birmingham).—"I have to run two L.T. batteries because one is always being charged, so I thought I would try to charge

from the mains (D.C.). The actual wiring did not bother me because my professional job is an electrical shop, and he made a professional job of the connections.

"What he did was to 'cut in' on the negative main, so that the accumulator to be charged was connected with its negative terminal to the negative of the supply. There was a lamp placed in the positive lead to act as resistance, and we switched on about 3 p.m. "At 9 p.m. we tested the voltage of each of the cells, and they showed no change. So we left the battery charging all night, expecting to find it well up in the morning. But our hopes were dashed, and there was hardly any difference, though all told we had been switched on for eighteen hours. Can you explain?

"I have looked over the connections and they are given in a D.C. charging diagram. The lamp lights up as usual when the switch is put on to charge. Why is it that the voltage does not pick up?"

From your description we think your connections are in order, so far as point-to-point wiring is concerned. And you certainly should be able to charge an accumulator with such an arrangement. But it will have to be treated sparingly.

There is a great difference between trickle charging and the ordinary charge given to an accumulator by a charger when it is taken along for treatment. The charger can arrange to pass a fairly heavy current through it for just a few hours, which will "take it up" to service condition again.

You cannot make a similar arrangement at home, to work economically, but if your accumulator starts in good condition you can quite well keep it "up to scratch" by the trickle-charging arrangement you have been working on.

In order to trickle-charge successfully, however, the accumulator must be kept fully charged and allowed to start with, in the ordinary way. It will then work the set as usual when connected up for that purpose: but at night, instead of being switched off and standing idle, it is switched over to the trickle-charger.

The morning's slow trickle-charge will have brought the battery up to the fully charged condition again, and thus the battery will never be allowed to run down as it did before, but will always be kept in tip-top condition.

(Continued on next page.)
Let Us Send You
This 40-Page
Booklet—Free

RADIO-TORIAL
QUESTIONS & ANSWERS
(Continued from previous page)

It is unlikely that the accumulator will need to be
switched over to "trickle charge" every night,
because, obviously, you have only to make good the
loss of current for one day at a time. For a simple
way to run such an arrangement is to check the vol-
tage and the specific gravity regularly, and charge
more as soon as the battery seems to need it; or
shock the charge in a little if both voltage and the
specific gravity are well up.

(The specific gravity is easily checked by means of
a hydrometer, obtainable at the dealer's. Instruc-
tions for taking readings are given with the instru-
cment, which is easy to use and quite inexpen-
sive.)

Your rate of charging will depend upon the resis-
tance of the lamp used, and it should be possible to
arrange that the ordinary house-lighting current
does your charging, instead of having a lamp burning
specialty for the purpose. Your friend should be
able to put you in touch with a qualified electrician
who would work out the whole scheme for you, and
would be the best way to tackle the problem, since
skilled interference with the mains is dan-
gerous, and against the regulations.

BROADCAST TALKS
WILL BE LIVELIER
(Continued from page 79.)

"Peak" talks will be featured in this
series, as well as talks of perhaps a more
sectionalised interest. But the characteristic
common-to-all of these talks will be their
delivery by real experts.

"Quite apart from the London studio
talks the Regions will be making valuable
contributions from their own institutions. For instance, the West
Region is going to present a fascinating
series called 'The Changing Village'—
wherein villagers will discuss the effect on
their lives of the coming of modern develop-
ments, such as transport—and wireless.'

Mr. Siepmann has spent three solid years
as Talks Director, and his final programme
arranged that the ordinary house-lighting current
will be featured—is in this
new post of Director of Regional Relations—shows that
he has been working with his colleagues on
sound lines. The concluding schedule reveals, I think, a growing realisation that not only
must the listener's interest be invited, but
the talker's mode of presentation must be
microphone.

A READER'S RESULTS WITH
THE KELSEY ADAPTOR

Dear Sir,—I am writing to thank you for the very
fine results that I am getting from the Kelsey 155
AA-Receiver Adaptor.

I built this up from a Pete-Scott "G" kit, and found it
very easy to construct. It has a very nice " com-
mercial" appearance, and takes up little room.

I worked it over a bit to suit myself, but the first station
received being W.2.X.A., at a genuine RD. I am
using the unit with a seven-stage Ecko superhet, and
have already received a large number of broadcasting
and telephone stations, although I have had the set
only a month.

The only slight snag encountered while operating
the unit was the fact that for about five minutes after
starting up there was a constant stream of static, and the unit kept getting out of tune. After five
minutes everything was quite normal. I cured this by spreading the pins of the valve greatly, although there was not likely to be making
good contact with the holder.

In conclusion I may say that, although I have
built many short-wave sets, I have never had one
with such power and ease of handling as the 155
"Kelsey." I have been an amateur radio man since
1927, and while some of these tubes were not
quite as good, the very crude crystal set described in that issue being my first,
receiver, while I owe my introduction to short waves
the unit was the fact that for about five minutes after
five minutes after
starting up there was a constant stream of static, and the unit kept getting out of tune. After five
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"Kelsey." I have been an amateur radio man since
1927, and while some of these tubes were not
quite as good, the very crude crystal set described in that issue being my first,
There is nothing particularly attractive in battling and then, my goodness, what a difference! That has taken place in commercial power stations except that the power station would hold off any newsagent or bookseller. It cannot think that their owners are unaware of it. As for results, when by banging the power-pack and while it is true that I have not tested every set and while it is true that I have not tested every set and lucid style, so that even those who have little or no knowledge of science can easily understand it, and the explanatory drawings show the reader just what is being produced, and it is being issued in about fifty *ILLUSTRATED CATALOGUE ON REQUEST. type*. A.C. mains 200, 250 volts.

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Trio-charger. Output 50 m.A.

Cash or C.O.D. £4/12/6d. or £5/3/9d. payable in 5 monthly payments of £1 10s. 6d.

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P.W.12.
A PORTABLE IN THE WEST

Following upon these experiments on the medium waveband, another portable receiver has been built, for use in Essex.

This receiver covers the short wavelengths from 17 to 200 metres. No conclusions have yet been reached regarding conditions below 100 metres, but examples of the more distant amateur stations on the 100-metre band has proved much simpler in the country, these low-power stations coming through in great numbers and at a strength that is never experienced in the town. It also appears that signals on the 80-metre amateur band are a little stronger, but it is well known that short-wave conditions vary from hour to hour, and until two receivers can be used in the different locations at the same time the evidence cannot be taken as conclusive.

"Good Situations."

Another short-wave receiver, similar to the first, is to be constructed, and it is to be hoped that some interesting facts regarding "good situations" will come to light. All that can be said conclusively at present is that in the country, on wavelengths between 150 and 500 metres, low-power signals may be received at a strength far exceeding that experienced in the town. Most of these signals are absolutely inaudible in the town. It is hoped to find out whether those remarks apply also to transmitters and which areas may be considered as town and country from the radio point of view.

FALSE FADING

(Continued from page 88.)

when the foliage is moved by the wind close up to the aerial wire, the received signals will be at their weakest. False fading is more common than one is apt to imagine.

A similar effect may sometimes be produced by a slack downlead wire from the aerial. Although the aerial wire itself may be easily seen, the downlead wire may be left slack and, in this condition, swaying in the wind, it will alter the capacity of the aerial circuit, and thus introduce false fading into the reception.

False fading is, perhaps, commoner nowadays than it was years ago. This fact is not due to any lack of efficiency in modern receivers. Rather, the phenomenon is still in the laboratory stage. The precise details have not so far come to hand, and it is pointed out that the invention is still in the laboratory stage.

TELEVISION IN COLOUR

Jottings of interest to every radio enthusiast, by Dr. J. H. T. Roberts, F.Inst.P.

ACCORDING to news from America, experiments are being made on a new system for the production of coloured television pictures. You will remember that a good deal of work on colour television, using different principles, has been done in this country by the Baird Company; and coloured television pictures have actually been reproduced on the screen.

A New Method.

The new American method is due to Dr. H. B. Maris and Mr. R. H. Worrall of the Naval Research Laboratory, and apparently depends upon the use of thin sheets of quartz. The light passing through the quartz can be made to change in colour according to the thickness of the quartz plate (the different light passing in different directions through quartz is, of course, well known), and a Kalloros cell is used in conjunction with it. These two details have not come to hand, and it is pointed out that the invention is still in the laboratory stage.

Using Quartz Plates.

Talking about colour television generally, some people have said that to attempt this is rather like trying to feed before we are able to walk, and that it would be much better to concentrate on the perfecting of black-and-white television before attempting to complicate the problem further by going into colours. But this criticism is hardly justified, because in fact colour television of sorts—I do not say that it cannot be a good deal improved—is not very difficult to attain, and although at first sight you might think that going in for colours in television is enormously complicating the problem, in fact it does not complicate it very seriously.

There is no doubt in my mind that if we could get television reception in colours it would contribute very greatly to the naturalness of the received picture. The peculiar sepia and cream hue of a cathode-ray fluorescent screen, although scientific experimenters soon get used to it, often presents an unnatural appearance to the ordinary observer. A received television picture, what with the line repetition and the picture repetition, wants all the help it can get to make it seem natural, and if colours can be added without undue complication it seems to me that it would be a great help.

Dissipation of Energy.

I have several times been asked by readers why it is necessary to waste energy in a resistance in a receiver; this from the fact that we so often read about energy being "dissipated" in a resistance which breaks down a voltage.

The answer is that it is the purpose of the resistance to dissipate, or if you like waste, energy because if it did not do so the energy would go into the part of the circuit with which the resistance is in series, and that is just what you don't want it to do.
TELEVISION IN COLOUR

(Continued from previous page)

For instance, let us take the familiar case of the charging of a two-volt battery from a 200-volt D.C. mains. Here you put in series with the battery a resistance which allows, say, one ampere to pass through it. If the voltage of the battery is 2 volts, then about 100 volts is applied to the end of the line

resistance (usually an electric lamp or lamps in this case), and if the current is one ampere there will be 100 watts being dissipated in the resistance, only two watts being used in the battery.

Potential Gradient.

Whenever electric current flows through a conductor heat is generated, and this heat is proportional to the resistance of the conductor and to the square of the current flowing. The purpose of the resistance is almost invariably to break down a voltage, that is to say, to reduce the voltage applied at a particular point to a value below that at the other end of the resistance.

In the battery example just mentioned the voltage applied to the battery is broken down by the resistance from 200 volts to a few volts. Sometimes a resistance is used to form, as it were, a voltage gradient so that we can tap off any intermediate voltage to a suitable point of the resistance. When a resistance is used in this way it is called a "potentiometer."

But to return to the question about the dissipation of heat — it is impossible, as already mentioned, to pass a current through a conductor without producing heat and, much as we would like to use a resistance for the purpose of breaking down a voltage without losing any energy in the process, it is impossible to do so.

Extension Speaker with Push-Pull.

I said something recently in these Notes about connecting an extension loudspeaker, and a reader wants to know whether this is a simple matter in a case where the set employs a push-pull circuit.

The arrangements with a push-pull circuit are somewhat the same as those where a 3-electrode valve is used with an output transformer. The two anodes of the push-pull valves are connected through the choke or through the primary of an output transformer, the centre-tapping of the winding being connected to H.T. positive.

The extension speaker can be connected to the push-pull anodes direct, or through the intermediary of a fixed condenser of fairly large capacity, say a couple of micro-

farads. In the ordinary push-pull stage there would be no D.C. current flowing, so that it is not absolutely necessary to use the condensers if the extra speaker is near the set; if, however, the speaker is used at a considerable distance from the set then the condensers can be used.

Gradual Distortion.

Sometimes you will find when you have had a set in use for many months that very gradual distortion of some kind or other begins to set in. I am not talking about the kind of effect that happens due to ageing batteries, which is quite unmistakable, or to the more gradual effect caused by the deterioration of valves. This latter effect is not nearly so obvious as that due to the batteries, but it is, nevertheless, a thing to

(Continued on next page.)
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CLIX Chassis Mounting Valveholders of the 4, 5, 7 or 8-pin type are supplied with either Terminal or Soldered connections.

SPECIFIED for the 1936 FERRO-POWER

The centre socket of the 5-pin and two sockets of the 7-pin type are made longer than the others: this reduces the possibility of short-circuits and makes easier the wiring.

4-pin - 5d.
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TELEVISION IN COLOUR

(Continued from previous page.)

be looked for as time goes on, and one which is not very difficult to recognise.

What I was referring to was the much more gradual and more insidious effect which cannot be attributed to either of the above-mentioned causes. This is often traceable to the gradual accumulation of dirt and dust on some of the components, such as condensers, grid leaks and even chokes and transformers. It is surprising how few people ever bother to keep the interior of a wireless set clean.

Keeping the Works Clean.

I have many times examined the insides of sets, and have been almost unable to recognise some of the components for the thick carpet of dust which was lying on them. People who are meticulously clean in other matters often allow in their sets a surprisingly indifferency to the need for cleanliness in the "works" of the radio set. Or perhaps it is that they are afraid of interfering with it, and so leave it alone.

Anyway, dust and dirt will in time become seriously conducting. The dust seems to have a faculty of absorbing a certain amount of moisture, and in some curious way of becoming slightly acid. The result is that you get a sort of high-resistance leak connecting across various terminals and this, in a sensitive set, is quite sufficient to cause instability and all manner of troubles.

A Resin-Capacity Point.

I do not know whether you have ever thought of it, but if the coupling condensers used in resistance-capacity coupling have any slight leakage this will enable a positive charge to leak on to the grid of the following valve.

Let us assume that the grid leak of this valve has a rather higher resistance than usual, then the charge will mount up and eventually will counteract the grid bias which is applied through this grid leak. Although the grid bias is applied to the valve, so far as the grid-bias battery is concerned, the grid of the valve will, in fact, be underbiased, with the result that the current in the anode circuit will be higher than it should be. This you can easily test by putting a milliammeter in the anode circuit.

Condenser Leakage.

If you find by the milliammeter that the anode current is higher than it ought to be for the grid bias which you have (parently) applied—checking up the grid bias as well of course—then it would suggest that current is leaking through the condensers, as mentioned above.

As a rule the better known types of condensers on the market to-day are perfectly reliable, but it is not impossible to get one in which there is a slight leakage, or in which leakage develops after a certain period of use, due to some obscure cause. At any rate, if you get distortion and the other symptoms of underbiasing in the valve, this R.C.C. coupling is one of the things you can bear in mind to look for.

That Silent Background.

I have many times heard discussions between radio fans as to whether it is possible to get an all-clean set—really as clean as possible, and free from background hum as a battery set. I expect many of you who are proud owners of very up-to-the-minute mains sets will come forward to declare that they are just every bit as good in this respect as any battery set.

Personally, however, although I am the greatest admirer of modern all-electric sets and think their advantages are outstanding, I would not subscribe to the view that an all-mains set is ever really quite so quiet as a good battery set. A good deal seems to depend upon whether the valve filament is mains-operated or whether only the high-tension is supplied from the mains.

If, for instance, you have a high-tension mains unit, with battery operation for the filament of the valves then I think you have a much better chance of getting rid entirely of hum.

Sometimes the set gets the blame for background hum which really should be laid on the loudspeaker; a moving-coil speaker with a mains-energised field, for example. A simple way to test this is to disconnect the mains from the set, leaving the speaker still connected; if you find there is still a hum in the speaker, obviously it cannot come from the filament of the valve. At the same time there may be some hum coming from the set, and you can test for this by using a permanent magnet moving-coil speaker instead of the energised type.

S.T.700

Great News for constructors! We have secured for POPULAR WIRELESS the exclusive publication rights of an amazing new receiver—the S.T.700—produced by Britain's leading designer.


This will be the greatest set of the coming year—a worthy successor to the S.T.300, S.T.400, S.T.500 and S.T.600. Meanwhile the inventor desires to arrange a series of DEMONSTRATIONS.

Will any reader who would like to hear the set before publication and who could attend one evening in London, Birmingham, Manchester or Glasgow, write immediately to Mr. John Scott-Taggart, C/O POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4. State your present set and results obtained. Both experts and those who have not experienced real success will be welcomed. Do not omit to write because you expect to receive thousands of applications.

Mr. Scott-Taggart also would like to hear from a few Glasgow and Manchester readers who would permit a demonstration in their homes to fellow readers.

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THE "FILADYNE"

Britain's New Stations.

In all this talk of better wireless stations hither, thither, and yon, it is easy to overlook the fact that we ourselves are not doing too badly. Cast, with me, a reflective eye upon the B.B.C.'s proposals.

Far to the north there is a banging and a clanging at Berghast, where the new Scottish station rears itself. Westward, chins in the Belfast district are upward thrust in honour of Northern Ireland's new mast and high power, Wales has a brand new station at Beaumaris to look forward to, and new studios at Bangor.

Down Plymouth way the ground is being prepared for West Regional Junior. Up in the north-east they learn, with satisfaction, that the order has been given to Standard Telephones and Cables, Ltd. for a new north-east transmitter. Devontry also is looking forward to a nice new Empire outfit. General outlook, fine and clancyly.

Round The Stations.

I see that the World Broadcasting Union has been making inquiries into the way the various stations behave themselves, and some of the findings are surprising.

Who would have supposed, for example, that the most gallant country, with the largest proportion of its programme time devoted to the girls, was Japan? (Dark horses, those Jap chaps!) And who would have thought that so far as serious music was concerned, our own Nationals were beaten by Huzen, Brussels, Warsaw, and Vienna?

The gayest dog in all of the kernels is Madrid, with a negligible proportion of serious music to his credit, but plenty of tuneful tango stuff. Good old Madrid, say I; and the sooner his new long-waver gets acquainted with my aerial the better I shall like him.

Items of Interest.

The Canadian Government announces that it will embark upon the construction of a chain of powerful broadcasting stations to serve the entire Dominion.

More radio licences are issued in Manchester than in any other British city, barring London.

Crystal control of wavelength is now being applied to the radio beams that provide navigators with their positions.

Radio Dead Spots.

A last a scientific effort is to be made to clear up the mystery of the world's radio dead spots. It has long been known that in certain "puddeny" areas the reception of wireless is inexplicably difficult, if not impossible. The Sahara Desert, the Valley of Kings in Egypt, the coasts of Ceylon—these are notoriously dumb regions, detected by radio men who have to do business there.

This note may meet the eye of far-off radio experts on the high seas, or in the low valleys, who would not bother to write reports to scientific bodies, but who would gladly shake a penful of ink at their old pal "Ariel." If so, let's have the facts about these wireless pot-holes you've noticed, laddies. All details gratefully received. And if you've heard any good yarns lately, by all means mix pleasure with business.

Irish Contest.

The last week-end in October and the first in November will see the Radio Society of N. Ireland's transmitting contest for the Leonard Trophy, on the 20- and 40-metre wavebands. This is open only to Irish amateurs, but there is also a contest for English and foreign competitors to see who can get the most Irish contacts on October 26th, 27th, and November 2nd and 3rd.

Particulars can be obtained from G. 5 O Y, Mr. M. J. Cown, of 74, Wheatfield Crescent, Crumlin Road, Belfast.

How Many Radio Homes?

As the number of wireless licences in force will increase enormously this winter I will add to my recent remarks on the subject some newly issued figures showing—what is more enlightening than mere licence totals—the percentage of licences to households. Out of every hundred homes in Germany thirty-six have wireless sets. In Britain the number is fifty-five per cent., while Uncle Sam, who doesn't impose licence fees, can claim that sixty-nine homes in every hundred are radio homes.

These are the three great wireless-owning countries of the world, and it will be interesting to see how the corresponding figures will come out when we get the 1936 statistics.

The Tatsfield of Paris.

To the south of Paris, at Bicetre, the French Minister of Posts and Telegraphs is establishing a listening centre for British and foreign competitors to see how the corresponding stations behave in their outpourings of propaganda and political rough stuff.

Underground lines will link the receivers with P.T.T. offices in the Rue de Grenelle, and a staff of expert lady linguists is already engaged in taking down, on silent typewriters, the things people say on the air.

Old Timer.

I have often remarked on how the latest outpourings of the technicians, with their hotted-up valves, fail to kill the favourite old circuits of years gone by. My latest surprise in this direction was to read the outpourings of a buddy in Brisbane, N.S.W.

Now Brisbane is a spot where, if you can't get DX reception you might as well hang your head on the Great Barrier Reef; but this chap I was telling you of—

(Continued on next page.)
IS DROITWICH STARTING TO FADE AGAIN?

Mr. W. J. Hunter, of 6, Harding St., Auchenflower, Brisbane—has been getting wonderful reception on the "P.W. Filadyne." How many of you old rascals can remember that set?

If somebody could persuade the Technical Editor to modernise the "Filadyne," it would be the biggest sensation since Mae West. For it was the upside-down set that ever saw daylight. It had L.T. on the plate, H.T. on the grid, and (this is all gospel truth) the tuning-coils were in the filament leads. Theoretically that circuit looked like a technician's nightmare; but in practice the "Filadyne" would reach out and suck programmes from stations that nobody in this country had ever heard of! If ever the Filadyne stages a comeback I warn you—mind your ear-drums.

Concentration.

I see that during a discussion on mind training and concentration somebody cited the case of a listener who found that he could read a book aloud to somebody else as listening to—and understanding—a broadcast talk.

Not very complimentary to the broadcast talk, is it? But, on reflection this is not so very surprising, for we have all heard the converse—speakers on the wireless who seemed to be reading their stuff aloud while thinking about something else.

A Little Help.

South Africa is keenly alive to radio progress, as witness her recent re-organisation of broadcasting, her radio-equipped air services, and her beam terrestrial stations. And now I hear that the government is encouraging school radio.

Not, mark you, by easy word of mouth, but by aiding the purchase of receivers. Up to a limit of twenty of the best it will lay out one pound for every pound the school provides. This is what you might call a quis pro quo basis—and very creditable to all concerned.

On the Bright Side.

One of the British Association meetings at Norwich was devoted to television, and one of those to address the men of knowledge was Capt. A. G. D. West, Technical Director of Baird Television Ltd., whose name was often in "P.W." in association with P. P. Eccleseney’s in early B.B.C. days.

Capt. West predicted that within four years the mooks and corners of our homes now occupied by radio sets would be graced by television receivers, giving a bright picture twelve inches square. He also said that some of the most telling items would be close-ups of radio talkers and lectures illustrated by models and drawings. But that, my hearties, is not my idea of a bright picture.

Portugal’s Burn-out.

Commissionate with the listeners of Lisbon, whose fine new station building at Parede has gone up in smoke. The firemen, early on the scene, managed to save most of the apparatus of both the short- and medium-wave stations, but the studios were apparently in hopeless plight from the first, and were completely destroyed.

Two men who were in the building managed to escape. The cause of the fire is unknown. The outbreak occurred at six a.m., but broadcasting had ceased at two a.m., so it seems unlikely that the origin was electrical.

Radio Topicalities

Arrangements have been completed for a relay from the famous British motor trial event of the Mountain Championship Race on October 18th. This race, one of the most thrilling events of the year, takes place over a circuit 12 miles in length, which has been covered ten times, all cars starting from scratch.

The field is made up of some of the fastest track cars in the world—where the fact that last year’s race was won by Whiton Straight at an average speed of 78.29 m.p.h. on a course which booms two exceptionally severe bends. Running commentary will be given by F. J. Edean.

Soccer enthusiasts will be pleased to learn that there will be a running commentary on the second half of the P.A. Charity Shield match to be played at Highbury on October 28th. This annual event takes place between the current winners of the English Cup and the League champions—represented on this occasion by Sheffield United and the Arsenal respectively.

Variety will be relayed to Western listeners from the Polaris Theatre, Plymouth, on October 17th.

Billy Mander’s "full male" concert party "The Quaintones" (excluding "The Quest Six Novelty Band") will broadcast again to Northern listeners from Leslie’s Pavilion, Rochdale, on October 17th.

Variety for Scottish listeners on October 15th comes from the Edinburgh studios where the programme will be produced by Ian MacLean (comic), Horace Wilson (vocal), Janet Stewart (vocal), Robert Adams (violin), and J. H. McAndrew (guitar).

James Urquhart, Elsie Brotchie and Ian Sadler will take part in a sketch, "The Carrying Code," by Jack Mander (comedian), Horace Wilson (vocal) and Ian Sadler (vocal), and the programme will be supported by Harry Cochrane and his Band and Barbara Lacey at the piano.

New Zealand’s Back-Country Phones.

An interesting experiment is being tried out in New Zealand, where a two-way radio telephone set has been installed by Mr. A. J. Adams, on his great estate near Kaikoura, Marlborough. The home station and the back station of the property are some eighteen miles apart, in mountainous country where telephones stand no earthly chance in winter storms.

The government has given a special permit to install the telephone link, and the experiment will be watched with great interest by other landowners who are similarly placed outside the normal areas efficiently covered by the N.Z. phone service.

The Oldest Listener.

We often get these reports of infant broadcast radio telephone prodigies, but it is seldom that the veterans get due share of the limelight. So let us salute Miss Janetta Hynde, aged 107.

Miss Hynde, who is reputed to be the oldest woman in Britain, is a keen radio listener, and much prefers a good programme to the pastimes that were in vogue when she was a girl. She lives at West Kirby, Cheshire, but a newspaper man who recently went there to interview her found, to his surprise, that the lady was off and away on her holiday.

Can any other county claim to have a listener older than Cheshire’s?

News from Malaya.

IR mails are not an unverified blessing. Here’s W. C. B., of Kuala Lumpur, Malaya, S.O.S-ing me by air-mail in connection with some short-wave apparatus, and writing his eighth page letter on diaphragm dream-paper, as light as thistledown, to save postage. He writes grumpily from a full heart, but in a microscopic calligraphy that would make the bottom line of an optician’s testing board look like bill-posting by comparison.

W. C. B. tells me that there is a scheme afoot for a Malayan radio system, and the Government is now considering proposals put forward by short-wave and other amateur interests. I believe there is a lot more interesting news in his letter, but this will have to wait, since only a gimlet-eyed G-man could decipher more than a page of it at one sitting.

Droitwich Fading.

Is Droitwich getting up to his fading tricks again? I have received several letter-complaints about the long-wave, and one poem! This latter came from a Belfast reader, and begins:

"Why cannot we listen to Droitwich? To hear him is surely a right which we ought to enjoy; But, honest, me bhover, This is very seldom a noight which Brings in a whisper From that will-o’-the-wisper . . . .

and so on; the remaining verses being, unfortunately, too impolite for publication!

However, if Droitwich really is starting to fade again, as he did last year, I cannot blame any correspondent for cussing. Get it off your chest, say I. Repress nothing. But—and this is important—address your letters on the subject to the B.B.C., and not to me!

Ariel.
A general view of Alexandra Palace showing the dismantled tower whereon the mast for sound and vision aerials will be erected.
to become more or less bright—but always brighter than when no modulation is applied.

So much for the picture modulation. What of the synchronising impulses? These further decrease the current strength so that this can be made to act in the opposite way on the beam. That is, it can be made to further decrease its intensity—indeed, it can be made to cut off the beam altogether so that during the synchronising impulses the cathode tube is "out." That is valuable in ensuring that the synchronising impulses have no effect on the picture.

Cutting off the Electron Stream.

As it is the tube can be set to a sort of "anode bend" point. In this position only the picture modulation has effect on the screen. The line scanning, which takes place even when no picture is coming through, is hardly visible, and on the change-over from line to line or frame to frame the electron stream is cut off and the screen is dark. It will be seen in the official "dope" that the picture modulation is such that "white" is transmitted as white, and black as black.

This means that the carrier strength is increased on white objects and decreased on black. Thus, when the transmitter scanner sweeps over a light part of the picture the black. Thus, when the transmitter scanner increased on white objects and decreased on black.

The accompanying diagram (Fig. 3) gives complete details of the waveform for picture modulation and synchronising impulses. From this it will be seen that, using the arbitrary 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 190.

It will be noted that the high-frequency synchronising impulses, which are superimposed on the picture, are triangular in shape and are maintained for 8 per cent of the time taken in traversing the line, and occurs between the limits of 37.5 and 42.5. The low-frequency synchronising impulses, which is also triangular in shape, is maintained during the time that 12 lines are traced, and occurs between the limits of 37.5 and 190.

The diagram also shows that, in addition to the above 8 per cent of the time during the 10,125 lines of the frame accounted for the transmission of a line synchronising signal and the remaining 92 per cent of the time occupied by the line-modulating signal.

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, counted sequentially and horizontally at 25 lines traversed per second to complete two 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 or 5:4. Amplitude modulation is employed, which results

INTERLACED SCANNING

THE MARCONI-E.M.I. 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 line frequency is 50 per second. The transmitter will radiate signals with side-bands extending to about 2 megacycles either side of the carrier frequency. Good pictures can be received utilizing 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 waveform is shown on Fig. 9.

(1) Line Frequency.

The synchronising is interlaced, the frame and line frequency is 50 per second. The transmitted waveform is shown on Fig. 9.

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**AN "OLD TIMER'S" EXPERIENCES.**

Sir,—I have been reading with interest your readers' early experiences in radio, and thank that mine may be of some interest to others.

It is stated that the first Cunarder could be put inside one of the funnels of the latest addition to that famous fleet, "Queen Mary." I wonder how many of the latest iron-cored coils could be put inside one of the huge solenoids we used in our first crystal sets?

Well I remember as a schoolboy my excitement when we heard that 8 S 6 was soon to be open, and I got a tuning coil, 12 in. long by 4 in. diam., and wound with an enormous number of turns of enamelled wire, sliders, terminals and a pair of phones, etc. After a week of experimenting I had heard absolutely nothing, so I gave it up for a while. Then I heard of a versatile meter in "P.W." and tried again, and this time we heard the remarkable speech and music coming through the set.

Wireless shops sprung up like mushrooms then and, fortunately for me, one of the local readers' early experiences in radio, and think then and, fortunately for me, one of the local heard the marvellous speech and music coming while.

enormous number 12 in. long by 4 in. diam., and wound with an opened.

ment when we heard that 5 S C was soon to be opened. The Days of " Magic."

solenoids we used in our first crystal sets — the multitudinous those days, but we got plenty of stations, 30s. each I.

soon I had a stage of L.F. added to my grid leaks then, and found them useful, too — modern " fans " know that we used variable

And it was magic !In fact, three of the " Magics " we built are a marvel of the age.

its early Monday morning programmes whilst the other, which I also designed and tuned -in Daventry, which, to our astonishment, was enough to blow your hat off. and, lo and behold, my friend's set worked

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and tuned -in Daventry, which, to our astonishment, was enough to blow your hat off. and, lo and behold, my friend's set worked

I keep on hearing that they had got this station

then I came to one describing a " H.A.C. "

" Fancy listening to European stations every night ; we listen to America."

Then there was a wonderful occasion, months later, when I logged my first American station, W 8 X K, now W 1 X K. Perhaps that and the time, a year later, when I got a “ veri " from W 8 X K were the biggest thrills I have ever had.

Six months ago I joined the R.S.G.B., but I always read the short-wave notes and, as a result, my " shack " is quite respectable. My short-wave receivers conform to " W.L.S." definition of good sets. One has battery valves and a home-made H.T. eliminator, while the other, which I also designed and built, is all A.C. operated.

Yours truly, E. C. 4.

**ONE GUINEA FOR A LETTER!**

**FROM THE EDITOR**

WANTED readers of "P.W." to help each other. I want them to use the columns of this paper to express their views on all-and every aspect of the great hobby of radio; in fact, here is a " swap " experi-

ences ; I want them to tell about their triumphs-and their failures-with the various sets they have built. I want, in short, to encourage an exchange of views, opinions, likes and dislikes.

Send your letters for publication this time, when I listened to my first foreign station, which was Langenburg. How wonderful, I thought, to listen to a station across the sea. Well, after this came a 2-valver, also described in "P.W." On this set I logged about 10 foreigners plus, of course, the ordinary locals.

Some time after this an uncle of mine started to talk about short waves and listening to them, and asked himself, "What are these short waves and listening to them?"

Yours truly, W. S. Blunt.

**A SHORT-WAVE ENTHUSIAST.**

Sir,—I have read with interest the letters published, and here is my contribution:

It is not many years since I started wireless, and I cannot claim to have taken POPULAR WIRELESS from the first number as I am only fifteen years old. Even so, I have vague recollections of one of my father's sets in 1924, complete with three bright emitters on top. Some three years ago I built a one-valver set. This was followed by a two and then a three-valver.

A small bicycle-shed was claimed for a " den," and this soon began to look like a wire factory after an air raid. My interests turned to short-wave work. I decided to " take the plunge," and started with a single-valver coupled to the 2 L.F. part of another set. It worked, but " W.L.S." would have expired at the sight of it.

That there was a wonderful occasion, months later, when I logged my first American station, WIXAZ, now W1XK. Perhaps that and the time, a year later, when I got a " veri " from W8XK were the biggest thrills I have ever had.

Yours truly, G. W. Green.

17, Jekyll's Road, Ipswich, Suffolk.

**IT NEEDED A CHOKE.**

Sir,—Although I am only a youngster and quite new to the game I am a very keen reader of your paper.

A few days ago I built my first short-waver, a two-valver. I had only just finished it at 10 p.m., by working in candle-light. After connecting up I switched on and, well, it sounded like a tin whistle out of tune, and try as I would I could

(Continued on page 129.)
S.T.700!
The EVENT OF 1935

COMING SHORTLY!

The S.T.300, the S.T.400, the S.T.500 the S.T.600; what a remarkable series of set designs these constitute; each one a masterpiece devised by Britain's master technician. And each one a tremendous success, vastly overshadowing any of its contemporaries. These S.T. sets were, in fact, the high-lights of their respective years. And now John Scott-Taggart has produced a design which transcends even all those mighty sets. It embodies REVOLUTIONARY NEW FEATURES

which give it qualities never before realised in any receiver, factory built or home constructed.

The tremendous successes achieved by the previous wonder conceptions of John Scott-Taggart are certain to be excelled by the S.T.700, for its manifold merits are such that they will at once be apparent to all constructors.

This new S.T. set which we are privileged to describe exclusively in "Popular Wireless" is even now being demonstrated to constructors up and down the country.

LOOK OUT FOR THE S.T.700
On The Short Wave

The Superhet

On this page W. L. discusses the use of the Superhet for short-wave broadcast, and gives details of some practical features in the design of such a receiver.

Of course, I know I'm here to be shot at, but why should two readers write on one week and talk about my "insane prejudice against the superhet"? It really isn't kind, and it certainly isn't true! My prejudice is against the bad superhet, and as quite a number of those I have seen appear to come in that category, perhaps I had better air my views on the subject.

The good superhet is absolutely untouchable for loudspeaker short-wave reception. I don't think anyone will deny that.

The point where all the trouble arises is the frequency-changer. The days of designing one's own I.F. couplings are over, and several excellent specimens of 450 kc. transformers are on the market. That frequency seems altogether admirable for short-wave work, and we shall do well to stick to it for a while until some better method of "superhetting" is discovered.

The point where all the trouble arises in the average superhet is the frequency-changer, although the triode-hexode has done much to overcome it. I sometimes wonder how on earth we used to get away with autodynes for that job. With two H.F. stages in front of them, second-channel trouble was not always too bad, but the profusion of harmonics generated used to result in little tweets and chirps all over the place.

Let's talk about loudspeaker work—S.W. broadcast, of course—and the type of superhet suitable for it. Fig. 1 shows it in its simplest terms—a modern type of frequency-changer (the triode-hexode), one I.F., and an anode-bend second detector, resistance-coupled to whatever L.F. you like to pile on the end.

The detector and oscillator tuning control can be ganged, a small trimmer being connected across the former. The I.F. may utilise a variable valve and A.V.C. from a later stage in the set; but, personally, I'm not very fond of A.V.C. for short waves. It has such a lot to do, what with "man-made static" in the form of sudden "cloriks," steady background noise and fading.

The days of designing one's own I.F. couplings are over, and several excellent specimens of 450 kc. transformers are on the market. That frequency seems altogether admirable for short-wave work, and we shall do well to stick to it for a while until some better method of "superhetting" is discovered.

In this way real electronic mixing occurs with a negligible amount of "pull." The danger of the "pull" with the heptode was that its existence was never really noticed if the two circuits were ganged together. This was all very well for the operator of the set, but it really resulted in a loss of efficiency through the fact that the detector circuit was never really in tune by the time the oscillator was in. Battery-set users have still to be content with a heptode, but we are looking forward to the appearance of a triode-hexode for battery operation in the near future.

One important point about the frequency-changer is that the oscillator should produce smooth oscillation throughout the whole of the wave range it has to cover. To secure this, it is advisable to provide a fixed condenser (C4 in the diagram) of about -0001, earthing the end of the reaction coil at a point as near to the actual coil holder as it is possible to get.

True, that same point is earthed by a de-coupling condenser higher up in the circuit diagram, but that condenser may be a long way off in the actual lay-out, and it may not be non-inductive.

Resistance and Condenser Values.

Again, the grid leak must not be too high a value. Some people recommend 50,000 ohms. I generally find 100,000 ohms or 25 megohm suitable. The condenser C3 may be of the conventional size—0001.

Transferring our attentions to the third valve in the set, which is the second detector and an ordinary "HL" type triode, a word about its coupling circuit may not be amiss. If resistance coupling is used there should not be a circuit which would extend for an H.F. choke in its anode circuit, providing that a condenser from anode to grid is put in.

This (C5) may be of anything up to about -0003, but should not be bigger, or it will by-pass some of the audio which should be handed on via C6 to the amplifier. C6 will be a bigish grid-condenser of 006 or 01, unless the set is so selective that some L.F. compensation is necessary. Even in that case it is better to start with a "straight" first stage and to do the "cooking" farther on.

Here we have, then, the three valves forming the basis of a pretty good superhet. If we want to improve it we must add valves, and I must say that I would sooner add signal-frequency H.F. than more I.F.—for the first valve, at any rate. If I were allowed to add too, I should certainly put in one H.F. stage and one more I.F., rather than two of either kind.

I don't think I should attempt to gang all three controls together when an H.F. stage had been installed. Of course, there is no enormous difficulty in tying all three together, but it does make the initial trimming a tricky business, and one really wants self-contained trimmers on all the coils.

Fig. 1. Here is a typical short-wave superhet circuit using a triode-hexode frequency changer.
Clubs

response.
ployed Men's Clubs, makes an appeal to me
and I hope my remarks will put them on the
screened -grid stage. I shall be dealing
readers really want to enlarge the set, I
T
ON THE SHORT WAVES-let
J. M. S., they're difficult places. to
in these, notes,
20 metres.
This looks like a Heaven-
ning of the various multi-range short-wave coil
units now on the market, as he would like to
try one in his " B.C.L. " Two. There's no
doubt that they are all vastly better
that the older types, and I don't suppose
you would notice any loss of efficiency over
the four-pin plug-in type.
H. J. F. (Hounslow) says kind things
about the " Simplex " Two, and inquires

Have You Any Old Components?
I am wondering whether there are any of
our readers who possess old short-wave
components or wireless gadgets of any kind
that they would care to send to me for
distribution to the clubs. I shall be dealing
with a simple unit of the kind next week,
and I hope my remarks will put them on the
right track.

Mr. Miles Davis of the Rhondda Unem-
ployed Men's Clubs, makes an appeal to me
which, I am sure, will meet with a good
response. I will quote from his letter:

"In several of the Unemployed Men's
Clubs associated with this settlement
short-wave groups are being organised this
autumn.
I need not remind your readers of the
ease with which it is possible to pass idle
hours with simple short-wave equipment.
In this Valley to-day thousands are trying
to meet a situation of enforced idleness.
There are many unemployed readers of
your paper who are—merely readers. They
cannot afford to do or build.

Some of the Q.S.L. cards received by W. P. G. Sadler, of Stamford Hill, London, in confirmation of his reception on the simple short-wave receiver seen in the photograph.

WHERE TO HEAR . . . WHEN TO LISTEN

Since the last notes that appeared under
this title dealt with summer conditions
I think the time is ripe for us to re-
adjust our ideas and to get used to the fact
that we are now well on the autumn
season of dark evenings and early fade-outs.

The best of the shorter wavebands
while they are good; 16 metres fades out
quite early every day, but during the hour
or so prior to that time—3 to 4.30 p.m.
or thereabouts—it is extremely good.

A Point to Note:
The 19-metre band is terrific at present
until 7 p.m., or a little later. By the time
this is in print I expect the fade-out will
have become noticeably earlier.

The main point about short-wave recep-
tion at this time of the year is to make sure
that you don't waste any time on a "dud"
waveband. If you listen round on 19 metres
at 7 p.m. and don't hear anything, don't
waste time trying to squeeze transmissions
out of nothing, but rush on to 20 or 31
metres, and make the best of whatever
is happening.

The 49-metre band will be the mainstay
of short-wave reception for people who
can't manage the early evenings. At 11
p.m. it appears to be almost at its peak.
In the summer we have to wait till the small
hours to get anything really good out of
this band, but all that is changed in the
winter, and if you have a rooted objection
to being out of bed after midnight—well,
you needn't.

W 2 X A D (19.56 metres) has not
changed his schedule from the old 8-9 p.m.
period at the time of writing. I expect
something earlier will come along very
shortly. His Sunday transmission from
4.30 p.m. onwards is a godsend for short-
wave listeners who miss him during the
week.

Incidentally, if you have the patience to
follow one transmission for a while, you
may plot some beautiful curves on W 2 X A D
from 4.30 p.m. until 9 p.m. or after. A
series of these, showing how much earlier
the fade-out is on each Sunday, makes
interesting data.

South Americans Easy to Receive. V K 3 L R
(Melbourne) continues to come in well on the
31-metre band on weekend mornings. V K 2 M E's
two Sunday transmissions (morning and afternoon)
are still very good.

If you want South Africa you must
listen for Nairobi and Johannesburg during
the early evenings on the 40-metre band.
For India, almost your only hope is
Bombay, V U B, in the 31-metre band on
Sunday afternoons.

South America is too easy—the 40-metre
band is full of it every evening. Incident-
ally, the South American amateurs are
extremely good on 20 metres, and quite
a number of them are on telephony.

The 40-metre amateur band is interest-
ing at any time from 5 p.m. round to 7 a.m.
the next day. " 20 " is only active between
mid-day and 6 p.m., or thereabouts.

With regard to the other bands—listen
whenever you can. There's always something
doing. W. L.
In this second special article, "Uncle Jeff" takes us a step farther on the path towards perfected broadcasting. He describes the founding of the B.B.C. and his first meeting with a certain Mr. Reith.

As shown in this letter, the B.B.C. has been in its infancy only a few years. It is interesting to note how much difference a few years make. In those days, when the B.B.C. was just a small department with a few staff members, the job of broadcasting was not easy. However, with the passage of time, the B.B.C. has grown in size and stature, and today it is the most respected broadcasting company in the world. The changes that have taken place are evident in every aspect of the company, from the equipment used to the programs aired.

The B.B.C. has always been committed to providing high-quality programming to its audience. This commitment has led to the creation of many innovative programs, such as "The Wireless Word" and "The Wireless Film Night." These programs have been well-received by the public, and have contributed to the B.B.C.'s reputation as a leader in the field of broadcasting.

In conclusion, the B.B.C. has come a long way since its founding. From a small department to a major broadcasting company, the B.B.C. has evolved and adapted to the changing needs of its audience. Today, it continues to provide high-quality programming that is enjoyed by people all over the world.
THE most familiar example of what may be called a "mechanical" high-frequency oscillator is the piezo-electric crystal which is now commonly used to stabilize the carrier-wave frequency in broadcasting. One also finds it applied to microphones where it converts applied sound waves into corresponding electric currents, as a gramophone pick-up, for similarly converting the movements of the record needle; and also, in the reverse sense, for changing the electric current from an amplifying valve into mechanical forces which drive a loudspeaker.

Another type of crystal oscillator which comes to mind in this connection is the copper oxide, or zincite, commonly used as a wireless detector. When suitably prepared and connected to a high-tension battery such crystals can be made to generate high-frequency oscillations in much the same way as a thermionic valve. The discovery of this interesting fact caused quite a stir in the early days of broadcasting when it was at one time regarded as a possible "cheap" rival to the valve. Unfortunately it turned out, however, to be uncertain and "chancy" in operation, so that it has now drifted into the limbo of forgotten things.

The magnetic-rod oscillator is the latest and perhaps the most interesting example of all. It is thrown into sustained vibration by the action of an applied high-frequency current, somewhat like the piezo-electric crystal, which also vibrates at a "fundamental" frequency under the same conditions, though the explanation of the effect is very different in the two cases.

An Obscure Phenomenon.

An iron or nickel rod vibrates owing to what is called magnetostriction. This obscure phenomenon, which is still imperfectly understood, has come very much to the front within the last year or two as a substitute for the quartz crystal for stabilizing wireless transmitters. It is also being widely used for under-water signalling from ship to ship, and for "sounding" the depth of the sea by measuring the time interval between an outgoing supersonic signal and the "echo" of the reflected wave.

Discovered in America.

The discovery of magnetostriction goes back nearly a hundred years, when an American physicist named Page first noticed that a magnet, set close to a solenoid winding, came into contact with the coil when the circuit of the latter was closed, and so emitted a slight "click." Later on, in 1899, a German schoolmaster, Philip Reiss, used much the same arrangement to produce one of the earliest forms of telephone. He rested the point of a knitting-needle against a diaphragm or resonator, so that variations in the current from a distant microphone, in passing through a coil of wire wound round the needle, caused the point to vibrate in sympathy. In this way, musical tones and even fragments of speech were transmitted over a considerable distance.

A VIBRATING ROD

In Fig. 2 an oscillator R of nickel surrounded by a magnetising coil—fed with A.C. current from an alternator A and with D.C. magnetising current from a battery B. By choosing the dimensions of the rod so that it resonates with the applied A.C. current, it can be made to vibrate violently at frequencies ranging from 100 to 100,000 cycles per second.

It must be remembered that these frequencies are mechanical, not electrical, and that they therefore give rise to physical movements of the surrounding air—or water if the rod is submerged—which are capable of producing very extraordinary effects, particularly at the higher or super-audible frequencies.

Method of Killing Bacteria.

In Fig. 3, for instance, the end of the rod oscillator R is immersed in water for the purpose of subjecting the contents of a sealed flask F to the intensive agitation. In this way it is found that bacteria and other forms of life can be killed "at a distance," and that mixtures of normally inert chemicals will promptly react on each other under supersonic treatment. Many new forms of colloids and emulsions have been prepared in the same manner. It is interesting to note that after a spell of intensive vibration the cork sealing the experimental flask F appears to be burnt and charred as if it had been thrust into a fire.

(Continued on page 126.)
Quality is the keynote of this fine Receiver — quality performance — quality appearance; and, manufactured throughout by the Empire's largest self-contained Radio factory, it is above all reliable.

The latest application of the Cossor 'Super-Ferrodyna' developments, special super-selective coils, a Screened H.F. Pentode stage — and an H.F. Pentode Detector permit even greater selectivity. And with it, increased sensitivity, resulting in a yet wider choice of interference-free programmes. Hear, and prove it to-day at your usual wireless shop!

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**Name**

**Address**

**F.W. 12/10/35**

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TRIPLE SELECTOR CIRCUIT

- VARIABLE-MU SCREENED H.F. PENTODE
- H.F. PENTODE DETECTOR
- DIRECTLY-HEATED POWER PENTODE OUTPUT
- "THERMOMETER" TUNING
- 8" ENERGISED MOVING-COIL SPEAKER

**SPECIFICATION:**

- "Thermometer" Tuning with illuminated scales in wavelengths and engraved with station names. Combination "on-off" wavelength and gramophone pickup switch. Selectivity control and Volume control.
- 8" Mains Energised M.C. Speaker, 18½ (±3½) ø 1½ " 15½" with lavelite feet.
- Terminals for pick-up. Twin plug and switch for extension speaker. Station name-plate is readily changeable in the event of alterations in wavelengths.

**Price:** 9½ GNS

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**TRIPE SELECTOR CIRCUIT**

- VARIABLE-MU SCREENED H.F. PENTODE
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**Quality is the keynote of this fine Receiver — quality performance — quality appearance; and, manufactured throughout by the Empire's largest self-contained Radio factory, it is above all reliable.**

The latest application of the Cossor 'Super-Ferrodyna' developments, special super-selective coils, a Screened H.F. Pentode stage — and an H.F. Pentode Detector permit even greater selectivity. And with it, increased sensitivity, resulting in a yet wider choice of interference-free programmes. Hear, and prove it to-day at your usual wireless shop!
SENDING SOLIDS BY RADIO

The possibility of transmitting substances by radio by de-materialising them and re-building them at the receiving end is a fascinating subject for speculation. On this page J. F. Stirling allows his imagination full play, but argues that such transmission is by no means beyond the bounds of possibility.

The radio transmission of energy has long been mooted. Indeed, at the present day this achievement is possible to a very small and strictly limited extent. By radio, for instance, it is a matter of practical possibility to transmit sufficient electrical energy to light up a glow lamp situated at a distance of several yards from the transmitting apparatus. By the famous American pioneer of wireless, Nikola Tesla, who, during the latter part of the 19th century, demonstrated this feat at the present day is obviously impossible to a very small and strictly limited extent. By radio, for instance, it is a matter of practical possibility to transmit sufficient electrical energy to light up a glow lamp situated at a distance of several yards from the transmitting apparatus. By the famous American pioneer of wireless, Nikola Tesla, who, during the latter part of the 19th century, demonstrated this feat at the present day is obviously impossible. Yet the alert mind suggests that before such objects could be radio-projected some form of de-materialisation would have to be performed on them. Such a de-materialisation process would have completely upset the finely-adjusted constitution of the living organism, no matter how low down in the scale of life it might be. We can, therefore, have no idea whatever of ever being able to transmit ourselves across the Atlantic by means of radio power or of embarking upon more adventurous excursions to the moon by similar means.

In a very limited way it is even at this day possible to transmit matter from one place to another without any mechanical intervention. Such a transmission of matter takes place every time an object is electro-plated.

TRANSMITTING COPPER

The electric transmission of solids takes place every time electro-plating is carried out. Here copper is being "transmitted" from the plate on the left to the two steel articles on the right.

The current, however, suggests to the alert mind the possibility of discovering new applications of radio which, could they be hit upon and made practicable, would revolutionise the world's work. One such application, for instance, is the harnessing of radio to the task of transmitting material objects from one place to another. The feat at the present day is obviously impossible; but—what knows?—the time may come when such wonder transmissions constitute part and parcel of everyday commercial life.

An Interesting Conjecture.

Since the world began man, if he wishes to move an object from one place to another, has been constrained to carry it himself or to utilise some mechanical means of accomplishing its transport. The locomotive, the electric motor, the internal combustion engine, the rocket—all these are merely mechanical means of transporting objects from one point in space to another. They may be improved upon during future periods, they may even be revolutionised in conception and design. Nevertheless, they all must of their fundamental nature remain the same as regards the above principle.

When we come to the possibility of transporting objects from one place to another by means of radio, however, we are conjecturing an entirely new principle in material transport, a principle which, if only it could be made practicable, would open up almost limitless possibilities.

Take, for instance, the case of an Italian firm who wish to send a consignment of marble to England. If the marble could be loaded into a transmitter and then sent through space by the power of radio to England, reappearing at the receiving end of the system in its original form, much saving in time and in freight would be gained. If butter could be transmitted by wireless from New Zealand to England or from the Irish Free State to America, not only would the many problems of preservation and storage be eliminated, but the freshness of the material would be guaranteed, since all things which travel with or by means of radio travel with the speed of light.

From England to Australia.

The invention of a suitable method of transmitting material objects by means of radio would also greatly assist the present-day infant science of interplanetary communication.

If, for instance, by a simple and non-wasteful beam-radio system we could transmit, say, a ton of coal from England to Australia, there is no fundamental reason why we should not attempt, also, to transmit coal to the moon or to our neighbouring planets, Venus and Mars. It is, however, rather difficult in this case to imagine exactly what would become of the "radioed" coal, since its reception on the moon or on Venus or Mars would necessitate the presence of a receiving station there. Probably in such an instance the coal, having been converted at the sending station into some type of sub-atomic "transmittable" form would, for lack of a suitable receiver on the extra-terrestrial domain, continue to remain in that condition for ever. Matter, therefore, although not annihilated, would have become permanently changed in form.

Not Applicable to Live Objects.

The possibility of sending material articles over distances by radio means can only apply to inanimate objects, for it is evident that before such objects could be radio-projected some form of de-materialisation would have to be performed on them. Such a de-materialisation process would completely upset the finely-adjusted constitution of the living organism, no matter how low down in the scale of life it might be. We cannot, therefore, have any idea whatever of ever being able to transmit ourselves across the Atlantic by means of radio power or of embarking upon more adventurous excursions to the moon by similar means.

In a very limited way it is even at this day possible to transmit matter from one place to another without any mechanical intervention. Such a transmission of matter takes place every time an object is electro-plated.

(Continued on page 128.)

AN IMPROVED BATTERY

HAVE you ever been held up in your radio or electrical-testing work for want of a suitable small battery? The situation, when it occurs in an annoying one, particularly when the testing work in hand is such that the smallest current supply would suffice for it.

In all such instances quite an efficient little battery can be improvised by sticking a knife and fork into the opposite ends of a lemon. Care should be taken to see that the knife and fork do not come in contact within the lemon. Connect leads to the knife and the fork and take these leads to your testing meter. If the latter is at all sensitive a very appreciable deflection of the needle will be noticed.

A "lemon battery" improvised on the above lines will usually deliver up a current of about a hundred micro-amps. Sometimes it will give a greater current. The current, when the circuit is closed, quickly drops to about 70 micro-amps, and then remains constant at that intensity for quite a long time.

A grape-fruit, an orange, an apple and even a plum will give up a current when treated in the above manner, but usually the best effect is obtained with a lemon. A knife and fork, of course, are by no means essential for the formation of the "poles" of the battery. Any two dissimilar metals will suffice, as, for instance, an iron nail and a stout copper wire. J. F. S.

A NOVEL POWER SUPPLY

Popular Wireless, October 12th, 1935.
Did you know about these extra voltage readings with the AVOMINOR?

Sure! didn't you know?

Well, that makes the AVOMINOR more useful than ever!

The testing ability provided by the D.C. AVOMinor is perhaps greater than you imagined. To some users it was not clear that the three voltage ranges provided on the instrument can be doubled if the positive plug is inserted in the 6 m'a. socket instead of in the positive socket. This gives three additional ranges of voltage readings from 0-600 volts. Altogether the D.C. AVOMinor gives thirteen ranges of readings to enable you to test circuits, valves and power units with an expert's precision. There is no substitute for the AVOMinor.

The D.C. AVOMinor is actually thirteen instruments in one.

VOLTAGE

0-6 volts 0-12 volts 0-240 volts
0-12 volts 0-240 volts 0-600 volts
0-300 volts 0-600 volts

CURRENT RESISTANCE

0-6 m.amps. 0-10,000 ohms 0-30 0-60,000 ohms
0-120 0-40,000 ohms 0-5 0-1,200,000 ohms
0-1200 0-1,200,000 ohms 0-3 megohms

No substitute for this Safety Specified for the '1936 FERRO-POWER'

The reliability of Erie Resistors is recognised by designers and manufacturers alike. Eries are specially impregnated so as to retain stability under any extremes of heat and damp. That's why they are used in all the leading sets. Always insist on Eries.

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Erie Volume Control will give a lifetime's service. All values, 50,000 ohms to 3 megohms. Comes with built-in mains switch. £1.75.

Vital to the parachutist. That is why every item in making up the parachute is tested by lynx-eyed inspectors time and time again.

With T.M.C.-HYDRA condensers failure may not be a matter of life and death, but they are just as stringently tested at every stage of their manufacture: all possible precautions are taken to prevent failure or breakdown—that is why T.M.C.-HYDRA condensers are as reliable and as perfect as good condensers can be.

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SINGLE SIDE-BAND TUNING

An interesting method of control which makes for simplified operation and improved selectivity.

By SEXTON O'CONNOR

THE modern wireless set is reaching a stage where the weakest link in the chain of operation is introduced by the listener who uses it. No matter how well-designed a receiver may be, its performance can be reduced to the level of a ten-year-old model by careless handling—particularly by running it more or less "off tune." It stands to reason that the more elaborate the circuits are made—as is necessary to ensure a high level of selectivity, under present conditions—the more pronounced will be the effect of clumsy handling. Like any other piece of apparatus, skill in manufacture must be supported by care in operation if the best results are to be obtained.

On the other hand, the listener who has paid a stiff price for the latest thing in wireless craftsmanship does not always relish the idea of having to spend time on learning how to use it properly. Unlike the short-wave fan he finds no joy in learning the "feel" of the set, nor any pleasure in gently tickling the controls here and there to make the signals perfect.

For this reason the designer has set himself the task of making the tuning controls practically fool-proof. They must either be set precisely right—when the set will give the results for which it has been designed—or else it will produce no sound at all. In other words, careless tuning is absolutely ruled out. It still remains a simple operation because the correct adjustment is in each case indicated by a flashlamp, but "squawking" and other forms of distortion are automatically diverted from the loudspeaker.

This form of control must be distinguished from the ordinary Q.A.V.C. scheme for "muting" the loudspeaker when changing over from one station to another. This merely prevents static and background "noise" from coming through, whilst the later development is designed, first and foremost, to ensure that the set shall be tuned easily, but at the same time accurately, to any station that the listener may want to hear.

Automatic Station Setting.

In a sense it achieves the same purpose as that secured by the more elaborate method of switch-tuning, in which a desired station is "snapped in" by pushing a press-button or pulling a lever. The latter of course involves the use of some variable control—and with it the possibility of mis-tuning. But the new scheme is far more elastic, since there is no limit to the number of stations that can be received.

As used in America "automatic" tuning control is combined with a further refinement which makes for greater selectivity. Actually the set is so arranged that reception can only take place on one of the two side-bands—in other words it uses single side-band reception. This means that the tuned circuits need only pass half the normal band of frequencies, and they can therefore be made nearly twice as selective as in the ordinary set.

The fact that there are two alternative settings on which any required signal can be tuned-in, one covering the upper side-band and the other the lower, can again be used as an additional help to "dodge" interference. If, for instance, the nearest "interfering" station happens to lie close to the upper side-band, the listener simply flicks the tuner over to the lower side-band, and so gets clear of the intruder. There is the same choice of two settings on every incoming signal, and the listener selects the one which produces the best result.

Some Helpful Comparisons.

Fig. 1 illustrates the difference between ordinary and single side-band reception, and shows how each affects the final response in the loudspeaker.

The two methods.

This diagram illustrates the difference between ordinary and single side-band reception, and shows how each affects the final response in the loudspeaker.
As you will have seen, the set is built in trimming, and so forth, there are many have just returned to listen to the local. The wavelength readings are correct, and setting the trimmers and tuning scale so that the 1936 “Ferro-Power” and the speaker “Baffles.”

The set I am listening to is on a plain “Metaplex” baseboard. Two plywood runners. The chassis made from a sheet of “Plymax” and two sections. Built in Two Sections.

The terminals on both units are of the “Pop” spring variety, making unusually secure connection—an important point in a powerful mains receiver. We will deal with the radio portion first. The only control mounted on the upper (metallised) surface of the chassis is the variable condenser. The three others are mounted below on the bare wood surface—the volume controls, one for gramophone and one for radio, being fixed on brackets.

The scale of the variable condenser should be cut across the corners, otherwise these points of construction to consider.

Further details for the construction of a high quality, sensitive and selective A.C. mains receiver.

## THE PARTS THAT ARE USED FOR THE RADIO CHASSIS

- **1** Set Colvern “Ferrocart” coils, types G. 19, 11, 12, 14.
- **1** Poly. “Miller” four-star tuning-condenser.
- **1** Poly. Semi-circular drive for above.
- **2** Bulgin “Pulse” chassis-mounting valve holders, type S.W. 42.
- **2** G.F. 5-pin chassis-mounting valve holders, with soldering tags.
- **1** Bulgin “Hydra” twin wound volume-control, type V.C. 29.
- **1** Erie 50,000-ohm power potentiometer, type C.P.55.
- **1** Bulk H.F. choke, type H.F. 32.
- **2** Warele “Pop” terminal blocks, type 22/1.
- **7** Graham Parish “Pop” terminal blocks.
- **1** Bulgin 23,000-ohm power resistance, P.R.13.
- **1** Bulgin 15,000-ohm power resistance, type P.R.9.
- **1** Bulgin 12,000-ohm power resistance, type P.R.11.
- **1** Bulgin 25,000-ohm power resistance, P.R.15.
- **1** Bulgin 15,000-ohm power resistance, P.R.17.
- **1** W.T. 30-ohm baseboard-mounting potentiometer.
- **7** Graham Parfex “Pop” terminal blocks.
- **2** Wearle “Pop” mounting-brackets, type 22/1.
- **1** “Plymax” baseboard, 12 in. x 12 in., with 7½ in. wood runners.
- **2** 500-ohm, 1-watt resistances.
- **1** Bulgin 10,000-ohm power resistance, type P.R.19.
- **1** Bulgin 10,000-ohm power resistance, P.R.12.
- **1** Bulgin 75,000-ohm power resistance, P.R.13.
- **1** Bulgin 75,000-ohm power resistance, P.R.17.
- **1** W.T. 30-ohm baseboard-mounting potentiometer.
- **2** Wearle “Pop” mounting-brackets, type 22/1.
- **1** “Plymax” baseboard, 12 in. x 12 in., with 7½ in. wood runners.
- **2** 500-ohm, 1-watt resistances.
- **1** Bulgin 10,000-ohm power resistance, type P.R.19.
THE 1936 "FERRO-POWER"
(Continued from previous page.)

on the upper side of the "Plymax" baseboard.

* The fact that there is no metal surface to the underside of the baseboard necessitates the earthing of the coil chassis by means of a wire. This must be done. The variable condenser, of course, has its moving vanes automatically earthed by the three fixing brackets.

EXCELLENT SPEAKER

The W.B. "Stentorian" type E.M.W recom- mended for use with the 1936 "Ferro-Power.

It should have a 1,000-ohm field, and the ratio used on the transformer is 20:1.

Where leads on the H.F. side go through the baseboard it is a good plan to drill clearance holes right through, and then to drill away the metal surface with a drill a couple of sizes bigger. This drilling only gives the depth of the aluminium, and the leads come through clear of the metallising. This is important where grid leads and those to the fixed vanes of the variable condenser are concerned. Extra capacity to earth is not required.

Valve Holders.

The chassis mounting valve holders are screwed down on the top surface of the baseboard and plenty of clearance is allowed round the valve sockets. This is important, not only for capacity reasons, but also for safety. In the case of the

(Continued on page 122.)
DO YOU WANT TO KNOW—

The best times to listen on the various short-wave broadcasting and amateur wavebands?

How "Class B" scanning, the latest development in television time-bases works?

The correct way of tackling the problem of "man-made" static and the best methods to apply in various circumstances?

What is going on at Broadcasting House, and the latest news from B.B.C. headquarters?

How television one day help us to study the sun and to find out more about its fiery corona?

All about the way in which the valve, and especially its filament, has rapidly developed during the last 12 years?

You will find all this information and much more besides in the wide variety of articles contained in the

OCTOBER NUMBER OF

WIRELESS AND TELEVISION REVIEW

ON SALE EVERYWHERE.
THE 1936 “FERRO-POWER” (Continued from page 120.)

By-Pass Condensers.
And talking about condensers, note the arrangement of the H.F. by-pass condensers in the anode circuit of the detector. Make sure that the ‘0000 mfd. comes next to the anode, for in that position it is not only a valuable remover of H.F. from the anode circuit, in the sense that it reduces the amount that can get through the choke, but also it ensures that efficient rectification shall be accomplished by the detector valve. This condenser is “returned” to cathode and not to earth. All the H.F. chokes in the set are screened. This is important, for feed-back and unwanted coupling generally can play havoc in a set of this description. That is why I have screened the anode leads of the H.F. pentodes and arranged $V_n$ and its associated H.F. choke to act as the shield between its feed lead and 0001 mfd. condenser, coupling it to the detector grid circuit and the similar lead and condenser from the H.F. choke of $V_n$.

There are one or two more points concerning the radio chassis. One is the lead marked red “A.” This is a lead not supplied with the coil unit, as are the other red, yellow, and black leads. It is fixed by the constructor to the same soldering tag as is the red lead on coil G.4. It is brought out on the opposite side of the coil, through one of the slots, and makes connection between the anode feed of $V_n$ the coil and the grid condenser of $V_n$.

Switching-on The Set.
The main switch on the coil unit I have not used. I always prefer to switch the set on and off by the wallplug switch, rather than to run even shielded mains leads into a sensitive receiver. Those who want to use the switch on the coil can do so, however. I have the set fitted into a radiogram cabinet, with speaker and power pack below, and run a lead up to the set and back to the power pack for mains control would be very inconvenient.

One more thing: Don’t push the rod of the 80-ohm potentiometer right home through the spindle hole. If you do it will touch the baseboard and short-circuit the grid bias of $V_n$. Points concerning the power pack and operation of the set I shall leave till next week, when final details will be given.
A practical article that will be of benefit to many users of battery-operated receivers. The problem of obtaining a greater output from the loudspeaker is discussed by JOHN WAYNE.

How frequent it is that one finds the volume of sound given out by the speaker is less than is desired, and what a common thing it is for the listener to wish that he could turn the volume control just a bit farther. It is particularly with battery receivers that this occurs, since the output from a mains receiver is adequate for most requirements. And, generally speaking, it is by no means a difficult matter to obtain increased volume output by making comparatively slight modifications. For example, a different output valve will, in many cases, give precisely the desired effect, changing from a small-power valve to a pentode will often almost double the available volume.

Changing to a "Super-Power" Valve.

In passing, however, it might be advisable to "kill" a rather prevalent idea that greater volume can be obtained by putting a super-power valve in place of the existing small-power valve; this change would probably have the effect of appreciably reducing the volume. The reason for this is that the amplification factor of the super-power valve is less than that of a power valve, so that increased output could be obtained only if the input to the valve were also increased.

To change over from a power valve to a pentode is a particularly simple matter, for, as shown in Fig. 1, it is only necessary to use a five-pin valve holder in place of the four-pin holder previously employed, and from the terminal on the cap to H.T. positive.

The above is, of course, a very obvious method of achieving the desired effect. Reference was made to the use of a super-power valve, and this might be employed successfully when the detector valve is preceded by two H.F. stages, or in the case of a superheterodyne when the detector can be fully loaded, provided that the L.F. transformer becomes what is commonly known as an auto-choke, or auto-transformer.

INSERTING A PENTODE

A new fixed resistance and a .1-rafd. fixed condenser are required for this purpose. As is evident from the second circuit in Fig. 2, the transformer windings are connected in series, and the 1-mfd. coupling condenser is joined to the series connection. When these connections are employed the transformer becomes what is commonly known as an auto-choke or auto-transformer, and the effective ratio is equal to the ratio between the number of turns on the primary and the total number on both primary and secondary. Thus, if the component is rated at 1 : 5 (or 5 : 1), which is not a strictly correct method of rating the step-up ratio actually obtained by resistance feeding is 1 : 6.

With regard to the value of the fixed coupling resistance (R1), it should be explained that this depends upon the value used in the detector circuit; the resistance should have a value equal to about three times the impedance or A.C. resistance of the valve. Thus, if the detector has an impedance of, say, 11,000 ohms (an average value) the resistance should be rated at approximately 33,000 ohms, although a little variation on either side is not important. The only objection to this form of coupling is that the anode voltage now applied to the detector is reduced, so that it might be desirable to reduce the value of the decoupling resistance to "balance" this.

(CONCLUDED ON PAGE 125.)
QUESTIONs AND ANSWERS

Curing Breakthrough.

G. O. Y. (Coventry).—"I could not get the back number describing Mr. Scott-Taggart's explanation of how to get rid of breakthrough on the S.T.600 in this district, because it is out of print. So will you repeat the gist of his remarks about this trouble?"

Mr. Scott-Taggart said:—"In every case where breakthrough is experienced on the S.T.600 the culprit is a wrongly adjusted trimmer. This is a purely trimming affair and I think I can explain it best by giving an example. Suppose you are in the middle of a long and experimental war and you find that Luxembourg and Kalundborg (which is in the case of an anode coil) would drown all traces of breakthrough. If you have no aerial coupler, you will be unable to get loud breakthrough without a valve. The aerial choke is connected to the aerial terminal outside the set. The reason that different ratios can be obtained in connection with the alteration of the system pressure is because the apparatus in question has been altered. In those cases where the apparatus is altered the regulation of the system can cause the apparatus to behave differently. The copy of the Electricity Commissioners' conditions to which reference is made above reads as follows:

CONDITIONS.

Unless otherwise agreed, the Undertakers shall at their own expense carry out the necessary alterations to suit the altered system and pressure of the supply, or pay for such alteration if not carried out by the Undertakers. If the alterations are of the nature of company undertakings, the Commissioners will become the sole consumers. The undertakers shall in all cases where the local authority has given consent to the alterations the regulations of the Arbitration Act, 1889, and upon such appointment being made, the Undertakers shall be entitled to compensation for any loss or damage incurred in consequence of the alteration, and to such additional compensation as the Arbitrator shall be deemed to be a reasonable and incidental cost to the alteration of the system pressure, as the result of the alteration of the system pressure.
drop of machine oil. In its overhauled and re-trimmed condition the set was perfect.

"Soon, however, it began to show signs of mis-trimming. Having been most careful to lock the adjustments I could not understand this, and eventually I traced the trouble to the trimmer I had oiled. There must have been a little surplus oil, for a film of this had spread a little between the plates. As soon as I had wiped this oil off the set was O.K. with the same adjustment as before."

"Why should the oil, which was not touching the lower plate but only the upper one, make any difference?"

The oil, in effect, increased the capacity of the trimming condenser, and so the result would necessarily be the same as an increase in the trimming adjustment.

The incident is particularly illuminating since it shows how even the tiniest variation of trimming capacity makes a big difference to the results achieved. And it is yet another example of the ill-effects following upon oily components.

In case you fail at first to see why a film of oil should make any difference to capacity, we would remind you that the capacity of any condenser depends not only upon the active area of the plates, but also upon their distance apart, and the nature of the intervening insulator.

By wiping off the oil you restored air as the only dielectric.

INCREASING YOUR VOLUME
(Continued from page 123.)

It is fairly well known that a considerably increased output can be obtained by replacing the normal single output valve by a push-pull stage. The principal objection to push-pull is generally the necessity for a new push-pull transformer, but this can be overcome by using the simple arrangement shown in Fig. 3 when the two similar L.F. transformers are available. It is seen that the primary windings of the two transformers are wired in series and resistance-capacity fed, while the two secondaries feed the two output valves. It should be added that the two valves now used in push-pull should be of similar types, although they need not be identical, due to the fact that they can be " balanced " by adjusting the G.B. voltage applied to the two tappings. Ordinary three-electrode valves are shown in Fig. 3, but pentodes may well be used instead.

Use Low-consumption Valves.

Whether the valves are triodes or pentodes, however, it is desirable that they should be of the high-efficiency type which have a low anode current consumption. If they take more than 5 or 6 milliamps each there may be a danger of the current drain being too great for the H.T. battery.

It will be evident that when using push-pull it is essential that a suitable output transformer or choke should be used to feed the speaker, but this is not likely to prove an important consideration since most speakers now on the market are fitted with centre-tapped transformers.

The above by no means exhausts all the available methods of obtaining greater volume from the speaker, but mention has only been made of the simpler systems, for such arrangements as Q.T.P. and Chan B have been dealt with very fully in many previous articles in this journal.
MECHANICAL OSCILLATORS
(Continued from page 114.)

Fig. 4 illustrates the manner in which a magnetostriuctive rod is needed to couple the plate and grid coils L, L1 of a valve generator V. The resulting oscillations are so constant in frequency that they serve as a carrier-wave, "control."

It should be explained that the magnetostriective effect is reversible. On the one hand, an increase or decrease of the applied magnetising current produces an alteration in the length of the bar. On the other hand, any physical expansion or contraction of the bar alters the intensity of the magnetic flux inside it.

The action is, in fact, on all fours with that of a piezo-electric crystal, though the cause is different. The advantage of the red oscillator lies in the fact that it is more robust than the crystal.

It is thought that the actual expansion and contraction of the bar is due to the gradual rotation of the atoms of the bar under the influence of the magnetising field. If the atoms are assumed to be slightly elliptical in shape they will clearly take on more or less space, according to their orientation.

Although excessive noise is one of the crying evils of modern city life, it is possible that "supersonic" sound waves of the kind produced by magnetostriuctive oscillators may prove to have a beneficial effect in medicine.

NOTES ON TELEVISION

WE, as a country, are at the present time in the curious position of being extremely television-minded, and having no transmissions whatever on which to exercise our powers, and it seems that the public time is best spent on experimental work concerning the ultra-short waves.

Just about the one thing that is certain is that the public television service, when it does finally arrive, will be on an ultra-short wavelength. Many of us are already pretty well experienced in the handling of these very high frequencies, and some of us have even gone so far as to get superhet working on them.

In the U.S.A., even for short-distance amateur-hand working, there is a distinct tendency to discard the once popular "super-regen" and get down to superhet operation.

Incidentally, it is more than interesting to note that the Federal Radio Commission of the U.S.A. is refusing to throw the ultra-short wavebands open for commercial use.

They are to be treated, for another year at least, as an experimental field only. One can just see what would happen if they were thrown open for ordinary communications! Thousands and thousands of small concerns would be set up, and these would use them for purposes now served by the telephone, and there simply wouldn't be a spare kilocycle left within a week.

A Reserved Waveband.

A large slice of the ultra-short waves—probably nearly half of the order of the megacycles (6 to 9 metres)—has obviously got to be internationally reserved as a television band.

At the rest—well, I have always maintained that the great wide open spaces below 3 metres or so would find some use, and I believe television is going to be down there, too. In passing, it is interesting to note that amateurs applying for permission to use the 112 and 224 megacycle bands (roughly 2,5 and 1 metres) are being told by the G.P.O. that their applications are being held up, pending discussion with the Government departments interested in the use of these frequencies.

L. H. T.

“SOAP-BOX” DAYS
(Continued from page 113.)

artist. The result of course was obvious—practically every concert organisation barred broadcasting.

I think that the majority of singers were very keen to help with the new toy, but naturally they could not afford to risk losing their livelihood. I remember on one memorable occasion I had in one evening's programme four out of five artists rang up at the last minute to tell me that their agents had forbidden them to sing!

Oh, yes, we had fun—but was it worrying at times? This "guinea business" was only a ten per cent. venture, it created a very bad misunderstanding.

Cecil Lewis was appointed as assistant to Burrows as Organiser of Programmes in November. Cecil and I worked together in the closest co-operation and there was many a "victory" we won together. With Burrows we inaugurated the Children's Hour—London— and I think the credit for starting the first Children's Hour in the country goes to Percy Edgar, now Director of Midland Regional, then 5 IT.

The Children's Hour was the one time of the day when one could relax and enjoy oneself after a heavy day's work. There was practically no organisation as such in this hour in those early days, and I'm afraid on occasions the children were regaled with an entertainment that wasn't always of a juvenile character; but we enjoyed ourselves, and from the letters we received our listeners were obviously also having a good time.

EUGEN J. FORBAT, 28-29, Southampton Street, Strand, W.C.2.

Popular Wireless, October 12th, 1936.
BARRY KENT
CALLING
News and Views from the "Big House."

Second Thoughts.

BEFORE Colonel Alan Dawney left the B.B.C. he induced Sir John Reith to make a general tempering of the office discipline. For example, there was to be more latitude about holidays, less work on Saturday, and the summer closing hour of 5.30 was to be extended over the winter for the main staff.

Apparently there were "second thoughts" about the wisdom of this relaxation, because now I hear that Sir Charles Carpendale has issued a warning that the modifications are only experimental and will be only during good conduct. The official words are as follows: "It must be understood that the concessions are experimental and may be withdrawn if experience shows it to be undesirable."

The Ricketts Affair.

The cancellation of Mr. Ricketts' broadcast to America from a studio at Broadcasting House nearly wrecked the newly established entente between the B.B.C. and the Columbia Broadcasting System which Mr. Paley had come to London to seal. Columbia simply asked the B.B.C. for the usual courtesy facilities of a studio. The B.B.C. agreed, provided the United States Embassy was agreeable. There was no objection from that quarter and the arrangement went ahead.

Everything was in order until the British Foreign Office suddenly heard of the broadcast. Sir John Reith was rung up at his home in Beaconsfield and asked to try to stop the broadcast. So it was stopped, much to the perplexity and consternation of many people in America.

Empire Children's Hour.

I must keep up my record of giving you each week at least one item of exclusive "red-hot" news. Well here is one for this week. The B.B.C. is going to start an Empire Children's Hour for the short waves.

The Royal Wedding.

The arrangements for the broadcast of the wedding of H.R.H. the Duke of Gloucester and the Lady Alice Montague-Douglas-Scott will be in the hands of Mr. Lotbinière, the new Director of Outside Broadcasts. This will be the first event of the kind in the past ten years which Mr. Gerald Cock has not handled. The latter, of course, is now concentrating solely on television.

Special Armistice Sunday Relay.

An effective answer to the accusation that the B.B.C. has become anti-Jewish in policy is provided by the announcement that on Armistice Sunday, November 10th, at 4 p.m., there will be in the National programme a special relay of a Jewish Ex-Servicemen's Remembrance Service from the Horse Guards Parade, London.

The Ullswater Committee.

The report of the Ullswater Committee has now been twice round the members of the Committee, who in this way have had a chance of studying all the amendments and counter-proposals which the reflection of the holiday period has provided. The report is to be ready to issue as a White Paper as soon as Parliament reassembles.

I have heard nothing to confound my original forecast of the main features of the Report. The constitution of the B.B.C. will remain very much as it is. There will be a recommendation of the grant of another million pounds a year from licence revenue with specific conditions and directions about television; there will be a cautionary clause about the extension of publishing activity; and there will be new proposals for the representation of the B.B.C. in Parliament.

B.B.C. and the Territorials.

The negative attitude of the B.B.C. towards recruiting generally and towards the Territorial Army in particular has always been the subject of grievance in military circles. I hear that this is now about to be put right. Recruitment for all the armed forces of the Crown is to receive carefully planned stimulus from broadcasting. This will bring Britain into line with most of the other Great Powers.

The Problem of 'Ideas.'

The B.B.C. is now having to deal with a problem of payment for ideas and 'brainwaves' that may be sent in by people who are not entrusted with carrying them out. There has been no regular rule in the past, but the matter is now being regularised.

GET THIS
IMPROVED REPRODUCTION
FROM YOUR SET!

VOLUME—20% GREATER
The improved—and larger—"Mansfield" magnet brings a substantially higher sensitivity. The increased loudness not being obtained at the expense of "balance," is comfortably accommodated by the ear. It materially increases the "realism" of the performance.

BASS RESPONSE—FULLER AND 15 C.P.S. LOWER
Measurable bass response goes 15 c.p.s., lower than previous models. Audible response—that part of the bass which is at audible frequency and reaches audible volume—is in these new models much more loudly reproduced. "Thus the "bass background" is stronger and more colourful.

HIGH NOTE RESPONSE—900 C.P.S. HIGHER
Due to the stronger magnet, new hand-made cone, and larger section-wound, interleaved transformer, far brighter and cleaner reproduction of high notes and overtones has been achieved this year. This does not imply shrillness—in fact objectional high resonances are conspicuous by their absence.

ATTACK—CLEANER AND CRISPER THAN EVER BEFORE
That "forwardness" of tone and the clean, instant response to transients which are so important to realism in reproduction, are, in this new speaker, present to a remarkable degree. Cone material, transformer, and the new accuracy of assembly are chiefly responsible.

The simple substitution of this advanced speaker for your present instrument will bring to your radio increased volume and a new amazingly colourful realism. Ask your dealer to demonstrate to-day, and hear for yourself!

PRICES

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STENTORIAN
Whitley Electrical Radio Co Ltd. (Information Dept.), Mansfield, Notts.
**ON THE AIR**

Our broadcasting critic gives his views on the recent programmes.

"**BAFFLES.**—The Amateur Bateman" was an amusing cricket-cum-crook story of misunderstanding between an accomplished burglar and a simpleton of an accomplice. The letter was played by Claude Danperier. Bobby Colmer was the crook. A promising partnership. "Baffles" has designs on Lord Ambergrosses plate. To the fathead Lord Ambergrosses's plate couldn't be anything other than his lordship's dinner plate. The dialogue was very amusing, cleverly written and applied equally well to both plates. The result was definitely funny. You know the sort of thing.

A Good Production.

"Puritan Lullaby," which I believe was a revived production, was also good. I don't think I heard the original, otherwise I couldn't be as enthusiastic as I am over it. I didn't anticipate anything quite so good in the ABC. Probably because this was because it was called an operetta. But the cast attracted me. It was evident early in the production that here was something uncommonly fine in the way of operettas. Every phase of the show was excellently polished: the singing, the spoken parts, and the B.B.C. Theatre Orchestra. In fact, I feel inclined to award the palm to the orchestra for its remarkable restraint and sympathetic playing. The B.B.C. Theatre Orchestra has always shown quality, but never has it appealed to me more than it did in "Puritan Lullaby."

Stuart Robertson is a versatile artist. As Wottawmat he sang with his usual clarity, even if the rhythms were less usual. His Indian-aside-de-camp (it was never clear who this was) was just as good. George Baker (Miles Standish) Webster Booth (John Alden), Natalie Hall (Priscilla) all sang and spoke beautifully. "Puritan Lullaby" was an interesting situation which was told in a peculiarly way very suited to broadcasting. The only fault I had to find with the operetta was the large proportion of songs. The libretto suffered. I like a 50-50 proportion, especially when the speaking voices of the actors are attractive. The individual songs, too, were rather long, and in places they struck me as being a bit tautless. As, for instance, in Miles Standish's opening "letter" song.

The Indian music (sols and choruses) were well conceived and executed. Humour wasn't absent. I chuckled over the "Give 'Em Merry Hell, Blast 'Em!" and "Stay Awhile," etc. Scores of vocalists are charming these songs daily at us, and the tunes are beginning to pall. We are becoming unappreciative of them. But not when Arthur Tracy sings them, even at this advanced stage of their existence.

The Street Singer.

Whatever "It is," Arthur Tracy, the Street Singer, has it. One notices this "It," particularly when he sings such songs as "Red Sails In The Street," "Lovely To Look At," "Stay Awhile," etc. Scores of vocalists are crowning these songs daily at us, and the tunes are beginning to pall. We are becoming unappreciative of them. But not when Arthur Tracy sings them, even at this advanced stage of their existence.

Arthur Tracy's 15 minutes were 16 of the very best. James Hyrerenforth announced one song in some well-chosen words relevant to the profession of the street singer to a reminiscence, of the medieval troubadour to whom, so the speaker almost suggested, the street singer has an affinity. Altogether this was a complete and attractive presentation.

The most significant of the fare that same evening was undoubtedly the sound pictures of the Hungarian capital, called "Night Falls In Budapest." Those responsible for these broad-casts admit that they are experimenting. If the experiment proves successful we are promised more. It is encouraging to find that fresh avenues of entertainment are being explored.

Experiments are imperative if broadcasting is to continue to entertain the masses.

Clodoasly Breton's second talk on the "Genius of France" was just as good as his first talk. Now he has crowded into his treatment of the subject an even more of French literature into such a comparatively short talk was a masterly example of compression. I was unacquainted with this English author, and his concise descriptions of them.

"Music Hall" on Saturday night made its return with a bumper bill. I hope the standard will be maintained, and thus bring Saturday night listeners move into tune with Saturday night moods.

C.B.

**SENDING SOLIDS BY RADIO.**

When an article is to be electro-plated—let us say copper-plated—it is suspended in a bath containing a solution of a copper compound. If the article to be plated is a plate of metallic copper. The copper-plating and the article to be plated are connected to opposite poles of an accumulator. A current thus flows through the solution.

Transposition of the Metal.

Now the remarkable thing about this current is that it carries along with it tiny particles of copper from the copper-plating, and deposits them on the surface of the article to be copper-plated. Finally the distance between the copper-plating and the article to be copper-plated is not more than a foot or so. Nevertheless, if the two plates were five miles apart or even fifty miles distant from each other, the copper particles would be carried through the solution in just the same manner, always supposing, of course, that the driving force of the external battery or accumulator was sufficient.

If such analogous processes could be applied to material objects and, instead of being transmitted more or less slowly and piecemeal through a special liquid solution, they could be rapidly transmitted through the ether, the problem of transmitting objects by radio would be solved.

A Very Involved Subject.

Such a problem, however, is not for our generation of scientists and technicians. Before it can even be attacked we must know more about the inner nature of the atom. We must know whether it is possible to change a lump of material into an invisible sub-atomic form, and then, at our will, to reconvert it into visible matter again. And, when only when, it is found possible to accomplish this feat will the transmission of matter by means of radio be made possible, for such an accomplishment involves the de-materialisation of the object to be transmitted into sub-atomic form, the sending of this form of matter by means of radio energy, and, finally, the reconstruction at the receiving station of the reconstituted matter into its original material condition.

The problem is an enormous one. Yet it is fascinating. It makes it still more interesting is the fact that, in the light of present-day scientific knowledge, the idea does not go counter to any accepted scientific principles.
modulation component) is transmitted as an ampli-
tude-modulated sine wave which is associated with a
definite brightness. This has been called intermittency and results in there being no
fixed value of average carrier, since the average
of the sine wave remains constant. Intermittency,
frequency transmitter output is specified in what
form it takes the peak value: this percentage is in terms of current (or voltage) and not
in terms of power.
(9) 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 to effective zero carrier. Signals below 30 per cent. of peak carrier represent
signals below 30 per cent. of peak carrier represent
synchronising signals. Signals between 30 per cent.
and 100 per cent. of peak carrier are rectangular in shape and extend downwards from
synchronising signals. Signals above 100 per cent.
of peak carrier are transmitted as an ampli-
(10) Line Synchronising Signals.
The line synchronising signals comprise a train of
synchronising pulses, each occupying four-thousandths
of a line and having one-tenth of a line interval of black.
(11) Frame Synchronising Signals.
The line synchronising signals are of one-thousandth
of a line, and are followed by a minimum of
20 microseconds of a line of black and per cent. peak
carrier. This method of interlacing differs from the
Baird system (where no vision signals exist) and above which no
mission of a black border round the picture.
2 frames since leaving A and, as 2 frames occupy the
scanned area with the distance between the
mains.

FROM OUR READERS
(Continued from page 100.)

not get it to stop. In charged the whole
family. "What's up?" they yelled. Lucky
for me I had just switched off, otherwise
my labour would have gone through the
window.

Anyway, after a long sermon from dad I
went to bed in a very sad frame of mind, with
an ideas in my mind to check it.

Another Circuit Tried.
But next morning being Saturday, I tried
again by taking it to pieces and building an-
other circuit altogether. This time I made
a home-made choke, which consisted of 150
turns of No. 36 wire, wound on a test tube
(which I got from a chemist for 2d., and which
I mounted on the backboard with a cork
and Peto-Scott Walnut Table Cabinet,
Cash or C.O.D. Peto-Scott Permanent Magnet Speaker, Type .91,
Cash or C.O.D. Peto-Scott Baby Model .3A, Cash or C.O.D. Peto-Scott
Baby Model .3A, Cash or C.O.D. Peto-Scott 1936 Radio Receivers; Speakerand Accessories; Short Wave; " Easiway

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IMMEDIATE DELIVERY CASH, C.O.D., or P.O.
THE LINK BETWEEN
By G. T. KELSEY.

I am very glad to notice that my "throw-out-the-duds" campaign, which appeared in these notes last week, has already taken effect. Up to the time of going to press with this issue, there has been quite a brisk demand for the set catalogues which I mentioned, and that, I imagine, is only the start of it.

As a matter of fact, since writing those notes I have returned to my holidays, and one of my first jobs has been to make some further inquiries in authoritative quarters as to the prospects of lower-priced sets. I might have saved myself the trouble, for everywhere my inquiries have been met with the same reply, "Not a chance in a million."

The catalogue covers the whole of H.M.V.'s existing range, and, to quote from their own introduction: "The production of this catalogue is the result of many years' experience, combined with the highest scientific knowledge, which has been carefully revised by H.M.V.'s experts in every detail."

The catalogue is beautifully printed throughout in photogravure and the cataloguing limitations are indicated on each page.

Incidentally, may I remind you that the catalogues which I mentioned last week are available for one shilling each. The application is advised. Just quote the number I give in black type at the end of my catalogue descriptions. That is all. (373.)

For "P.W."

Football Enthusiasts.

I do not know how many of my readers are interested in League football, but I imagine quite a number. In any case, I think it was a very happy thought on the part of Siemens to include at the back of their "Full O'Power" battery catalogue a complete list of the League fixtures for the present season.

It means that those who possess the catalogues are likely to refer to it constantly until the beginning of May, and that is the clearest proof of keeping the name of "Full O'Power" prominently in the front, I should like to know what it is. This pocket-size reference book is another one for which I think that applications are likely to be heavy, and I do advise you to send in your post cards promptly. (374.)

For the Constructor.

The quick detection of faults in a set, there is nothing to equal a meter test. When meter prices were high there was perhaps an incentive to the employment of the "hit-and-miss" method of fault detection, but nowadays reliable meters can be obtained at very reasonable rates. For instance, I have just glanced through the catalogue in which it was described as the "Avo" meters, testing instruments, and that constitutes a striking argument in support of my new instrument.

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I propose to include this brochure in our post card literature service, but early application is advised. Just quote the number I give in black type at the end of my catalogue descriptions. That is all. (373.)

LISTENING TO ADDIS ABABA

Despite all the rumours of high-power broadcasting of propaganda from Addis Ababa (writes W. L. S.), I have not been able to trace any transmission from the Abyssinian capital except from the existing 2-kw. station E.T.A., working on 7620 kc. (about 39-5 metres). This station, which has hitherto been working only on C.W., seems to have been equipped for telephony during the last few weeks, and transmissions are heard on this wavelength after dark, and occasionally on about 15 metres during the late afternoon and early evening.

No propaganda has been heard, but new bulletins are certainly put out, the languages used being some African language and rather doubtful French.

The 16-metre transmission (just below the 16-metre broadcast band) is easily found by first identifying W.3 X A L, or 16-87 and tuning slowly downwards. It has usually faded out by 5 p.m.

The 39-5-metre transmission is much weaker, and is badly interfered with by a powerful station transmitting pictures, which every short-wave listener must have heard. The irregular high-pitched whine is easily recognised when once it has been heard.

Other "marker" stations in the vicinity of Addis Ababa, 11-50 kc., are Zeesen, 13-8, Y., on 7257, Ongar, 5 O Q, on 7500, and Pontoise, 5 Y., on 7700.
TECHNICAL JOTTINGS

Items of Interest to every enthusiast.

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

Suppression Devices.

Amongst the firms that are now specializing in devices for the suppression of electrical interference with radio reception is the Telegraph Condenser Company, known to all radio users for their famous T.C.C. condensers.

They are now marketing a special unit for this purpose, which consists of a pair of non-inductive condensers, of a capacity of one microfarad each, with fuses in series, a terminal being provided for connecting the centre-point to earth.

In an article on the subject for the makers say that interference with radio reception, which is heard as a series of crackles, clicks, sizzling and other noises, either continuous or intermittent, coming from the loud-speaker, arises from sudden changes of current in various types of electrical apparatus such as motors, fans, vacuum cleaners, refrigerators, flashing signs, etc.

How Interference is Radiated.

The sparks cause either waves to be radiated in all directions, and if these should reach the receiving aerial, at a strength comparable with that of the waves from the broadcasting station to which the set is tuned, then interference will be experienced.

The strength of the interfering radiations decreases very rapidly as they travel away from the source, except near metallic conductors, along which they travel with great ease. Thus, although interference due to direct radiation occurs only in the immediate neighbourhood of the offending apparatus, the disturbances may be carried along the electric supply mains to considerable distances.

Experiments in Germany.

Messrs. T.C.C. make the interesting statement that recently investigations have been made at Baden Baden, in Germany, where an attempt has been made to suppress interference as thoroughly as possible on a voluntary basis. Special facilities were provided to encourage owners of interfering apparatus to have the cause investigated and suitable corrective devices installed, and with a few exceptions it was found that condenser units only were quite adequate. The tests from the fact that 7,727 condensers were used, while only 300 other devices, such as chokes, or combinations of chokes and condensers, were found necessary.

Atmospheres are Different.

Those of you who are troubled with interference from artificial sources (not to be confused with atmospheres, which are quite different and are not cured by a unit of the above-mentioned type) should get a copy of the excellent T.C.C. pamphlet on interference suppression; this can be obtained (Continued on next page).
Let Us Send You This 40-Page Booklet—Free!

It gives full information regarding various I.C.S. Courses of Instruction in Radio work.

The Radio Industry is progressing with amazing rapidity. Only by knowing thoroughly the basic principles can one hope to keep up with it. I.C.S. Instruction includes American broadcasting as well as British wireless practice. It is a modern education, covering every department of the Industry.

OUR COURSES

Included in the I.C.S. range are Courses dealing with the installing of radio sets and, in particular, with their Servicing, which to-day intimately concerns every wireless dealer and his employees. The Equipment Course gives sound instruction in radio principles and practice.

There is also a Course for the Wireless Salesman. This, in addition to inculcating the art of salesmanship, provides that knowledge which enables the salesman to hold his own with the most technical of his customers.

Then there are Preparatory Courses for the Oily and Guilds and I.W.T. Exams.

We will be pleased to send you details and free advice on any or all of these Courses. Just fill in and post the coupon, or write in any other way.

Radio

International Correspondence Schools, Ltd.
Dept. 161, International Buildings,

Without cost, or obligation, please send me your Radio booklet of information about the Courses I have marked X.

☐ COMPLETE RADIO
☐ RADIO SERVICING
☐ RADIO EQUIPMENT
☐ RADIO SERVICING AND SALESMANSHIP
☐ WIRELESS ENGINEERING
☐ EXAMINATION (State which)

Name

Address

Age


S. T. 700

As announced last week, we have secured for Popular Wireless the exclusive publication rights of an amazing new receiver—the S. T. 700—produced by Britain’s leading designer,


This will be the greatest set of the coming year—a worthy successor to the S. T. 300, S. T. 400, S. T. 500 and S. T. 600.

AMAZING DEMONSTRATIONS!

Amazing demonstrations are in progress, including some at only one mile from the Brookmans Park stations. Will any reader who would like to hear the set before publication and who could attend one evening in London, Birmingham, Manchester or Glasgow, write immediately to Mr. John Scott-Taggart, c/o Popular Wireless, Tallis House, Tallis Street, London, E.C. 4. State your present set and results obtained. Both experts and those who have not experienced real success will be welcomed. Do not omit to write because you expect us to receive thousands of applications.

Mr. Scott-Taggart also would like to hear from a few Glasgow and Manchester readers who would permit a demonstration in their homes to fellow readers.

PUBLISHED OCTOBER 30th!

As a result of all

rectifying. Another modulation effect which has been troubling is that of the "modulation hum" and becomes more prominent with certain definite settings of the tuning. This is produced by a high-frequency component in the mains supply which gets modulated by the mains frequency.

Sensitivity of the Moving Coil.

In view of the great popularity of the moving-coil speaker, many people think that this type of speaker is much more sensitive than any other. In point of fact, the balanced armature speaker is one of the most sensitive of all types of unit, and although it is not so commonly used as the moving-coil, it is used to a far greater extent than many people imagine.

When using a moving-coil speaker it is very important to match up the speaker to the output valves—that is to say, there must be the proper relationship between the impedance of the speaker and the impedance of the output valve. A few years back, when loudspeakers of fairly high impedance were used, it was common practice to introduce the speaker directly into the anode circuit of the output valve of the set. The impedances of the two may not have been anything like equal but they were, broadly speaking, of the same order.

Pentode Impedance.

Then along came the pentode valve with its high impedance. This upset things, and matters were made still worse when the moving-coil speaker arrived with its relatively low impedance. As a result of all this it has become the general practice to use an output transformer, the primary of the transformer having an impedance suitable for matching with the output stage of the set, whilst the secondary of the transformer is, of course, adapted to the impedance of the loudspeaker. In a great number of loudspeakers to-day, especially moving-coil speakers, this transformer is supplied as part of the speaker, so that all the user has to do is to connect up the terminals of the speaker to the output of the set.

Overloading Valves.

In order to avoid distortion it is very important to steer clear of overloaded valves or a poor quality transformer. A worn-out valve will often give a similar effect to overloading. If the valves or any of them have been in use for perhaps two or three years, it is time that you tried replacing them with others, to see that they are still giving their best.

Another point to bear in mind is that modern sets generally require a fairly high H.T. voltage in the output stage, and if you have the means to use a little extra H.T. voltage it is even worth while to adapt the output stage to match it. I do not mean merely to apply more H.T. voltage to the present output stage, but to alter the output stage so that it is capable of using a higher H.T. voltage.

SHOWS UP DEFECTS.

As between a moving-coil speaker and a balanced armature, you will in some conditions find that the balanced armature gives you a greater volume for the same power. On the other hand, the moving-coil gives more faithful reproduction. This in itself is apt to make it rather searching in the sense that it shows up any little defects in the output of the set which might not previously have been introduced with some other type of speaker. If you introduce refinements at one part, it may be necessary to improve things all along the line.
 Mortgages repossessed by Receiver

[Image of a mortgage document with a crossed-out signature]

 Yours sincerely,

J. D. Receiver

W. C. 2.

P. W.

Telephone: Holborn 9703.

[Image of a telephone number]

[Image of a postage stamp]

P. WALRAVEN, Stationsweg, Hillegom, Holland.
—and they won't be disappointed!
It’s one long spell of excitement and laughter when BOBS YR UNCLE is about. This jolliest of all card games is entirely new, and the rules are as simple as ABC. All the family can join in—and what a happy family it will be!
The pack comprises 54 highly coloured cards featuring many amusing characters and familiar nursery rhymes—and when Uncle Bob turns up—as he always does—it’s just one roar of riotous laughter. Hurry up and get your pack and share in the fun and thrills of this topping game!

**THE THRILLING NEW CARD GAME**
Made by JOHN WADDINGTON LTD., makers of the world’s finest playing cards.

1/6

Bob's & Uncle
NEW CARD GAME
A riot of Fun
A million laughs

On Sale Everywhere

A scene during the making of the new film entitled "Calling All Stars," in which Jack Payne and his band play a leading part. Many other radio favourites, including Harold Ramsay, Harry Pepper and Leslie Sarony, are in the cast.
HANDSOME  
•  
RELIABLE  
•  
OUTSTANDING PERFORMANCE  
•  
‘THERMOMETER’ TUNING  
•

C OSSOR  
SUPERHET RADIO  
for Battery and A.C. Mains users

These two new Receivers incorporate the most up-to-date superhet practice. Employing a Pentagrid Frequency Changer in conjunction with specially designed coils, they possess an exceptionally high degree of selectivity. Backed by a wealth of experience in manufacturing hundreds of thousands of receivers they are, above all, reliable.

BATTERY MODEL 366A  

ALL-ELECTRIC MODEL 364  
(Similar to illustration)  
Hire Purchase Terms: £76 deposit and 12 monthly payments of £10.

(Prices do not apply in I.F.S.)

Ask your usual Wireless Shop for a demonstration, or post this coupon for full particulars.

COUPON
To A. C. COSSOR LTD., Melody Dept., Highbury Grove, London, N.S.

Please send me free of charge, literature giving full particulars of the new Cossor Superhet Receiver:  
*Model No.  
*Please state Model required.

Name ____________________________
Address ____________________________

D.W. 19/10/35
NOT SO EASY!
THE BIG THREE
AMATEUR "POLICE"
THE "TWO PEN"

More Mast Pruning.

CROYDON informs me that Chelmsford is not the only place where mast pruning is in progress, for about two-thirds of the 100-ft. aerodrome mast near his house has been snipped off, to help pilots approaching Croydon in foggy weather. The aerodrome wireless beacon station has a thirty-mile range, and will guide aircraft to the "blind approach" two miles from the aerodrome boundary.

Here two marker beacons, as used at the Tempelhof Aerodrome, Berlin, will come into action. When the pilot passes over the first he gets a signal in his phones and on his instrument panel, indicating he must throttle back at a given altitude, and glide down through the fog. Another indication tells him when he is passing the second beacon station and then the altimeter and ground lights warn him when to flatten out for the landing.

It all sounds beautifully easy, but how would you like to land a few tons on emptiness at radio's invitation?

An Interesting Centenary.

A CENTENARY of unusual interest to wireless men occurs next year, when the French will be celebrating in honour of André Ampère, who died in 1836.

There is talk of some special programmes from the French stations in commemoration of the great scientist who gave his name to last for ever and ever, to the unit of electrical current. Ohm, Volta, and Ampère—where would electrical development have been without the Big Three?

Italian Radio.

ITALY hopes to have the new Bolzano station working on 10 kilowatts by November, if not before, and then there is to be the opening of a high-powered station—50 kilowatts or more—at Bologna. After that Rome's two transmitters (1 kw. and 50 kw. respectively) come to attention, and by next year they will be relieved by two 120-kilowatters.

Apart from this Rome has its two new 20-kw. short-wave transmitters to play with and make a Roman holiday. Nevertheless the Italian populace has never really coddled up to radio, and at the beginning of this year there were fewer than half a million licences in the whole country. (This figure represented a trifle over 1 per cent, as compared with over 15 per cent in Britain.)

Bradford's Programme.

THE Bradford Experimental Radio Society (to whom I must extend every praise) have kindly posted me their 1935-36 syllabus. And a very eye-brightening syllabus it is.

Among the attractions are a visit to the Moorside Edge station, several technical and engineering excursions, and a proposal to visit the B.B.C. studios at Leeds during broadcasting hours.

I like this society because they meet every week (on Wednesdays), summer and all. Their taste in lecture-subjects is unusually sound, and I wish I could pop in sometimes to share the fun. Failing that, I advise Bradfordians to roll up. The Bradford Experimental Radio Society has a fine record of attendance and lectures and is undoubtedly one of the most energetic radio clubs in the country. It certainly means to forge ahead.

Coveted Wavelengths.

ON the principle that a cat may look at a king, low-powered amateur radio stations all over the world are looking at the high-powered commercial stations. Watching them closely, too—the hours they work, the wavelengths they use, and the things they say. For there is a shortage of wavelengths, and the amateurs are hoping and praying that commercialists could very well spare some of theirs for amateur use.

In 1938, when the next international telecommunications conference is to be held, the spokesmen of the amateurs will try to prove that they could make better use of the wavelengths just below forty metres than the present holders. At the moment the amateur policemen (a wily crowd, with agents everywhere) are collecting evidence.

Local Listening.

HOW many people do you know who want to listen only to the local stations? A reader who lives at Swepstone, Leicestershire, tells me that up his way—a mining area—there's a wide demand for a simple "local" receiver, which a chap could sit down to enjoy in the evenings. (I know that the Technical Hounds have not lost sight of the possibilities in this direction.) My Leicestershire friend is all for a "Two Pen "—a great act for the little man who hasn't "two pen" to waste.

And, by the way, this chappie slips in a very neat word for yours truly. He says "I'm a great believer in a good aerial—your paper's got one!" I blush prettily, "I retire into my attic, With a pleasure that's ematic, And the gratifying feeling, That my duty has been done."

The Tragic Exception.

ALL ships of more than 1,000 tons gross are required to law to carry wireless equipment and a wireless operator when leaving British ports. But the Board of Trade has power to grant exemption in certain circumstances. This exemption was asked for and, obtained, in the case of the Joseph Medill, because she was built for service on the Great Lakes, and was only crossing the Atlantic to take up her new duties. She sailed from the Tyne in August, and was lost with all hands on her maiden voyage.

A temporary wireless equipment would have kept her in touch with other vessels. Even an amateur short-wave transmitter might have saved the loss of a fine vessel and all who manned her.
FRENCH TELEVISION STATIONS NEARING COMPLETION

Too Realistic.

THOSE actuality broadcasts, in which effects are faked to make listeners believe they are hearing the real thing, sometimes boomerang back upon the heads of the would-be deceived. There was a case at a Chinese station where a Z-class singer was to end his song supported by the Al clapping and cheering of an enthusiastic gramophone record. But a well-intentioned charlady turned the selected record over after dusting it, and nobody in the studio noticed the reversal. The result was that, when the song concluded, the final notes were drowned by the father and mother of a row, with cries of "Chuck him out!" "Foul!" "Dirty swine!" "Boo-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-o-
Our first Christmas at Marconi House was a very pleasant one. Broadcasting had been a new game and our listeners, sorry that we were working during the festive season, sent us good wishes and Xmas fare. On Boxing Day the studio looked rather like the window during the festive season, sent us good listeners, which, incidentally, I should be made chaplain of Broadcasting House, sundry.

I have an encouraging word for his visits as a spectator, he would always be an artist to put over a good show as, during—the Rev. Mayo, Rector of Whitechapel. The Westminster Chimes.

Actually I feel that this happy person should be made chaplain of Broadcasting House, as he has taken such a personal interest in its activities from the beginning.

It was about this time that I introduced the Westminster chimes to my listening public by means of a set of tubular bells, and did I ever hear the end of matters when on my first attempt I played them incorrectly! Some kind person sent me a book of various chimes for my edification, which, incidentally, I still treasure. On one occasion I hit my finger instead of the bell—and drew the obvious audible conclusion—though reception must have been poor that evening as I didn't hear that anything untoward had happened.

Actually I feel that this happy person should be made chaplain of Broadcasting House, as he has taken such a personal interest in its activities from the beginning.

I remember Burrows and held the fort during this Christmas. There is a very familiar figure (to be seen very often nowadays at Broadcasting House)—the Rev. Mayo, Rector of Whitechapel. He went of the microphone to broadcast. His happy personality has helped many an artist to put over a good show as, during his visit as a spectator, he would always have an encouraging word for all and sundry.

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It was about this time that I introduced the Westminster chimes to my listening public by means of a set of tubular bells, and did I ever hear the end of matters when on my first attempt I played them incorrectly! Some kind person sent me a book of various chimes for my edification, which, incidentally, I still treasure. On one occasion I hit my finger instead of the bell—and drew the obvious audible conclusion—though reception must have been poor that evening as I didn't hear that anything untoward had happened.

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after their conclusion, and with luck Madam Payling and I should synchronise.

We had three rehearsals. All that the loudspeakers could produce at the first two was a loud succession of clicks, bangs and noises, but never a note from madam.

The engineers took out a direction-finding van to localise the electrical disturbance, and, I think, ended up at Battersea power station.

The last rehearsal commenced. Still this noise, but it disappeared as if by magic. We had a successful run through, when the noises started again. The engineers thought it might be O.K. at the performance, and I saw to my horror that the roof of butter muslin was alight.

"Flash" and, when the smoke was subsiding, "dead" as possible. Interesting to compare this fellow with the present modern No. 1 Studio at Maida Vale.

It was in this studio that I produced the first studio opera broadcast from London, with an orchestra of forty odd, chorus of about the same number and cast. There was just enough room left for the announce and the atmosphere became thick, to say the least of it. If space permitted I should like to talk more of our endeavours in broadcasting opera and musical comedy, but in conclusion I must refer to one figure associated with early opera and the B.B.C.—the late Mr. Percy Pitt, who was my chief in the earlier days.

A charming personality, a very able musician and a very kind friend. He was also Director of the British National Opera Company. His wide knowledge and experience were a great asset to the B.B.C. in those pioneer days.

THE ORIGINAL TRANSMITTER AT 2 L 0

The TELEMESSER instrument, as it is called, is the crude when judged by present-day standards, it was nevertheless highly effective, as many thousands of listeners can testify.

...can testify.
Concerning MODERN "MIXERS"

An Article of Special Interest to all Set Constructors

The frequency-changer stage of a superhet is the most critical section of the circuit, for in it lies the fundamental difference between the "super" and the "straight" receiver. As most experimenters know, the incoming signal is simultaneously amplified by oscillation and rectifier, the "beat note" so produced passing on for amplification by the intermediate-frequency stages.

We are not concerned here with the reasons for this process, but only with the best method of achieving good frequency stability, the circuit for in it lies the fundamental essential circuits are the same.

Electronic Mixing.

Third, we have the heptode, or pentagrid, which achieves electronic mixing of the oscillator and incoming signals, by making the electron stream from the cathode first modulated by the oscillator, then on through a screen (G2) and the input signal grid (G4). Here it is again modulated, this time by the incoming signal voltage and the combined modulations are then passed on through a screen, another grid (G3).

Electronic coupling through the suppressor grid (Fig. 2). The various curves of the various valves are found of the most advantage.

Second, we have the multiple valve, the triode-pentode, which is in effect the above two valves combined in one bulb. The frequency voltage needed for full modulation is of the order of 50 volts, a value which the oscillator cannot normally produce. The heptode and octode, needing some ten volts, are satisfactory, although the former requires special care. But these two valves run into trouble because of the capacity between the oscillator anode (G2) and the input grid (G4), in spite of the screen (G3). This capacity is sufficient to give rise to coupling between the relative circuits, with the result that the input tuned circuit "pulls" the oscillator off its correct frequency, upsetting the tuning and lowering the sensitivity of the set.

The phenomenon is noticeable on the 200-500-metre band, but becomes more serious as the percentage difference between incoming carrier and local oscillator frequencies diminishes. Take an example: A signal at 1,000 kc. (300 metres) combines with an oscillator at 1,465 kc to give an I.F. frequency of 1,465-1,000, or 465 kc. The percentage difference between 1,000 and 1,465 is 43.5 per cent. But a signal at 10,000 kc (30 metres) combining with an oscillator at 10,465 kc also gives an

The various curves of the various valves are found of the most advantage.
**Concerning MODERN “MIXERS”**

(Continued from previous page)

1.F. frequency of 10,465-10,000, or 465 kc., and the percentage difference is now only 4.65 per cent., or ten times less. The tendency to "pull" is roughly ten times as serious, and our remedy is either to improve the screening—a difficult task—or to get the anode current away from such a dangerous spot.

Effect of Anode-Current Change.

The third trouble is a little more obscure, but quite easy to follow. If we have a triode oscillating steadily at a given frequency, and we change the anode current by some means, there is a slight change in the frequency of oscillation, although we have not touched the tuning. In the heptode and octode the oscillator is slightly affected by the steady D.C. bias on the input grid (G4) so that as A.V.C. is applied to this grid, the tuning of the oscillator circuits is apparently shifted by a very small degree. Yet the shift is enough to make the tuning scale of a very selective receiver appear to be wrongly calibrated on very strong or very weak stations. It has also the effect of moving the tuning in and out of adjustment (in the electrical sense only, of course) on a station which is fading up and down in strength, so causing sidetone distortion.

Well! That is a formidable catalogue, but research workers are never content, and the new triode hecrod is an attempt at clearing up these difficulties.

As the name implies, it combines a triode oscillator with a hexasode (six electrode) detector, the system being illustrated in Fig. 5. One cathode is used, but the triode is mounted below the hexasode.

It is clear that G1 is now the input grid, G2 is the detector, G3 is the modulating grid, permanently connected to the grid of the oscillator, and G4 is another screen.

Now let us see what we have gained.

**AN IMPROVED LOUDSPEAKER**

By A. T. Mighall

The speaker is hung above the bed in the manner shown.

The cover is removed and the diaphragm bare ring protrudes, a knot or piece of twine preventing its being pulled through and moving the receiver.

Covered with Paper.

The lid of the box, which has a hole of about one inch diameter in the centre, is placed in position, and the whole box covered and sealed by pasting brown paper all over it.

An ordinary “tie-on” label is then cut so that the bare ring protrudes, and is passed over the back with the ring on the opposite edge to that through which the wire goes. The box can then be covered with paper to match the bedroom, with, if desired, a suitable motif on the front.

A length of coloured twine or silk or ribbon, with a “tent-rope tightener” for adjusting its length (for which purpose a celluloid tag, as used on battery-set wires, is admirable) is fastened to the ring, and is used to suspend the speaker from a picture-hook, the plug, of course, being connected to the remote end of the flex.

Reproduction Pleasingly Good.

If the job is well done and the phones of fairly good make the speaker may be worked at sufficient volume to fill a room, with quality quite as good as that obtained from many M.-C. speakers. Hanging behind the bed and worked at just sufficient strength for the occupant’s comfort, the reproduction leaves little to be desired, being as pleasing, in fact, as that from a modern speaker worked at the same low volume.

Outside the room, of course, it is quite inaudible. It is hardly necessary to include a separate switch, since the speaker can easily be disconnected, if music is only required in one bedroom, by pulling out the plug.

**THE COMPONENT PARTS**

The oscillator section is far more efficient than that of the heptode or octode, and there is no difficulty in generating ample modulation voltage on G3 down to 10 metres and below.

The oscillator anode is well away from G1 and the “pulling” effect is reduced to less than one-tenth that of the heptode, so that operation on short waves becomes more certain and the efficiency is maintained at a fair level.

Controlling the Impedance.

We have the desired electronic mixing, but the oscillator anode stream is quite separate from that of the detector, so that variation of D.C. bias does not alter the oscillator-frequency.

In addition, we are able to control the impedance of the hecrod by varying the voltage on G2 and G4, without affecting the oscillator. The normal value is some 2-megohms, giving little effective convection gain and low damping on the I.F. transformer.

So you see we have something here which represents a useful advance.
AFTER three years the B.B.C.'s 30-line television transmissions have been receiving a second Southern March and, as far as I am aware, without a protest. I am writing this article so that a great pioneer effort shall not pass unhonoured, with lessons laboriously mastered forgotten.

Three years ago low-definition television was the new marvel to the world, and the new toy of the B.B.C. The toy was worked by a band of enthusiasts who, from the first to the final day, never, to their everlasting credit, lost heart. This in spite of the ever-growing background of scepticism, salvation finance, and the knowledge at last that the system was obsolescent.

Programmes prepared with infinite pains were often ruthlessly hacked to suit other transmission requirements.

Sometimes I fear that history will repeat itself. High-definition television is the toy now. "Oh, yes," say the pundits, "but this is different. This is the real thing." But the sceptics are still here, the funds available will call for economy. Any new service that must develop by trial and error will encounter early discouragements. Is that background of doubt to be allowed to grow until it overwhelms the new service as it did the old, making necessary a third start in a few years' time?

My point is, if not made sufficiently clear already, that the B.B.C. have tended to take at best a passive part, waiting for the tide of progress to overtake them. The first essential now is that the B.B.C. begin by believing in television. Then it will be possible to take the lead rather than wait to be pushed. Mr. Gerald Cock and his staff at the Alexandra Palace will be enthusiastic enough, but they must by some means infect those on the quarter-deck at Broadcasting House. I claim that it is indirectly B.B.C. hesitation that has left this country at the moment without any television service and the prospect of none for six or eight months. I am perfectly well aware of the history of the television committees and of the difficulties and perplexities, but I am convinced that the biggest error of the past has been disbelief.

Progress Should Be Rapid.

Once the B.B.C. acknowledge in their inner councils that high-definition television is here as a good, though not necessarily perfect, entertainment, then I think that progress will be smooth and rapid. For numerous reasons perfectly well known to readers of Popular Wireless, and which therefore need not be restated here, television cannot replace sound broadcasting for many years, if ever. But both services can develop side by side supplementary to one another.

The next lesson of 30-line television relates to programmes. Whenever I demonstrated reception to visitors at my home, without exception they were deeply impressed by the thought that a moving picture could be picked up on a piece of concealed aerial wire and reconstructed line by line on the screen. The novelty of it swept them off their feet—they were delighted and thrilled. I had much the same feeling when I first manipulated a mirror drum receiver which, by the way, seemed to me like a very difficult fruit machine, inasmuch as I had to get 30 lines in the right positions and not merely three.

The Use of Vaudeville.

But I think that with television this feeling of novelty wears off more rapidly than it did with ordinary broadcasting. I found that I quickly became bored with the 30-line system. I am perfectly sure whether vaudeville should be the staple diet of television. It may play a much less important part than in broad-

PLAYS EIGHT RECORDS

Mr. Robb made many gallant experiments with opera, ballet, and musical comedy. Of these I can only say, in general, that the smallness of the 30-line screen and the imperfections of the picture made it impossible for me to judge accurately of the entertainment or cultural value. In high-definition television undoubtedly a place for the classical poet and the acrobatic dancer. As the screen will at the outset be small, however, it will be reasonable to overcrowd it, just as it was a mistake to cram tiny figures on to the low-definition screen. High-definition will, of course, stand a great many more figures than low definition, but the B.B.C. will blunder if they imagine that it can present "The Birth of a Nation."

Television, in my view, has little or nothing in common with the cinema. People will not want big screens in their homes, they will not wish to see spectacular films of an hour and a half's duration. I am constantly meeting the sceptic who asks as if he will want a screen in his home as big as the one in the local cinema, made to be watched by the whole family simultaneously. He thinks in cinema standards.

The Best Programmes.

What sort of programme shall we want, then? I ask myself what were the most successful low-definition programmes and argue from that. I liked best those programmes that showed me something I genuinely wanted to see—Zoo animals, a famous modern sculptor explaining his work, famous museum treaures, eminent artists, distinguished visitors, etc.

Television should show us short plays with fairly simple action; it is an excellent medium for prominent speakers (the Shaws, Baldwins and Churchills); it will be admirable for brief rubys of sporting events of many kinds (not, I think, football). In the main it must be restated here, television; in fact, a sort of visual magazine, with its fashion parade, its glimpses of other countries. Its instruction in games and its therefore the programmes must be proportionately better. I am afraid it all looks very expensive, and if any of the B.B.C. programme chiefs happens to read this article I hope it will not unduly depress him because we want optimists at the Alexandra Palace.
HIRE-PURCHASE POINTERS

Some interesting facts that every listener should read.

By A. T. Fleming, M.I.W.T.

A recent contributor stressed the advantages of acquiring radio apparatus on the hire-purchase system. While it cannot be disputed that it is well to remember that there are two sides to every question, and the purchasing of radio goods on this system forms no exception.

Very few hire purchasers are aware of the exact conditions of the undertakings into which they enter. This article deals with certain points which are usually found in such agreements and which are often overlooked.

Totally Different Agreements.
The first point to determine definitely whether the so-called hire-purchase agreement is really such, or is a deferred payment contract. The two forms are very similar, but the legal consequences in the two cases are totally different, and these differences should be appreciated by the person signing the agreement.

Under the hire-purchase system the listener is really paying a rent for the hire and use of the apparatus. This apparatus does not belong to him, but to the person from whom it is hired. That is to say, the right of ownership of the apparatus hired does not vest in the person who is paying the instalments until each and every instalment has been paid. That is why in hire-purchase agreements the person who supplies the apparatus is styled the "owner" and the person who is paying the deposit is called the "hirer."

Under a hire-purchase agreement the listener is entitled to return the apparatus to the owner on fulfilling certain conditions, and this is one of the fundamental differences between hire-purchase and purchase on deferred terms. In this latter system, however, the ownership of the apparatus vests in the person who is paying the instalments immediately the contract is signed. Consequently the listener is not entitled to return the apparatus and consider the deal at an end. On the contrary, the suppliers can enforce the payment of each and every instalment.

Conditions Often Overlooked.
Having seen these fundamental differences we will revert to the hire-purchase system and consider these points which are often overlooked by the hirer. In the first place, as mentioned above, the hirer has the right under a hire-purchase agreement to return the goods and consider the contract at an end. This, however, is subject to conditions. One of the most important is that all payments which have become due must be paid to date before notice of the intention to terminate the hire contract is given to the owners.

Such conditions are obviously perfectly fair, as is also the condition that when the hire is terminated, the apparatus is returned carriage paid, in good condition, to the owners or their agents.

The next point is one which is not often appreciated. This condition has for its object the protection of the owner against persons who might elect to return the apparatus after hiring it for a very short time only, and consequently involve the owners in considerable financial loss. It is, therefore, usually provided that should the hirer return the apparatus, after only having used it for such a time that the money has paid does not come to one-third of the hire-purchase price of the apparatus, then the hirer must also pay to the owners a further sum which will make the total sum payable one-third of the said hire-purchase price. To take an example, if the hire-purchase price of a set is £9, the hirer cannot return it without paying a minimum of £3 for rent.

A Common Misconception.
It is a common misconception that it is better to purchase a radio receiver on the hire-purchase system than for cash. This is based on the erroneous assumption that a wireless dealer is more likely to give after-sales service to a receiver which is on hire than to one for which he has already received the money. This is definitely not the case, and very often the position is exactly reversed.

For instance, many dealers have their own service guarantee under which they will only give free service to sets bought on the hire-purchase system when the instalments are fully paid up. That is to say, if for any reason the set is not working properly, the wireless dealer under these circumstances will give it no free service until the hirer has ceased to be in arrears with his payments. When this system is in force it is futile to adopt the attitude "I refuse to pay any more instalments until my set is put right to my satisfaction." The dealer can reply: "Until you pay up your arrears, you will get no free service."

Using a Pentode.
The pentode valve is generally used in the output stage for any simple reason, such as giving a large output for a relatively small input, or rather of giving an output equal to or up to some kind of a power valve with a much smaller input than the power valve would require.

The pentode, however, has one very slight disadvantage that it is not so easy to over-emphasise the high notes. To get over this it is a common practice to connect a resistance and condenser across the output circuit.

What it Does.
People often think that this arrangement actually increases the strength of the lower notes. In fact, it does the opposite, and it does is to cut out the apparatus and fill in notes to a suitable level in comparison with the lower notes. After that, the total over-all volume can be increased if you like.

But the resistance and condenser scheme does not add anything; it acts by subtracting something.

If the capacity of the condenser is increased, this will reduce the strength of the high notes further. A similar effect can be obtained by diminishing the value of the resistance. If you reduce the resistance to zero, leaving only the pentode and condenser scheme does not add anything; it acts by subtracting something.

If the capacity of the condenser is increased, this will reduce the strength of the high notes further. A similar effect can be obtained by diminishing the value of the resistance. If you reduce the resistance to zero, leaving only the pentode and condenser in the circuit.

What it Does.
In some cases the serial number of the set, which will be found stamped on the chassis, is quoted in the hire-purchase agreement. Now it sometimes happens that the original set has proved technically unsatisfactory and the makers have supplied a completely new receiver in preference to repairing the original. It will be apparent that the second set must bear a different serial number, as such numbers are never duplicated.

The position now is that the hirer is paying rent under the agreement for a receiver which is not in his possession, and it has been held in the courts that a hirer has been free from all obligations under such circumstances. Such a position is, however, very unsatisfactory to both sides, and most agreements now contain a clause permitting the owners to substitute other identical apparatus in lieu of that originally supplied if they wish to do so.

THE SUN AND RADIO RECEPTION

Recording the action of the sun on radio reception at the Harvard School of Geophysical Exploration of America. Dr. Nelson, whom you see pointing to one of the readings on the graph, started this record eleven years ago, and the results have been of great value in aiding scientific research on various puzzling phenomena in radio.


J. H. T.
MODERN theories of electricity seem curiously one-sided when explained in terms of the electron. We are told, for instance, that a body is negatively charged whenever it carries an excess number of electrons, i.e., more than its normal quota. On the other hand, it becomes positively charged, not as the result of acquiring something, but simply by giving up a certain number of electrons which properly belong to it.

In the old days there was a school of thought which, taking things at their face value, held that a positively charged body contained an excess of one kind, and a negatively charged body an excess of a different kind, of electricity. And, in a sense, there seems to be sound logic in this "two-fluid" point of view.

The idea of a positive form of electricity which repels its like, but attracts its "opposite number," is easily accepted, whilst there seems to be something rather unconvincing in a theory which depends upon the comings and goings of a single negative unit such as the electron.

**Discovered Nearly Forty Years Ago.**

One gets the same sense of singularity in the modern picture of an electric current as consisting of a one-way stream of electrons, whilst the familiar terms "positive" and "negative"—as applied say to the opposite terminals of a battery—seem to have little meaning, so long as the only things that move are electrons, and so long as they always move in the same direction.

In fact, ever since Rutherford first discovered the electron in 1897, it has gradually forced its way into the limelight as the one and only unit of electricity. Electrostatic charges, the electric current, and even magnetism, have all been reduced in turn to so many manifestations of its various activities.

Electron Has an "Opposite Number."

In addition, the electron is also acknowledged as a vital part of the constitution of ordinary matter. All matter, in the limit, is built up of atoms which at one time were thought to be single particles, incapable of further subdivision. Then Rutherford showed that they were, in fact, made up of highly complicated assemblies of electrons rotating around a central massive nucleus.

And so all forms of ordinary matter took on a definitely electrical aspect, and they, too, seemed to be dominated by the electron.

Within the last year, however, the picture has definitely changed and the electron which has for so long ruled the roost no longer stands alone. In short, the physicists have discovered that there is such a thing as a positive electron—a definite and real "opposite number" to our negative friend.

It is too soon as yet to gauge the full effect of this discovery upon accepted notions of the real nature of electricity and of matter in general; but it certainly helps to remove the present one-sidedness of the outlook—and lends us at least part of the way back to the mid-Victorian belief in two separate and distinct forms of electricity.

We owe the discovery of the new positron, as it is called, to the result of bombarding certain atoms by highly penetrative forms of radiation, such as the mysterious cosmic rays, which are the shortest and most powerful waves known to science.

It has been known for a long time that atoms can be broken up or dissociated when subjected to this form of assault. The usual result is the knocking-off or liberation of some of the electrons which rotate about the centre "heavy" proton or nucleus. The latter, it should be said, has always been assumed to be sufficiently "positive" to balance the rotating electrons.

That is to say, there is the same "lack" of electrons inside the nucleus as there are free electrons dancing about outside, so that the atom as a whole is held stable by mutual attraction.

But the make-up of the nucleus is altogether different from that of the electron. It is nearly 2,000 times more massive, besides being comparatively slow-moving and inert. In fact, it represents almost the whole mass of the atom, the mass of the free electrons being practically negligible.

Splitting the Nucleus.

Now the fact has emerged that the nucleus is, at least in part, made up of "positive" electrons, which are actual counterparts of ordinary negative electrons, except that they carry a positive charge instead of a negative one. It is no longer possible to argue that they owe their positive character to the fact that they are "short" of their proper quota of "real" electrons.

Such an explanation cannot hold water for a moment, because the positron is of precisely the same size and mass as our old friend, which we can now call the negatron, as short for negative electron. Obviously there is no room for any surplus or excess in its electrical content. It is as much an atom of electricity as the negatron is, only it is an atom of positive instead of negative electricity.

When an atom is broken up by bombardment, the products of the disintegration are observed by passing them through an expansion chamber placed in the field of a powerful magnet.

The Two Paths.

In the apparatus shown in the sketch, no fewer than 2,000 amperes of current are passed through the windings (1) enclosing an observation chamber (O) which is only seven inches square and two inches thick.

When negatrons are liberated from the atom they pass through the chamber, not in a straight line but in a curved track. A negatron, it must be remembered, carries so much negative electricity; so that, when it moves, it represents that amount of electricity in motion, which is the same thing as saying, "here we have an electric current."

Now when a current flows through a wire placed in a magnetic field, the wire moves bodily in a certain direction—as we know from the principle of the ordinary electric motor. The direction in which it moves,
THE 1936 "FERRO-POWER"

Further details of the powerful five-valve receiver described in the October 5th and 12th issues, including notes on the operation.

By K. D. ROGERS

We have already dealt with most of the details of the "Ferro-Power," but we still have the power pack and the operation to consider.

As regards the power pack, this is particularly straightforward. An indirectly heated valve is used so that the H.T. voltage is developed slowly, giving time for the valves in the set to warm up and to impose a current drain before full voltage is applied. This prevents peaking and saves the condensers from being strained or even broken down.

The resistance X Y (1,000 ohms) I have removed from the original set and in its place have wired—by leads from the 20,000-ohm resistance (positive side) and the "O" terminal on the transformer (to the 2 v. 3½ amp. winding)—the W.B. speaker field.

The Question of Hum.

At this point I would like to say something about hum. I have tried the set on several different mains supplies, during the course of which tests I found one supply which did cause a little hum—due to the current through the speaker-field. You may not meet it. It depends on your mains but I do not want any misapprehension about the set. If you do experience it, an extra choke and a couple of 4-mfd. condensers will do the trick.

The choke is connected on the positive side of the speaker field—I used a 40 heavy choke—with a 4-mfd. condenser on the speaker side to earth. Another earthed condenser was used on the other side of the speaker.

Many will say that the power-pack is unusually complicated and elaborate. True, but with a set of particularly high amplification it needs great care in the decoupling, and it will be seen that this has been taken in the case of the "Ferro-Power." Not only are the vital circuits decoupled in the set but with a set of particularly high amplification it needs great care in the decoupling, and especially is this so in the case of the "Ferro-Power" set.

The detector should be left alone unless a change from the listed types.

Setting the Potentiometer.

With the set trimmed have a quick run round to see that all is well. Now proceed to trim in the usual way—leaving the foremost trimmer (detector grid) set. Trim to a station below 250 metres if possible. The Valves.

The Magda P.P.4/500 could be used instead of the P.L.4/500, with success, but the Cossor 41M.P. is not interchangeable with any make. The detector should be treated with the greatest respect.

The Valves.

Someono is sure to want to use all sorts of valves other than those I have specified in this set. Let me say here that this is most inadvisable, and in many cases impossible without ruining the operation of the receiver.

The underside of the radio chassis of the 1938 "Ferro-Power." Note that the standard leads from the pick-up terminal on the gramophone volume control is taken along the outside of the radiator to obviate it coming into contact with any of the components, and thus preventing an H.F. short.

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Popular Wireless, October 19th, 1935.
There's no finer pick-up than a B.T.H.

**Fitted by leading radiogram manufacturers, preferred by all knowledgeable radio men—the B.T.H. pick-up stands for all that is best in record reproduction equipment.**

For as little as twenty-one shillings you can have B.T.H. record reproduction. The Minor compares favourably in performance with pick-ups costing very much more. It is supplied complete with volume control fitted in the tone arm pillar. All radio dealers sell it.

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**Price and Preference**

For many of us, price marks a boundary; but no limit need be set to the enjoyment here and now. Price and preference can be reconciled. Most of smokers who first considered cost, now "hill up" with "Airman" for choice.

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**You see, it's the speaker that makes the set.** And Blue Spot have made the best speakers for years. Now they are putting their own sets round those speakers—and the combined effect is absolutely startling! Frankly, it's a new realism in radio. You simply must hear it.

Above is the A C 5, in Walnut—a superhet job with SEVEN tuned stages and SEVEN tuned circuits. Fully compensated AVC. Image suppression. Output 2½ watts. Special energised moving-coil speaker. At 12 gns! Also Radiogram, 21 gns. and AC/DC4 Universal, 9 gns.—or easy terms. Post the coupon below now. or 21½ monthly.

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Acoustic output equivalent to 1 watt. Moving Coil Speaker. Automatic compensation for falling H.T. voltage. Selectivity control. Illuminated station dial. In Walnut £6.17.6 (excl. batteries) or 12½ monthly.

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ONLY TWO MORE WEEKS!

In fourteen days' time full details of John Scott-Taggart’s masterpiece, the S.T.700, will appear exclusively in "Popular Wireless."

Already the set has been demonstrated to a number of home constructors, and they have expressed their keenest appreciation and wonder at its entirely original features and its amazing performance.

Revolutionary departures in technique and design have been made by Britain’s leading Radio Physicist and Engineer in his great new set, and its inevitable immense success is bound to be accompanied by excited discussion in both amateur and professional radio circles.

John Scott-Taggart expresses himself in the S.T.700 as both a great inventor and a great designer, and we are confident that even his previous colossal triumphs are destined to be eclipsed by the S.T.700.

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ON THE SHORT WAVES

IMPROVING THE TWO-VALVER

In response to a large number of requests from readers for instructions for adding another valve to the "Simplex" Two, W. L. S. gives details of a simple H.F. unit.

I SUPPOSE that 80 per cent of the readers who decide that they must do something about this short-wave business start off with a two-valver receiver. Quite a few of us know a "single," but I am quite convinced that the two-valver has it, as far as popularity goes. Sooner or later there comes a time when the majority of us will want something a little better. We all know that it, as far as popularity goes, is to add another valve to it, something a little better. We all know that quite convinced that the two-valver has a few, I know, use a "single," but I am start off with a two-valve receiver.

T SUPPOSE that 80 per cent of the readers of thought. Two, and that has put me on to this line of queries just recently on the subject of adding a stage of H.F. to the "Simplex" of the capacity type. It is important to note that, if you use the "Simplex," exactly as it was, and you should be hearing signals right away. Probably the dial readings have altered a bit. Settle down on the first station you hear, and now rotate the dial of the tuning condenser on the S.G. unit, with the same size coil plugged in as you have in the set itself.

Some Preliminary Adjustments.

Somewhere on that dial (and not far from the same reading as on the receiver dial) something will happen. You may just find your signal coming up in strength and needing a bit of re-tuning. On the other hand, it may just flip right away out of sight, to the accompaniment of squeals, roars and what-nots. It may be with results, decide that they want to anticipate them for you. So we will now all ready to switch on and set the proud parent.

Go ahead, then. Switch on, but don't take any notice whatever of your new controls. Just tune in the "Simplex," exactly as it was, and you should be hearing signals right away. Probably the dial readings have altered a bit. Settle down on the first station you hear, and now rotate the dial of the tuning condenser on the S.G. unit, with the same size coil plugged in as you have in the set itself.

AN H.F. "ADD-ON" STAGE

If you have a three-winding coil and inductive coupling, you must insert a fixed condenser of 0001 between the lead from the S.G. unit and the aerial terminal on the set itself.

You will then have parallel-fed transformer coupling, which is excellent; but if you try it without the fixed condenser you will probably have a short-circuited H.T. battery, which is not so good.

You have probably heard about this short-wave business I seem to have had an enormous number of queries just recently on the subject of adding a stage of H.F. to the "Simplex" Two. For those who, like myself, can reduce the screen voltage on your first valve. If it still does it, loosen the coupling to the set by reducing the value of the neut. condenser in the set. Likewise, tighten the aerial coupling to the unit by means of the first neut. condenser. By playing with these two you should be able to find a point at which your new tuning control acts almost as a volume control without materially affecting the tuning at all.

Preventing Interlocking.

If there's any tendency towards instability when an ordinary type of valve is used, it ought to disappear if you substitute a metallised type with a screened top-connector. Personally, I've never come across real instability in a high-frequency unit like this, and I should be rather at a loss to deal with it if it did crop up! Tightening the aerial coupling of course "ties it down" somewhat, but is not to be recommended if it is carried too far.

Generally speaking, the potentiometer for screen-voltage control should be set near the maximum position. If the 50,000-ohm resistance in series with it is accurate in value, the voltage range available will be from zero to 50 per cent of the anode voltage. Results with the unit in use can be summed up by saying "Stronger signals—no more background."
BAND-SPREADING seems to be a favourite topic these days. J. E. (Shipley) quotes an ingenious scheme—one that I have met before, but seem to have overlooked. He uses two tuning condensers, one of 0.0025 and one very small one, with the spindles coupled together so that both are rotating all the time.

He changes over from one to the other by means of a clip, and arranges his coils so that the interesting bands are nicely spread on the small condenser, and really wide bands are covered on the larger one.

Experiencing "Dead Spots."

Also, the minimum of the large one is so high that it starts, more or less, where the small one leaves off. One coil will give him a range of 16-23 metres, or 23-52 metres, according to which condenser is in use.

He also has a grumble about "dead spots" on about 16.5, 22 and 37 metres, which persist even with the aerial removed.

One coil will give him a range of 16-23 metres, or 23-52 metres, according to which condenser is in use.

The circuit of the H.F. unit described by W. L. S. on the preceding page.

Trouble with the "B.C.L."

Two, writes to tell me that he has cured it all on his set by putting up a vertical metal screen at the left-hand end of the set, from the front panel to the terminal strip. Why this should help things, frankly, I don't know, but he assures me that it has made a marvellous improvement.

A SIMPLE CIRCUIT

The Circuit of the H.F. unit described by W. L. S. on the preceding page.

A. C. and G. H., two Coventry readers, write jointly to ask me how to cure their threshold howl (or howls). They have both built single-valve sets, and even they suffer from it! I should suggest that the valves are at fault, although it may be grid leak trouble. But never, in my life, have I succeeded in producing threshold howl from a single-valve, so I'm hardly qualified to advise on the subject.

R. W. (Kenilworth) says that he is waiting "in despair" for this big set that I keep promising, and he has almost given up hope. Well, R. W., the position is this: I have it on my bench all "haywire." I'm quite satisfied, now, with results, and at the moment of writing am awaiting a chassis on which to build the publication model. So you can see that it does exist.

The Big Set is Coming.

I quite see that you can't keep wives and other relations clamped within the confines of a pair of phones. On the other hand, with this big chap you'll probably drive them clean out of the house!

H. W. (Coventry) quotes the same sentiments, so perhaps he will accept the same reassurance that "something is being done about it."

H. H. (Bristol) would like to meet other short-wave fans in the neighbourhood. His full address is H. Harris, 571, Fishponds Road, Bristol. S. Sorry, H. H., but I don't know the wave ranges, with the coil you mention. But obviously the 5-turn winding is the grid coil, 5-turn reaction, 3-turn aerial coupling.

(Continued on next page.)
WHAT READERS ARE SAYING

(Continued from previous page)

G. A. W. (Reading) also wants to meet someone else in the neighbourhood. Will such a person inquire at 13, Minster Street, for Mr. G. A. Watson? He is worried by the fact that he has to use a small indoor aerial in an electrically noisy district. His log, however, doesn't seem to have suffered much from these handicaps.

A. E. L. (Kingsbury) introduced himself to short waves with the "Simplex" Two, and is now astir for something bigger. I imagine that the article on page 145 is just about what he wants. He also wants to know whether there is a short-wave club near Hendon. There is, of course, the Golders Green and Hendon Radio Society, about which he can obtain full particulars from the secretary at 8, Denehurst Gardens, Hendon, N.W.4.

The 5-Metre Receiver.

One or two readers want particulars of the circuit of the midget 5-metre receiver that I recently showed on this page. I will try to give them next week. The circuit is quite straightforward, being a super-regen. The 5-valve ("grid-blocking") type. W. L. B. (Midlothian) encloses a circuit in which he is using a wavechange coil that should get down to 12 metres, but doesn't. Sorry, W. L. B., but as there's apparently nothing wrong with the circuit it must be the coil that's faulty.

A SHORT-WAVE society is being organised in Loughborough, and all readers of "P.W.I." within reasonable distance are asked to attend, if they are interested in the project. Meetings, for the present, are to be held at the house of the organiser, Mr. P. Newton Nield, 5 Park Street, Loughborough. The first meeting will be at 7.30 p.m. on Friday, October 25th, and will be continued on subsequent Fridays.

Helping the Beginner.

The Tottenham Short-Wave Club is now well away with its winter session, and all readers of "P.W.I." who are interested in the sport are invited to attend. The club and its members are trying to attract more members. It has now formed a QSL forwarding bureau. Only reports to and from amateur transmitters will be dealt with—not "yetis" from broadcast stations. Full particulars will be forwarded on receipt of a stamped, addressed envelope.

A. E. L. introduced himself to short waves, and is now surprised that he lives in an electrically noisy district. I regard as a pretty healthy sign.

The I.S.R. has now formed a QSL forwarding bureau. Only reports to and from amateur transmitters will be dealt with—not "yetis" from broadcast stations. Full particulars will be forwarded on receipt of a stamped, addressed envelope.

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THE FINEST RADIO ENTERTAINER OF 1936

McMICHAEL 135

Twin Speaker A.C. Superhet

The McMichael 135 is designed simply to give you the highest possible standard of enjoyable entertainment. Its twin stereophonic moving-coil speakers are responsible for a more life-like tone than you would think possible; its 5-valve superhet circuit offers more enjoyable programme alternatives than you ever need, and the Giant Dial tuning renders selection delightfully easy. These features and the beauty of the walnut cabinet make McMichael 135 a pure delight to hear, to see and to own—EXTENDED TERMS READILY ARRANGED.

YOU MUST HEAR

YOU WILL ENJOY A DEMONSTRATION

POST THIS NOW.

To McMichael Radio Ltd., Slough, Bucks. Please send me full particulars of Model 135 and the address of my nearest McMichael Agent.

Name: ____________________________

Address: __________________________

P.W.I.

CHOOSE McMICHAEL FOR QUALITY & RELIABILITY
**“WIDE-BAND” SUPERS**

The design of a receiver for high-definition television reception is no easy matter. Here are a few notes for experimenters on the ultra-short waves.

By L. H. THOMAS

**THERE** seems to be no method of telling how many readers are quietly working away at ultra-short-wave superhet with the object of making them eventually suitable for television work. There is no doubt, however, that the superhet has suddenly become extremely popular among the fraternity who listen to the ultra-short-wave amateur transmissions on 10 and 5 megacycles.

The design of a "radio" superhet, as distinct from a television receiver, is simpler when one comes to television is tied up with the intermediate-frequency stages, and the means that "cooking" that colossal band-width that will be required.

Such a receiver would be practically useless for listening to the existing amateur transmissions. The 5-metre band is 4 megacycles in width, and a receiver with I.F. stages giving a band-width of 1 or 2 megacycles would naturally receive several transmissions superimposed.

**A Useful Test.**

The ability to do this, however, constitutes a very useful test for the successfulness or otherwise of one's television receiver design. One method is to use straight resistance-coupling for the I.F. stages; I have had the opportunity of trying in some work with a friend who has developed a similar type of set. Measurements have shown that a band-width of over 3 megacycles is well within reach. Overall gain is more than enough for television purposes; the receiver is simplicity itself, and the only snags are concerned with the first detector and oscillator.

My own superhet is using a kind of resonant choke coupling (which is only another way of describing tuned-anode coupling with nearly all "L" and no "C")

**SNAPPED AT ABBEY ROAD**

I was talking to a member of a certain gramophone concern a short time ago, and he was bemoaning the complexity of the record trade at the moment. He said that the struggle for new ideas, for new names and so forth, was becoming more and more terrible. I am afraid I was not very sympathetic. The record companies have brought it on their own heads.

I am afraid I was not very sympathetic. The record companies have brought it on their own heads.

We are flooded with unknowns who sing popular songs in a kind of anodyne style, and the other a very mediocre number called Double Trouble. I do not think Ray's records have been so good while he has been in the States. I hope we shall soon have him back again. He is a good singer who will get down to some of his straighter but neater orchestration and arrangement and may perhaps soon find himself, after a very popular eighteenth months ago (H.M.V. 20 211).

Indeed, Tchaikovsky has again recorded Yon... My Heart's Delight, this time in English. It is on Parlophone 173024, and coupled with Fen... Mountains Softly Fall. A delightful record by a delightful artist.

**ROUND THE RECORDS**

The design of a “radio” superhet, as distinct from a television receiver, is simpler when one comes to television is tied up with the intermediate-frequency stages, and the means that “cooking” that colossal band-width that will be required.

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**SNAPPED AT ABBEY ROAD**

We all know it; it is haunting in its melody and popular. It is inevitable that the public will want it on their records. They want it played by their favourite bands (many of them broadcast bands), and sung by their favourite crooners. Some of those bands and crooners will oblige, but there will be a lot of “extra” energy into the I.F. stages as we have previously heard, so we shall never want the record.

**L.R. K. D. R.**

**SONGS IN GERMAN AND ITALIAN.**

Another recently known recording is that by Joseph Schmidt (Parlophone B 2111). It contains 8 Fur... From Heerlen, from the film of that title, and the Italian folk-song Mandolinata di Napoli. The first number is in German and the second in Italian. I prefer the second piece, which, by the way, comes from the same film.

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Perhaps your taste runs in the direction of string music of the mellifluous type. I do recommend Gregor's famous Ich... Deich (I love you), played by the Cor... Trio. On the other side is the same composer's Revue from his lyrique piece Oms 43, No. The record is Parlophone B 2133.

A sheer delight to me—though I am by no means a highbrow—is the recording on three red label H.M.V. records of Beethoven's Appassionata. I do not think Ray's records have been so good while he has been in the States. I hope we shall soon have him back again. He is a good singer who will get down to some of his straighter but neater orchestration and arrangement and may perhaps soon find himself, after a very popular eighteenth months ago (H.M.V. 20 211).

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**RADIOTALORIAL QUESTIONS AND ANSWERS**

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, and answers for publication. All communications, or photographs, dealing with all radio subjects, addressed to the Editor, PopULAR WIRELESS, John Carpenter House, Tallis Street, London, E.C.4.

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

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the field, none of the arrangements and specialties described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentee to use the patents before doing so.

To find the ratio of the transformer required you need to know the working impedance of the loudspeaker, and the optimum load impedance of the output valve. To use these figures correctly from the respective makers' literature, as other figures of impedances are often quoted in connection with loudspeakers and valves, and if you use the wrong basis of calculation you will certainly fail to arrive at the right result.

Ratio = \( \frac{\text{working impedance of loudspeaker}}{\text{optimum load impedance}} \)

To take a practical example: Suppose, as you may, the answer to your inquiry about the output valve is that its optimum load is 6,000 ohms, and its working resistance is 6 ohms, the working will be

\( 6 \div 2 = 3 \) (approximately).

The next step is to find the square root of this answer. (There is nothing to go to the trouble of getting very exact results, since a close approximation is quite good enough.)

You will find that the square root of 1,083 is approximately 33. (Prove this by squaring 33. The answer is 1,089.)

This figure for optimum load is that its optimum load is 6,500 ohms. The first step is to divide this by the working impedance of the output valve, I have written for this figure to the makers. Suppose that they say the optimum load is 6,000 or 7,000 ohms, how do I get the right ratio from that?

According to the marking on the loudspeaker its working resistance is 6 ohms. What ratio of transformer will be needed to make that figure match the valve maker's figure for optimum load?

**MATCHING THE LOUDSPEAKER.**

R. W. (Melton Mowbray).—"Can you tell me the method of selecting the correct ratio of the transformer, to match the loudspeaker to the output valve?

I thought, when I got an adjustable ratio transformer, that I should be able to tell by ear when the best results were indicating that the right ratio had been chosen. But although changing the ratio certainly makes a difference to reproduction, I cannot decide which tapping is the right one to use.

"As I have been told that to get the right ratio I must know the optimum load impedance of the output valve, I have written for this figure to the makers. Suppose that they say the optimum load is 6,000 or 7,000 ohms, how do I get the right ratio from that?"

"According to the marking on the loudspeaker its working resistance is 6 ohms. What ratio of transformer will be needed to make that figure match the valve maker's figure for optimum load?"

---

**GET THIS IMPROVED REPRODUCTION FROM YOUR SET!**

**VOLUME—20% GREATER**

The improved—and larger—Mansfield "magnet brings a substantially higher sensitivity. The increased loudness not being obtained at the expense of "balance," is comfortably accommodated by the ear. It materially increases the "realism" of the performance.

**BASS RESPONSE—FULLER AND 15 C.P.S. LOWER**

Measurable bass response goes 15 c.p.s. lower than previous models. Audible response—that part of the bass which is at audible frequency and reaches audible volume—is in these new models much more loudly reproduced. Thus the "background" is stronger and more colourful.

**HIGH NOTE RESPONSE—900 C.P.S. HIGHER**

Due to the stronger magnet, new hand-made cone, and larger section-convex, interleaved transformer, far-brighter and cleaner reproduction of high notes and overtones has been achieved this year. This does not imply shrillness—in fact objectionable high resonances are conspicuous by their absence.

**ATTACK—CLEANER AND CRISPER THAN EVER BEFORE**

That "forwardness " of tone and the clean, instant response to transients which are so important to realism in reproduction, are, in this new speaker, present to a remarkable degree. Cone material, transformer, and the new accuracy of assembly are chiefly responsible.

The simple substitution of this advanced speaker for your present instrument will bring to your radio increased volume and a new amazingly colourful realism. Ask your dealer to demonstrate to-day, and hear for yourself!

**PRICES**

**CABINET MODELS**

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**CHASSIS MODELS**

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Whiteley Electrical Radio Co. Ltd. (Information Dept.), Mansfield, Notts.
RADIOITORIAL
QUESTIONS & ANSWERS
(Continued from previous page)

Finding the Crackle's Cause.

W. B. (Lowestoft.)—'I am suffering from a most persistent crackle, which I think is due to a bad joint, as the echo is very faint, perhaps due to a bad joint, as the echo is very faint, perhaps due to a bad joint. Can you help me to localise it, or otherwise it will mean taking the whole cabinet to pieces, which is a job I do not relish ?

'I have taken off the aerial, and with a programme coming through very faintly the crackle is still present, as well as with the aerial on, and a strong programme. So I think we can say definitely that the trouble is in the set and not due to disturbance picked up outside.

'The set is battery-run, S.G. with choke in its anode circuit, and coupling condenser to tuned circuit, which is ganged with the S.G.'s input circuit. There is the usual grid leak and condenser preceding the detector.

'In the detector's plate circuit there is a 1 L.F.P. and an extra coupling feed going to E.F.G. and to grid bias. The loudspeaker is choke-coupled, and I have tried that on a similar set. But the trouble has persisted all the time, I am afraid, with the aerial on all the time, the answer was, 'No crackles from the loudspeaker.'

'I need hardly say I have inspected every thing carefully, and done all the obvious things without getting a clue as to where the crackle comes from. It is very faint, without any apparent cause—walking across the room, or even tapping the set, has no apparent effect. Sometimes it is heard without it, and sometimes it will be nearly continuous for several minutes.

'How do I find in which part of the set it lies ?'

You did right in taking off the aerial, and that process will now be expected in the case of all such sets, but don't fill in and post the coupon, or write in any other way.

Let Us Send You This 40-Page Booklet—Free

RADIOITORIAL QUESTIONS & ANSWERS
(Continued from previous page.)

You have rightly concluded that the first place to look for trouble was in the actual high-frequency stages before the detector, and that you understand that the screening there is unusually good, and the workmanship exceptionally good, if it is a new set. What is the position now?

Obviously, you would not forget such an elementary precaution as to see that the aerial lead, etc., was cleared of loops, and that all aerial wires which lie in wait for the haphazard constructor.

It seems to us as well as British wireless practice, it is modern education, covering every department of the industry.

Let Us Send You This 40-Page Booklet—Free

International Correspondence Schools, Ltd.

Without cost, or obligation, please send me your Radio booklet of information about the Courses I have marked X.

[Checkboxes for different courses: COMPLETE RADIO, RADIO SERVICING, RADIO EQUIPMENT, RADIO SERVICING AND SALESMAHNSHIP, WIRELESS ENGINEERING, EXAMINATION (state which)]

Name,________________________________________
Age,______________________
Address,______________________________________________

FINDING THE CRACKLE'S CAUSE.

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THE "DAILY TELEGRAPH" MAP OF ABYSSINIA

This comprehensive map of Abyssinia, showing also the surrounding territories, is printed in five colours and black. It is folded compactly into a pictorial cover, measuring 4½ in. by 7¾ in. and contains a brief summary of the features of Abyssinia on the inside cover.

It is priced at 6d., and can be obtained from all newsagents, the publishers, Messrs. George Philip and Son, Ltd., 32, Fleet Street, London, E.C.4, or direct from The "Daily Telegraph," price 7½d. post free.

Everyone should possess one of these informative maps as a guide to operations in the war-zone.

DON'T HESITATE!

Put New Life into your Old Set

The marked deterioration of the performance of your set is invariably caused through gradual loss of emission in the Valves; there is no cure for this other than by replacing them with reliable counterparts.

NOW, you may say that you cannot afford to buy a complete set of new valves. Right. Then buy them one at a time, and start off with a Hivac Power Valve. The results will more than justify your choice. The next valve you can afford to buy should be a Hivac H.F. or L.F. type, and finally a Hivac Detector. If you are in doubt as to the correct types to purchase, send us the name of your set or a list of the old valves and we will advise you by return of post which Hivac valves to use. Please mention "Popular Wireless.''

By fitting Hivac you will save 25% on Valve costs and put new life into an old friend.

HIVAC - THE SCIENTIFIC VALVE

HIGH VACUUM VALVE CO. LTD.,

THE "DAILY TELEGRAPH" MAP OF ABYSSINIA

This comprehensive map of Abyssinia, showing also the surrounding territories, is printed in six colours and black. It is folded compactly into a pictorial cover, measuring 4½ in. by 7¾ in. and contains a brief summary of the features of Abyssinia on the inside cover.

It is priced at 6d., and can be obtained from all newsagents, the publishers, Messrs. George Philip and Son, Ltd., 32, Fleet Street, London, E.C.4, or direct from The "Daily Telegraph," price 7½d. post free.

Everyone should possess one of these informative maps as a guide to operations in the war-zone.

DON'T HESITATE!

Put New Life into your Old Set

The marked deterioration of the performance of your set is invariably caused through gradual loss of emission in the Valves; there is no cure for this other than by replacing them with reliable counterparts.

NOW, you may say that you cannot afford to buy a complete set of new valves. Right. Then buy them one at a time, and start off with a Hivac Power Valve. The results will more than justify your choice. The next valve you can afford to buy should be a Hivac H.F. or L.F. type, and finally a Hivac Detector. If you are in doubt as to the correct types to purchase, send us the name of your set or a list of the old valves and we will advise you by return of post which Hivac valves to use. Please mention "Popular Wireless.''

By fitting Hivac you will save 25% on Valve costs and put new life into an old friend.

HIVAC - THE SCIENTIFIC VALVE

HIGH VACUUM VALVE CO. LTD.,
EASY TERMS
Everything Radio supplied on the lowest available terms. Lead time of 1 week for orders. 

SPEAKER UNITS
W.B. STENSOREMS 6/27/0 3/11 4/11
W.B. STENSOREMS 3/27/0 4/11
ROLA 727 P.M.T. 11/15/0 2/11

ELIMINATORS
ATLAS 140 P.M.T. unit
and trickle charger
combined. 2/9/11 4/11

ECKO 75/10/0 H.T. unit
with trickle charger 2/12/16 5/11

All Hayward Eliminators also supplied.

ACCESSORIES
Aviator Battery Tester 12/0/11 5/11 7/5/9

VALVES
S.G. Det. and Power, any make.
Cash price, 51/5/0, or 5 with order, and 5 monthly payments of 5/6.

ALL CARRIAGE PAID.

ESTD. 1928 THE NATIONAL 1977

LONDON RADIO SUPPLY COMPANY
1 OAT LANE NOBLE STREET-LONDON E.C.2

ENGINEERS!

LISTEN...
There are thousands of opportunities around you, but unless you know where they are, and just how to prepare for these opportunities you will never make the most of them.

That is why a Radio Engineer is so valuable. He can quickly prepare you, in your own home, for资格 that are within your reach. The book explains how

EDRAX BARGAINS
Midget Receivers or Amplifiers. They Wee 1-volt valves, baseless, take less space than one ordinary valve, 4/6 each. Single 1,000-ohm phons and cord, 2/6.

BATTERY
Mains Battery, 2/6. Mains battery, reserved and unswitched, 5 cognitive, 2/6.

GUARDIAN
7/5. 1933

ELECTRADIX BARGAINS
Midget Receivers or Amplifiers. They Wee 1-volt valves, baseless, take less space than one ordinary valve, 4/6 each. Single 1,000-ohm phons and cord, 2/6.

ELECTRADIX BARGAINS
Midget Receivers or Amplifiers. They Wee 1-volt valves, baseless, take less space than one ordinary valve, 4/6 each. Single 1,000-ohm phons and cord, 2/6.

SIMPSONS
ELECTRIC TURNTABLES
Quadrant, £5.50; 60; 70. Radio Dealers: trouser, boot, F. KINGSWAY radiograms, Highbridge, N.1.

THE ONE AERIAL FOR THE MODERN SET

PIX INVISIBLE AERIAL
Highly efficient self-adhesive aluminium strips—gives wonderful pick-up, class of interference—supplied in a set without tools—just gives it and sticks.

RADIO SET DECORATION
By CHARLES J. ELLIOTT.

WIRELESS cabinets are not complete without certain metal ornamentations or fittings, most of them being useful as well as ornamental. Handles are the most prominent features of the cabinet—front for drawers, doors, etc., and have a wide range of variety and design.

The fixing of these handles purely an elementary job, but the selection of the right fittings is not quite so simple.

To those who are fond of introducing period styles in a wireless cabinet it is well to point out that suitable fittings—handles, escutcheons, etc.—must be chosen. Handles of the Sheraton style could not very well be displayed on a cabinet made to imitate Chippendale furniture. While neither Chippendale nor Sheraton styles of metal fittings would be suitable embellishments for a cabinet of the severely plain or modernistic style or design of the present period. Jacobean fittings would be very suitable for dark oak cabinets.

Those Cabinet Lids.

Some home-made wireless cabinets are designed with lids, and it becomes necessary to arrange that the lid shall not fold back flat—that is so that one of the flanges of its hinges shall have turned through 180°.

To get the lid to stay in a right-angle position, one flange of the hinge butt is let into the lid and the other into the back of the cabinet, as a rule; but the hinge is so placed that its back fits slightly inside the space between the lid and the side.

Now the top outer edge of the back and the bottom edge of the lid are both chamfered to half a right angle, and when the lid is opened these two bevels meet—that of the lid resting upon the back of the cabinet. Thus the lid stands upright.

"Stopped" butt hinges may be used to achieve the same object, no bevelling of the two edges being in this case necessary. For lids that fall down in front of the cabinet "back flap" hinges are used, and this form of lid or flap is incorporated in the design for a wireless cabinet. The lid arrangement is usual on all gramophone cabinets and on radio-gramophones.

KNOBS CAN BE ORNAMENTAL.

Knofs and dials are not only embellishments, but are essentials, and it is always possible to make such essentials give a good account of themselves from the point of view of ornamentation.

The great aim in all modern designs is to give the utmost simplicity of operation; the fewer knobs or other "gadgets" on view, the more readily does the public visualise the simplicity of all operations; the fewer knobs or other "gadgets" on view, the more readily does the public visualise the simplicity of all operations; the fewer knobs or other "gadgets" on view, the more readily does the public visualise the simplicity of all operations.

(Continued on next page.)

Popular Wireless, October 12th, 1933.

there is only one control on the front of the set, and this operates the tuning as shown by the dial, then it is simple.

The big being so, much more variety ought to be seen in amateur cabinet designing. We see displayed on many modern cabinet fronts an arrangement of lines—__V__ etc.—in an effort to connect up the loudspeaker fret with the control knobs; and who those who visit the retail showrooms will note these black lines and zones, relieved here and there by a chromium plated knob or dial surround, as the case may be.

Amateurs who propose to make their own cabinets should visit the retail dealer and ask him to show them the new designs of components and cabinet fittings. The knowledge so commonly displayed for new circuits should extend to a newness in cabinet designing—a desire to have a modern cabinet as well as a modern wireless apparatus inside it.
most helpful, and I thank all those stalwarts who have taken the trouble to write in. I shall be most interested in further experiences.

Let us hope that we shall not all have to resort to the "euro" which was adopted by one of my correspondents. At the time, apparently, he was living in New York, and the apartments next to his were occupied by a party that perpetrated noise, and more noise than those three o'clock in the morning! So he rigged up a powerful Harley oscillator and would hunt from his bed, and he just "chased" his neighbours up and down the dial as they searched for stations without which to them must have been a "mysterious" out-performing pair. He won the battle in two days! Ingenious, but hardly practicable in this country.

The "Al-Metal Way."

In general I make a point of dealing only with free literature under our post card scheme, because the latter has a tendency to be one of the "Stop-Go" excerpts: theatre music items.

The inclusion at long last of old ballads in the theatre music repertoire is a welcome addition to the "Psycho-analytical Approach to Social Problems."

"Very frightening, you say. But in his talk Dr. Ince said: "The savage woman puts a ring through her nose; the civilised lady through her ears. The Chinese ladies used to bind their feet; the civilised lady puts every organ of her body out of shape by high heels.

The season's talks, judging from the quality of the No. 1's that I have already listened to, are of a remarkably high order; a rival at present in this compering business. I shall have to say that on account of the large number of "P.W." readers who are making use of our literature service, but will you kindly note that you must enclose three shillings in stamps with your application, which will have to be sent to me in the usual way. I am reluctantly compelled to tell you that those free copies were very generous in asking that only three pence should be sent to cover postage and despatch. It's a "snip" for threepence.

Those of you who would like a copy can obtain one through our literature service, but will you kindly note that you must enclose three shillings in stamps with your application, which will have to be sent to me in the usual way. I am reluctantly compelled to tell you that those free copies were very generous in asking that only three pence should be sent to cover postage and despatch. It's a "snip" for threepence.

WIDE-BAND SUPERS

A friend who is working on a set tells me that he has been able to upgrade his overall gain from three I.F. stages at about 270. This, of course, is quite negligible compared with the terrific gain that we associate with modern superhet broadcasting receiver.

All this brings the problem farther forward in the receiver business, and shows us that we must not risk the slightest loss of efficiency in the frequency and linearity that matter to the aerial system. Given a reasonably strong signal to start with, three-resistance-coupled I.F. stages will be completely satisfactory for the job.

The Supreme Test.

Given a poor location, poor aerial and inefficient ultra-short-wave detector, nothing on earth will do it! The television receiver is going to be the supreme test of the amateur's ability to maintain the highest efficiency "all along the line."

There are rumours that Marconi is carrying out television experiments from the Eiffel Tower to the Italian coast, the reception point being a 15,000-ft. peak in the Alps. We also hear that Austria is going steadily ahead, and the use of an efficient and comprehensive high-def. service in Germany is, of course, well known.

The technique of design of radio apparatus has been advanced by the introduction of this range of Oil-Immersed Condensers.

The requirements of high fidelity amplifiers and television apparatus are adequately catered for by types 950 and 951 Dubilier Oil-Immersed Condensers. These Condensers are the smallest and most compact on the market in relation to the capacities and working voltages. Write for a copy of the Dubilier Illustrated Catalogue.
BARRY KENT CALLING

News and Views from the "Big House."

Special Musical Shows.

In addition to the twelve concerts of the B.B.C. main symphony season, there will be three features taking the form of the elaborate production of unfamiliar choral works. The titles of the features have not yet been announced. There will be one before Christmas and two afterwards. These will provide the young men of the Music Department at Broadcasting House with an excellent opportunity to display their virtuosity. Cost is not to be allowed to stand in the way.

Film Music and Radio.

Araising out of the discussion of the arrangements for the radio version of the film "Squibs," a ruling has been made by the B.B.C. against the use of film musical directors for radio productions. This means, in the present case, that Mr. Trytel will not be asked to do the radio version of his film. No reflection is conveyed on the art of film musicians; but it is thought that film work is so different that it is better for film directors for radio productions.

The St. Andrew's Day programme on Saturday, November 30th, will contain a twenty minutes' feature from Canada. The rest of the programme will be constructed through.

** Visitors Not Wanted.**

I hear that this proposal is likely to go forward. The job will be put up to open tender.

National Anthem.

On all its short-wave programmes to the Empire and the world, the B.B.C. is now making much more use than it did of the National Anthem. A special new record played by the Empire Orchestra, in the version approved by the King himself, has been prepared, and is being used daily and nightly at the conclusion of the programmes. Many listeners would like to hear the National Anthem more frequently in the home programmes.

St. Andrew's Day.

The St. Andrew's Day programme on Saturday, November 30th, will contain a twenty minutes' feature from Canada. The rest of the programme will be constructed in London and Edinburgh.

Popular Wireless, October 30th, 1935.

** The Kentucky Minstrels.**

The Kentucky Minstrels will produce their tenth radio edition on October 23rd and 25th. The cast is a strong one, including Scott and Whaley, Ike Hatch, Percy Parsons, C. Denier Warren, Harry Pepper and Dennis Arnold, the Kentucky Banjo Team, the Variety Orchestra, and the Male Voice Chorus.

Harry Pepper, who devises and produces the Kentucky Minstrels, is providing a different twist for the medleys. This time, they will be confined to different states in America, as for instance a medley consisting of the melodies of Louisianans and various other southern states.

** The "Voice of Britain."

During the present international crisis the B.B.C. News Bulletins are actually the "Voice of Britain." All news and statements bearing on the situation abroad are made with the close co-operation of the Foreign Office. This is why there was no direct relay of the speeches of the Abyssinian Emperor or of Signor Mussolini.

THE POSITIVE ELECTRON

(Continued from page 141.)

for a given polarity of the field, depends of course upon the direction of the current through the wire—or armature.

The presence of the wire is really neither here nor there. So long as an electric charge moves through a magnetic field it will be acted upon by a deflecting force, which of course, explains why the free neutron moves through the chamber in a curved path.

Until about a year ago the tracks were always found to curve in the same direction. Then as a result of using more intensive bombardment and more powerful magnetic fields, other tracks were suddenly discovered which curved in the opposite direction. This could only mean that new particles had been forced out of the atom, which were identical with the old electron, except that they carried a positive instead of a negative charge.

The existence of the positron has since been verified in other ways. Meanwhile, it has thrown all our modern notions of the nature of electricity into the melting-pot, and threatens to take us back to the old "two-fluid theory" of Benjamin Franklin.
TECHNICAL JOTTINGS
Items of Interest to Every Enthusiast.
By Dr. J. H. T. ROBERTS, F.Inst.P.

Television Experiments.

Now that the low-definition television transmission from the B.B.C. has come to an end, whilst, of course, the high-definition type is some considerable time in starting, there is a hiatus which is very inconvenient to all those who possess television receivers, or who want to experiment with home-made receivers for the new high-definition reception.

But it is possible to get records which, when electrically reproduced, will give you the necessary television signals and enable you to carry out your experiments. The record, in this case, is reproduced electrically in the ordinary way, the signals from the pick-up being passed to the television receiver. These records run for a total of more than five minutes, and quite fair pictures can be built up on the television receiver screen by means of the signals obtained from the records.

Vagaries of the Cathode Stream.

Those of you who have had any practical experience of the working of cathode ray tubes know that the cathode stream is very sensitive to any electrical or magnetic influences, and is very easily deflected. For instance, if a magnet happens to be near it will almost certainly cause some appreciable deflection of the beam. In the same way, it is a well-known fact that any wires near the cathode ray terminals will have an effect.

When the moving-coil speaker was first brought out it was invariably of the energised type, but presently along came the permanent magnet type which, of course, did away with the current necessary for energising the field winding, and whilst, admittedly, great improvements have been made in its working, workmen are taken to shield the latter, this same effect will occur, causing, of course, very bad distortion in the received picture.

Shielding from Magnetic Fields.

For this kind of reason it is very important in building up a cathode-ray receiver to take means to shield the tube from the stray electric or magnetic effects of any neighbouring components or conductors.

Sometimes, owing to slight lack of symmetry in the construction of the cathode-ray tube or in the disposition of the electrodes, the beam when in its "zero" position may not make the fluorescent screen at the geometrical centre. If this should be the case, it is sometimes quite easy to bring the beam in its normal zero state into the right position by placing a small magnet somewhere near the tube, so that it shifts the beam as required. The exact placing of this magnet must be found by trial, and when the cathode beam has been brought into the centre the magnet must be permanently fixed.

I should perhaps mention that this correcting device should only be used for very small corrections because if the beam is permanently subject to any large static magnetic field it will upset the proper working of the beam when under the influence of the varying voltages applied to the deflecting plates.

Permanent Magnet Speakers.

Would you say that more people used permanent magnet moving-coil speakers or energised M.C. speakers? I should be inclined to think that the permanent magnet speakers were in the majority. If this is the case, it must be because of their convenience, especially in cases of home-constructed sets.

When the moving-coil speaker was first brought out it was invariably of the energised type, but presently along came the permanent magnet type which, of course, did away with the current necessary for energising the field winding, and whilst, admitted, great improvements have been made in its working, workmen are taken to shield the latter, this same effect will occur, causing, of course, very bad distortion in the received picture.

As a practical consideration the resistance of the field winding must not be too large, otherwise you will cut down the H.T. voltage to the anodes of the valves too much. For example, in the case of a mains supply unit giving, say, 250 volts, you do not want a drop of more than perhaps 100 volts in the field winding of the speaker, leaving the other 150 volts available for the anode of the output valve.

Making a Multi-Meter.

If you have a fairly accurate milliammeter, reading up to say 5 milliams, you can use this for reading all the currents, especially up to many times the maximum reading on the instrument itself. All you have to do is to prepare for yourself a series of shunts, that is, conductors to bridge across the terminals of the instrument, each conductor having only a fraction of the internal resistance of the meter itself.

For example, let us suppose that the internal resistance of the instrument is 90 ohms, then if you bridge a resistance of 10 ohms across the terminals and apply a voltage to the terminals, it is obvious that 9/10ths of the current will go through the 10 ohms and 1/10th of the current through the 90 ohms, that is, through the meter, and (Continued on next page.)
Cried a wireless me-
chinal Lord.
"These sold'ring jobs
give me a pain!"
His Dad said, "My
Son,
Use FLUXITE, with-
the-GUN.
And you'll never have
trouble again."

See that FLUXITE is always by you—in the house—garage—workshop—wherever speedy soldering is needed. Used for 50 years in government works and by leading engineers and manufacturers. Of Ironmongers—in tins, 1d., 6d., 1/4 and 2/6.

Ask to see the FLUXITE SMALL-SPACE SOLDERING SET—compact but substantial—complete with full instructions, 7/6.

Wells for Free Book on the art of "soft" soldering and ask for Leaflet on CASE-HARDENING STEEL and TEMPERING TOOLS with FLUXITE.

TO CYCLISTS! Your wheels will NOT keep round and true—unless the spokes are tied with fine wire 2 at the crossings AND SOLDERED. This makes a much stronger wheel. It's simple—use FLUXITE—but IMPORTANT.

The FLUXITE GUN is always ready to put FLUX on the soldering job instantly.

A little FLUXITE on the soldering job places the right quantity on the solder and cuts the time and cuts the cost. FLUXITE is used in the best work of all nations.

Used for 80 years in government works and for the most exacting private and public work.

Try a small box of FLUXITE and you will not be satisfied with any other. This is the genuine FLUXITE—always the same.

A Book of Thrills and Interest

This fascinating book for boys contains hundreds of amazing photographs, collected from all over the world. Pictures and facts about wonderful things not to be found elsewhere, explanations of modern inventions, true stories of inventors and discoverers, and a host of exciting features to which any boy will want to turn again and again.

The Boy's Book of WONDER & INVENTION

At all Newsagents and Booksellers 6/-

TECHNICAL JOTTINGS

(Continued from previous page)

consequently whatever current is shown on the meter has to be multiplied by 10 in order to get the total current passing.

How to Make the Shunts:

In the same way, if the resistance of the shunt is not 1/9th but 1/90th of the resist-
ance of the meter, it is obvious that 99/100ths of the total current will go through the shunt and 1/100th through the meter, so that the total current is obtained by multiplying the readings on the meter by 100. When you are using very low-resistance shunts, so that you have to multiply the readings on the meter by a large factor, such as 100, you must be very careful to get the shunts as accurate as possible, as obviously the accuracy of the shunts directly affects the accuracy of the calculated current. It is not likely that the internal resistance will be a convenient figure such as 90 ohms, or even some figure easily divisible by 10. In such a case you can include a small resistance in series with the instrument so as to bring the total resist-
ce of the two up to a convenient value, such as 90 or 45 or any other figure you wish. Then your shunt has to be con-
ected across the whole combination, con-
sisting of the instrument and the series resistance. In other words, the series re-
sistance is to be considered as being included in the internal resistance of the instrument.

What Does Your "Juice" Cost?

There are a number of high-tension accumulator batteries on the market, one of them certainly a very reliable one being the Milnes H.T. supply unit. This comprises the necessary number of small battery cells, but these differ from usual lead-acid cell entirely in character. Instead of lead plates the plates are made of nickel cadmium and an alkaline electrolyte is used instead of an acid. The plates develop 1.25 volts per cell, or 5 volts per group of 4 cells. At first you might think that the lower voltage per cell was entirely a disadvantage. It appears that a greater number of cells has to be used to build up a given voltage, but it has a rather curious and important advantage in that 4 cells giving 5 volts can be nicely recharged (without any series resistance) from a 6-

S.T.700 DEMONSTRATIONS

Mr. Scott-Taggart is demonstrating this magnificent new set to many readers before publication. Readers in London, Glasgow, Manchester and Birmingham should apply at once stating present set and results obtained. Nearly all applications so far are from successful S.T. set builders.

We now want applications from builders of other designs and those builders of any sets who are dissatisfied with results. Write immediately to Mr. Scott-Taggart, c/o POPULAR WHEELER, Tallis House, Tallis Street, London, E.C.4.

Electric Supply.

Everybody who uses the electric supply for operating his radio receiver, or he either uses an all-electric set or, if he has a set that used to be battery-operated, he goes in for an H.T. supply unit or a supply unit for the half of the H.T., L.T. and grid-bias requirements.

But the fact remains that there is a very large percentage of radio users in this country who are still without a light. It is possible to use an electric light supply and are likely to be without it for a long time to come. This means that the number of entirely battery-operated receivers is over all the latest sets of the H.T. L.T. and grid-bias requirements.

The type of cell which is used does not corrode the nickel cadmium and steel grid for connection. This type of cell will also stand a very heavy rate of charge and discharge without suffering any permanent harm.

The high-tension Milnes battery is fitted with switching arrangements so that the whole thing can be instantly connected into sets of four cells (5 volts), all in parallel; when 6 volts are applied to the battery the correct charging current then passes through all the cells.

EVERYONE INTERESTED in the Ultra Short

EDDYSTONE GUIDE

WAVELENGTHS

Will find this new EDDYSTONE GUIDE invaluable. Full of interesting information with many constructional articles and fully illustrated.

MICROSCALE ADVERTISEMENTS
3d. per Word
6d. per word for first words in beauty type.
6/- per line for displayed lines

Minimum Charge 3/-
Remittance must accompany order.

Advertisements for these columns are accepted up to first post WEDNESDAY morning. The Proprietors have the right to refuse or withdraw advertisements at their discretion.

Postal orders, in payment for advertisements, should be made payable to the Assmelinested Press, Ltd., and crossed.

All communications should be addressed to Advertisement Department, Popular Wireless, John Carpenter House, London, E.C.6.

RECEIVERS, COMPONENTS AND ACCESSORIES
Surplus, Clearance, Second-Hand, &c.


WOBURN RADIO OFFER FOLLOWING NEW LINES.
W.R.C. Short-wave Chokes 10-100 metres, 6d. W.R.C. Short-wave Intermediate Frequencies, 1/3, 2/6, 5/6, 7/6, 10/-, all in sealed cartons.

All communications should be addressed to Advertising Department, Popular Wireless, John Carpenter House, London, E.C.6.

RECEIVERS, COMPONENTS AND ACCESSORIES
Surplus, Clearance, Second-Hand, &c.

SOUTHERN RADIO’S WIRELESS BARGAINS.

MIDGET SETS. 1935/36 Series. A.C.D.C. Universal Sets for 100-250 Volts, Medium and Low V's. 3 Valves, complete with moving coil Speaker in beautiful walnut cabinet. £3 16d. 6d. Similar Model for Medium Waves only, 6/- 6d.

ELIMINATORS. Recently return with a complete set of Trimmer, Choke, Speaker and 25/- Tonic, 1936 Model. Limited supply. 6/- 6d. in sealed carton.


PHONOGRAPH RECORDS.

REPAIRS.
All makes, Moving Coil Speakers. Send for price list. ROYAL, 19, Colborne Street, London, N.1.

WANTED FOR CASH.

PRICES PAYABLE.
We pay top prices for new and second-hand apparatus. SIGNET, 25, Euston Street, London, N.W.1.


Please insert our Pay advertisement in “Popular Wireless” for insertions at a charge of £ s d.

INDEX TO ADVERTISERS

October 16th, 1935

PUBLISHERS’ CATALOGUE SAVES POUNDS
MANUFACTURERS’ CATALOGUE SAVES POUNDS

20 VACANCIES.

MISSISSIPPI COAST—DIRECT TO KANSAS

MISSISSIPPI COAST—DIRECT TO KANSAS

BE SURE TO MENTION “POPULAR WIRELESS” WHEN COMMUNICATING WITH ADVERTISERS.
IF IT'S LAUGHTER YOU'RE AFTER

You Must Play

Bobs Y'r Uncle

The New Card Game For ALL the Family

Whether you are feeling depressed or frivolous there is nothing like a game of BOBS Y'R UNCLE to make the world seem a better place to live in. This new thrilling card game is the jolliest laughter-raiser ever invented. Fortunately it is a game for everybody—the kiddies can play it and enjoy it just as much as the grown-ups. The rules are as simple as A B C, yet it can be a game of quick thinking and slick action. The fun becomes furious and the laughter rings through the house wherever BOBS Y'R UNCLE is played.

Don't spend another dull evening—get a pack of these 54 humorous cards to-day and make your home a happy place to live in.

Made by
John Waddington Ltd.

A RIOT OF FUN
A MILLION LAUGHS

On Sale wherever Games are Sold

1/6
54 CARDS

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

DESCRIBES HIS NEW SET
S.T.700

NEXT WEDNESDAY
OCT. 30th

Britain's famous radio inventor and leading designer will disclose revolutionary new features never before used in a radio receiver. A tremendous demand for next week's issue is certain.

3 FREE GIFTS!!
(1) Full size Blueprint of the S.T.700.
(2) Auto-Dial Card.
(3) First of Six "Datagrams."

ORDER NOW!
Cossor Radio is radio at its best—quality results with simplicity in operation. It enables you to take your choice of the best programmes, clear—clean cut without interference and with true-to-life tone. Designed and built in the Empire's largest and most completely equipped self-contained wireless factory, backed by a reputation second to none, Cossor Radio is above all RELIABLE.

A.C. MAINS 'SUPER-FERRODYNE' RADIOGRAM MODEL 536

Incorporating the famous Super-Ferrodyne development with Variable-mu Screened H.F. Circuits, H.F. Pentode Detector, Pentode Output and Pull Wave Rectifier. Concert Grand Mains Energised Moving-Coil Speaker, single knob tuning, illuminated Full Vision Scale calibrated in wavelengths, combined On/Off, wave change and gramophone switch. Volume Control. Silent-running Induction Motor, turntable to take up to 12 in. records, speed regulator, fully automatic stop, high-grade pick-up and arm and separate Volume Control for gramophone reproduction. Walnut finished cabinet 3 ft. high, 1 ft. 6 in. wide, 1 ft. 5 in. deep. Sockets for extension speaker.

16GNS

Hire Purchase Terms: 25/- deposit and 18 monthly payments of 55/-

Prices do not apply to I.F.S.

BATTERY CONSOLE

MODEL 3355


PRICE (exclusive of batteries) £7-15-0

Hire Purchase Terms: 25/- deposit and 11 monthly payments of 55/-


Please send me free of charge, literature giving full particulars of the Cossor Model.........

*Please state model required.

Name

Address
SAVE HIS LIFE
RADIO SALONIKA
AMERICAN EXPORTS
NEW STATIONS

Advantages of Tea-time Music.

The advocates of music at meal times often say that a switched-on radio set aids digestion. That it can do much more than this is evidenced by a story from Sweden. The story concerns a man who was pouring himself out some tea one day, with the loudspeaker providing a cheerful background. Being inclined to diabetes, the man found some sucrine in place of table sugar. The beneficial effect was noticed at once. The novel feature was that the man no longer felt the need to take insulin.*

Salonika is one of the rarest birds in Europe. There is a story about a young man who had just sailed into Salonika, and wanted to be quite free of any interference. He tuned in and bagged 309,145 metres, for its output volume is enormous, without affecting the quality in the least. I do not hesitate to say it is the greatest set I have heard.

Austria has decided to build a larger broadcasting house in Vienna. Norway also is to have a new radio headquarters at Oslo which will be a lot of testing necessary, after that the transmitting gear installed, and engineers new lungs.

Sixty-four stations were received, all at amazing volume and not one interfered with another. Selectivity is absolutely marvellous. Output volume is enormous, without affecting the quality in the least. I do not hesitate to say it is the greatest set I have heard.

The Crystal Palace firework display was recently televised experimentally by engineers of the Baird company.

Australasia has taken to the naming of Nationals and Regionals, instead of using call letters to distinguish stations. 6 W F now becomes Perth National; 3 L O, Melbourne National No. 1; 2 F C, Sydney National No. 1; and 5 C K, Adelaide National.

Radio Rookies.

I am positive that all constructors will have a set to be proud of for many years to come. I do not hesitate to say it is the greatest set I have heard.

The S.T. 700 smashed my testa of their receivers. That it can do much more than this is evidenced by a story from Sweden. The story concerns a man who was pouring himself out some tea one day, with the loudspeaker providing a cheerful background. Being inclined to diabetes, the man found some sucrine in place of table sugar. The beneficial effect was noticed at once. The novel feature was that the man no longer felt the need to take insulin.

The B.B.C. is pressing forward with the arrangements for a North-East transmitter. One proposed site is on land at Bewclay Farm, west of Newcastle.

Not Easy to Get.

GREECE is not what you would call ardently radio-minded, for they have only one station there—Salonika. Moreover, the power is somewhat anemic—a mere one and a quarter kilowatts. Furthermore, the hours of working are definitely scanty—only half an hour's programme daily. There's worse to come. This solitary, low-powered, short-houred station at Salonika closes down for most of the year, though it has been working lately in connection with the Salonika International Fair. Should you hear it, on 233.5 metres, log it in capitals, for Salonika is one of the rarest birds of the air.

Birth of a Station.

Inquiries about the young fellow who is coming to town in Northern Ireland next year have elicited some reassuring news. Everything is going on very nicely, thank you, and the blessed event is expected to take place in February, when listeners who tune to the old Belfast wavelength will be able to hear the new hopeful trying out his new lungs.

A Belfast reader tells me that the engineers have already taken all the transmitting gear installed, and after that has been done there will be a lot of testing necessary, owing to the novel features of the new station.

Figures Talk.

The American equivalent of the Board of Trade is getting out its figures for radio exports; and those figures are mighty impressive (yes, sir, I'll say they're impressive, in the mass and in detail). Last year Uncle Sam sold the rest of the world 612,084 receiving sets—a big advance on the 597,786 which was the total for 1933. The value of the 1933 crop of sets exported was 9,423,553 dollars: that of the 1934 exports, 15,358,143 dollars. The 'tools' trade was by no means quiescent either. In 1933 the world bought 5,399,145 valves from the U.S.A. In 1934 the corresponding figure was 6,289,311.

Technical Progress.

RIO DE JANEIRO is to have another broadcasting station, operating on 10 kilowatts. It will be called "Radio Tupi." Austria has decided to build a larger broadcasting house in Vienna. Norway also is to have a new radio headquarters at Oslo.

Neglected Wavelength Commandeer.

In a world as wicked as this one, it does not pay to leave an unoccupied wavelength hanging about in the cold. Luxembourg did this, with 240-2 metres, when it seized on the long wavelength which it still uses in defiance of the Locarno Plan. And now Germany has nipped in and bagged 240-2 metres, for its experimental Saar station. This newcomer relays the Frankfurt programme on low power until the New Year, when a 11 kw. station will be used. As soon as possible after that the puny Saar transmitter will be installed—a 17-kilowatt.

France's Lateis.

The Marseillaise are delighted with the first tests of their new Regional station, which should soon be pumping programmes over into British aerals. The wave-
length is 400:5 metres, the power (when let all out) will be no fewer than 120 kilowatts, and the chances of good reception in this country, rosy. Moreover, the Toulouse Regional is coming along rapidly, so from a radio point of view this part of France is indeed the Sunny South.

It will soon be possible to appreciate with some accuracy the broadcasting improvements under the General Ferrie Plan, for in addition to the Paris P.T.T. station, the new transmitters are on the air from Strasbourg, Nice, and Lyons.

The New Stations.

Has anybody heard the nice new Nice station, which is replacing Toulouse-Pyrenees. Heilberg is now certainly using his increased power and new aerial, whilst Leipzig appears to be doing ditto. What with one and another of them it's going to be a warm winter on the ether, whatever it may feel like beneath the old topcoats, dry-cleaned to carry on till funds improve.

A Big Disappointment.

Tired of all this political palaver, and superficial propaganda, you have to buy the press. It's a hoot to be faced by this Oriental interlude, the poor chap was horrified to hear the music stop, its place encircled by something really hot.

Setting himself comfortably to enjoy this Oriental interlude, the poor chap was terrified to hear the music stop, its place taken by the news, and all the old familiar terms: "Committee of Six," "Geneva," "Meretse Ballwin," and all that lot! "It's hard lines," his letter concludes, "when all the European stations talk about dreams of Lille (247 m.), La Doua (463 m.), of Lille (247 m.), and of thedf new Toulouse station, apparently impatient of dodging station, apparently impatient of dodging.

Circumlocution Request For Circuit.

The way in which these short-wave amateurs encircle the world with their low-powered transmitters is well illustrated by the following incident. A South Australian experimenter, who operates station V K S S U, wanted to get a good television circuit from a Heathfield, Sussex, fellow fan the owner of station G J S J. Failing to pick up the Sussex station direct, V K S S U passed the request on to V I T 3 E G, Victoria. V I T 3 E G got in touch with V S I A G, Malay. This station, apparently impatient of dodging about in the Southern Hemisphere, slapped the message down on to the aerial of G 2 N, England, where it was passed on to Heathfield.

It's just as well that the poor old Great-Grandpa never knew about this. The television part would have scared the old chap off, while calling up the other side of the world would have seemed to him to be sheer devilment, and right again Nature.

Following the Programme.

The Australian amateur, Mr. James Melrose, has fitted to his Peculiar Gull monoplane a radio-homing device that wants a lot of beating for simplicity. In three units, weighing barely 22 lb. between them, the gear is arranged to stay away under a seat or locker in the cockpit. On top of the fuselage is a short mast, with a fixed aerial extending towards the tail.

This form of aerial is strongly directional in the line of flight, so what the pilot does is to choose a station in the direction in which he wants to fly, and steer straight for the programme! Without ordinary navigation he can thus steer from station to station, knowing each hop that he takes will bring him on his course if he flies into the picked programmes.

Please, Sympathy.

There are vocational dangers in every walk of life, but who would have supposed that there is a professional risk in announcing? Indubitably there is, for the announcer at Radio Algiers, the unlucky M. Andre Hugues, has just proved it.

During one of the gramophone record broadcasts from that station he accidentally pricked his thumb with a gramophone needle. It did not seem much at the time, but he has now had to have his right thumb removed.

Police Radio.

Those police radio schemes seem to be coalescing into something really hot in the way of inter-county communication. Nottinghamshire is one centre where there is a scheme for linking up that county with Lincolnshire, Derbyshire, Rutland, and Leicestershire; Lincashire and Yorkshire could easily join up with this group, and extensions farther north and to the south and west would soon embrace the whole country.

The Nottingham station, at Colwick Wood, has been getting messages through very successfully at 75 miles or so.

In the south, a site near West Wickham, Kent, has been discussed, where a local Boy Blue there he baffled all my enquiries with a reticence that would have done credit to a dumb waiter.

However, I was not discouraged, for it is time you and I took off our hats and raised the roof.

Radio are Tramps.

Radio clubs seem to be all the go this year, but evidently there are not enough of them, for I have had two requests by the same post in connection with new ones.

Mr. H. A. Williamson, 22, Cambourne Avenue, Exeter, W.13, wants to start a society out his way, and would like to hear from anyone similarly minded.

In the Stockport district, Mr. Jack Taylor, of "Hollinwood," Judge's End, Marple, Cheshire, wants to get in touch with local short-wave amateurs with a view to forming a short-wave club. He tells me to warn W.15 that "I shall be worrying him soon," and concludes, "I use my eleven-valve short-wave super, and I am pulling the world to pieces with it!"

Just a Song at Twilight.

Nowadays, with powerful stations all round the dial, I am hardly ever asked to assist in identifying an item heard on a reader's set. Judge then of my surprise on getting a postcard inquiring "Who was it that sang 'Just a Song at Twilight' last night, at 10.15, just above Vienna?"

Impossible to say, I fear. It might have been Mr. James Melrose (a station addicted to the latest song hits!) or Budapest, or Bremen, or Stuttgart, or anybody. And as Vienna has one of the tallest masts in Europe, a song from "just above" might have been an angel's—we shall never know.
Judging the Tone

Now that the popular type of radio receiver has been made as sensitive and selective as conditions will permit, it seems certain that during the next few years the chief improvement will be in the direction of quality of reproduction. So, if you want to be in on the ground floor, now is the time to give this matter some consideration.

A new difficulty arises at this point, and that is to test the reproduction to see if it is good. How is it measured with instruments, but this necessitates the use of elaborate and costly apparatus and, even so, the results obtained tell only half the story. The other way of judging the tone is the rather obvious one of listening to it.

Opinions Differ Widely.

This, however, is not as simple as it may seem, for the opinions of listeners differ widely; and a further complication is the fact that a tone which sounds quite good at first may not sound so good after listening to it daily for some months. This is because many faults become more and more objectionable the more one listens. In spite of all these obstacles a reliable test can be obtained by listening, if the matter is approached systematically, and it is the object of this article to indicate how to pick out the various faults and the extent to which they mar the pleasure of listening.

All sounds are composed of vibrations in the air at various frequencies, and the nature of the sound is determined by the number and variety of the frequencies present in it. A radio receiver should reproduce all such audible frequencies with the same strength as they appear in the original transmission, but three main faults occur to prevent this: (1) Non-uniform frequency response—only a limited range of musical notes is reproduced and the extremely high or low notes are cut out. (2) Resonances—one or more particular notes are emphasised too much. (3) Harmonic distortion—alien frequencies are reproduced which did not appear in the original transmission.

Concentrating On One Part.

To pick out these faults one must try to concentrate on one part of the musical register at a time, but first a suitable programme must be selected. A small orchestra from the studio is the best for test purposes, preferably the type of orchestra with which one is most familiar other than over the wireless. A dance band will serve the purpose admirably, for the rich assortment of sounds now passing under the name of dance music will test the capabilities of the best of receivers.

Beginning with the low notes and working up, the main faults to listen for here are a deficiency of bass or an excessive resonance. The former is characterised by a thinness or lack of power in the tone, but step warily here as there is less bass to be heard from an actual orchestra than many people imagine. If you listen for the bass the next time you are near an orchestra you will find it is not an overpowering boom such as many sets reproduce, but a subdued background for the rest of the instruments, particularly the brass ones. A low note resonance is indicated by an over-emphasis of one particular note which masks the rest of the bass.

Listen for the string bass at a time when the brass is taking a breathing space. Each note should stand out clearly, and if all the notes are blurred over into a general boom it is a sure sign of a resonance. A receiver suffering at all badly from this fault should be avoided like the plague.

Proceeding up the musical scale to the middle register, the main fault here is harmonic distortion, which produces the familiar kind of harshness obtained when a valve is overloaded. You can test for harmonic distortion by turning the volume right up, at the same time standing well back to avoid being deafened. Note the type of distortion produced and see if it is present to a lesser extent when the volume is turned down to normal again.

Incidentally, considerable power is required to reproduce an orchestra at its original strength, and since harmonic distortion increases as the volume increases it is impossible, with many sets, to get full volume without the distortion becoming distressing. Loud reproduction is not itself unpleasant: it is the harshness which so often accompanies it that makes you want to turn down the volume control. A boxy tone for good quality an ample reserve of power is necessary, and it should always be possible to turn the volume up well above normal without excessive harshness appearing.

These High Notes.

Arriving now at the high notes, or what is technically known as “top,” one finds that this important part of the reproduction has been sadly neglected in the average set. The highest notes produced by musical instruments represent a frequency of about 5,000 vibrations per second, and a receiver must reproduce up to this frequency if the whole of a musical performance is to be heard. But there are present in most notes harmonics of frequencies up to 15,000, and it is the number and variety of these harmonics which give the characteristic tones to the various instruments, i.e., enable one to distinguish between two different instruments playing the same note.

Thus it is not easy to tell whether the correct amount of “top” is being reproduced, since much of it is present only as harmonics and cannot be picked out as individual notes. A general deficiency of top can be readily detected from the music sound as if it is coming through a thick blanket; the greater the deficiency the thicker the blanket.

Shrill Reproduction.

A common fault to be guarded against is a resonance at about 3,000 vibrations per second, i.e., about 2) octaves above middle C on the piano. This makes the reproduction shrill and, just as a bass resonance makes a heavy bass, a high note resonance blurs over the top into a screech at one particular note, thus rendering a soprano positively hideous. By listening carefully the unnatural-ness of a resonant top can be readily distinguished from true high-note reproduction. However, if a receiver is sadly lacking in high notes it is better to have a moderate resonance than no top at all.

To detect the presence or absence of frequencies above 5,000 is largely a question of...
"MUTING" THE LOUDSPEAKER

We are all familiar with the use of Q.A.V.C. to provide silent inter-station tuning. Here other methods of preventing noise in the loudspeaker while a set is being tuned between stations are explained.

By CARDEN SHEILS

AFTER reading some of the letters published during the silly season in the daily Press, one might be led to associate the idea of "muting" a loudspeaker with an aggrieved neighbour hurling a well-aimed brick at it—or even doing some close-range work with a coal-hammer. But the more serious and technical aspect of the title is associated with the use of A.V.C.

The object of automatic volume control is to get rid of the casual changes in signal strength which are caused by fading. In order to do this the sensitivity of the set is kept in check, so to speak, when the signals are coming in at full strength, and is automatically increased as they fall off. Obviously, under these conditions, the circuits will be working at maximum sensitivity whenever the set is "searching" for a new station, and so long as no worthwhile signal is coming in to keep it under restraint. In other words, during the interval of tuning from one station to the next, the set is reaching out as hard and as far as it can.

Objectionable Channel Noises.

Since there is always a lot of background "mush" about, most of it naturally gets through into the loudspeaker, where it becomes an unpleasant noise. The more powerful the set is the worse the noise becomes.

In addition there is a moment, just as the set is going "off tune"—and its sensitivity is therefore increasing—when the side-bands of the incoming signal are subjected to excessive amplification, and so give rise to a distorted "shriek" in the loudspeaker. These various forms of inter-channel and background noise are objectionable to the average listener, who naturally prefers to have a set that is quiet and pleasant to handle.

THE USE OF A RELAY

The relay P operates and short-circuits the loudspeaker when the valve V passes maximum anode current—that is, when no station is being received.

Accordingly, designers have produced a number of Q.A.V.C. circuits (Q standing for "quiet") as well as background noise suppressors, all of which serve to keep the loudspeaker "mute" during the operation of re-tuning and until there is some signal really worth producing.

One way of tackling the difficulty is to insert a relay in the plate circuit of one of the intermediate-frequency amplifiers of a superhet set, so that directly the signal strength falls below a certain "threshold" valve, the loudspeaker is automatically put out of action. As illustrated in Fig. 1, the last I.F. amplifier V is fitted with a relay P in the plate circuit, which in turn controls a resistance R shunted across the output of the L.F. valve feeding the loudspeaker.

How the Relay Works.

As soon as the listener starts to search for a new station the sensitivity of the set goes up, as already explained, and the current passing through the valve V increases and closes the contacts K. This automatically short-circuits the output from the last I.F. amplifier V, through the resistance R, and so effectively prevents any noise from getting through into the loudspeaker.

Directly a worthwhile signal comes along the H.F. components are rectified by the A.V.C. valve, and the resulting control-bias reduces the current through the valve V (or one of the preceding valves). The spring S of the relay is then able to open the contact K so as to throw the resistance R out of circuit and restore the path to the loudspeaker.

Fig. 2 shows a more elaborated method of using the Fig. 2 scheme, amplified bias being applied to V, from the double-diode-triode V.

By properly adjusting the initial grid-bias the set is made practically "inert" to any signal below a certain value—thus cutting out background noise and mush—though it "sits up and takes notice" directly it is given a satisfactory signal to handle.

Further Developments Employed.

But as soon as a satisfactory signal comes along, the D.D.T. begins to get busy. The voltage drop across the resistance R, "unlocks" the right-hand "diode," and a voltage is developed across the load resistance R, which reverses the original positive bias on the amplifier V, and "snaps" that valve back into action. The result is the same as before. The set as a whole practically ignores any signal below a certain level, but automatically gets to work on any signal that is worth listening to.

In a later development of the "silencing" principle, use is made of a well-known property of the superhet circuit in order to control a listener to tune accurately. If he doesn't, the loudspeaker is automatically "muted." In other words, the designer feels that a signal that is distorted by inaccurate tuning is not worth having, and he therefore insists that the set should be heard at its best or not at all.
The "act" of Murgatroyd and Winterbottom is one of the few really original inspirations on our radio. Their high-speed comedy strikes a new note. Their description of themselves as "Two Minds with Not a Single Thought" is characteristic of their breezy ballyhoo.

But to set one's hand on Messrs. Murgatroyd and Winterbottom in the flesh is a job that nearly sent your Special Correspondent into a delirium. I thought the best way to catch them together would be to go to Broadcasting House when they were rehearsing one of their broadcasts.

"We Never Meet."

"Oh, yes, you want to see Mr. Frankau and Mr. Handley," said the B.B.C. receptionist, careful not to soil his Oxford accent with the names of Murgatroyd and Winterbottom. And I was taken to studio No. 2, "to like look at—if you look at him."

Mr. Murgatroyd (alias Frankau) slapped me proudly on the back.

"We've made six double-sided records," he cried, "and met a man the other day who had bought one. And—"

"Mr. Murgatroyd" (alias Frankau)!

Ronald Frankau first went on the stage as Frank Ronalds.

But here he paused.

"Here's Winterbottom," he whispered.

"I'll go and do my hair. And quietly, swiftly, Mr. Murgatroyd slipped away.

"Hullo, folks!"

Mr. Winterbottom (alias Mr. Handley) strode up and bit me playfully in the ear.

"Look here, Mr. Winterbottom," I remonstrated, "what's this silly tale about your never meeting Mr. Murgatroyd?"

"I've never met him," said Ballyhooper No. 2, "despite the fact that the first word I heard when I was born was 'Murgatroyd', and the name has haunted my destiny all along like garlic.

Following birth came school—or-almost, and then I entered a career merchant's and learned to flick corn at the boss. Became a commercial traveller by day and entertainer by night until I turned all the days into nights—in other words went on the stage. Was in chorus, then understudy to a comedian, who ate too much liqueur one night and couldn't appear. I went on, and from then on never looked back, unless I thought a policeman was following me."

Broadcast "Back to Back."


"Tell you I've never met him! Poor Murgatroyd! I took pity on him, you know, and asked him to be my partner. I was hungry at the time and wanted someone to feed me. I decided that if he had his hair cut he'd be suitable. He objected to this, but said he'd let me know. A year later—" and Mr. Winterbottom sighed wearily—"he said he'd had the haircut, and what about it? So I there and then wrote our act, which has been so successful on the air—"

But," I interrupted, "he told me he wrote it—"

Of course he helps me now and again, sharpening my pen and putting little in their gags which I always rub out at night.

"We've made six gramophone records," he cried, "and met a man the other day who was going to buy one, but it rained, so he went to the pictures instead."

"My partner is a very peculiar man to look at—if you look at him. I never have. We broadcast back to back and are blindfolded while the other enters or leaves the studio. His wife thinks I'm the brains of the act, which is a pity because I'm married myself. However, with all his faults and despite the fact that he's an old public schoolboy he speaks very nicely. And now I must go and change my teeth."

Exit Mr. Winterbottom.

Two minds with not a single thought? You're telling me!

"The Red Sarafan."

(The Tuesday National Programme.)

"The Red Sarafan" is to take the place of the cancelled broadcast of the Royal Command Performance. The lost broadcast from this Russian restaurant provoked an unexpected response from all parts of the country and from knowledgeable critics. It is hoped for the next relay from "The Red Sarafan" to obtain as a visitor a very famous Russian film actress. The Cossacks are busily piecing together traditional songs which have not been heard in this country. When the whole has been worked up, it must be passed by the severest Cossack critics.
NOW that Dr. Adrian Boult has decided to devote all his energies to the whole-time job of conducting the B.B.C. Symphony Orchestra it is opportune to record some of this genial musician’s views on broadcasting.

I met the Doctor in his office on the third floor of the “Big House”—in an atmosphere so kind and cheerful that I almost wished I really did like Bach cantatas. For it would have been gratifying to have talked on a Higher Plane.

But that implies the Doctor is a highbrow—which is the last attribute I would accuse him of, knowing his intense humanity; his abiding love of real music.

Many listeners have stopped to think of the various different series of musical concerts that come during the course of a year under the unwavering banner of Dr. Boult? I myself was a little staggered when he ticked them off.

Symphony concerts, chamber music concerts, contemporary music concerts, musical festivals—a widely varying schedule this, especially when one realises that some of the concerts are given in studios and others in various concert halls.

Came, of course, my inevitable question, “Do you really believe, Doctor, that all this broadcast music is making the average listener more musically minded?”

Plenty of Young Enthusiasts.

“Perfectly certain,” came the reply without hesitation. “Look, for instance, at the Queen’s Hall during the recent ‘Prom’ season. Study, if you will, the ages of the Prominers. I would not like to say what the average is, of course, but I should estimate it to be not much more than twenty years.

Where do all these young people come from? And why do they come? I think it is highly probable these young enthusiasts caught their first fine careless rapture of music concerts, musical festivals with the real thing—listening to a broadcast Prom.

“They have sat at home, listening perhaps only casually to the programme being performed in Queen’s Hall. Then, at the end of each work, they must have been intrigued by the tremendous applause. Isn’t it rather likely these curious listeners have paid their shillings to come into Queen’s Hall to see why there is so much excitement? Well, that is just one way broadcast music is helping to initiate listeners. Another very important contribution is, I feel sure, through the medium of records—listening to a topic of no particular interest to one, Dr. Boult showed me his day’s mail, which contained some striking examples of the way in which ordinary simple folk, without any particular background of education—musical or otherwise—had gained pleasure from his broadcasts.

One letter, from a servant girl, comment may be curiously enough to want to hear how different it sounds—and, of course, the orchestra would reveal subtleties a band cannot be expected to bring out.

“Once listeners are initiated, so to speak, I think I can safely say they don’t go back. Give them a taste of the real thing and they will, like Oliver Twist, ask for more.”

Dr. Boult showed me his day’s mail, which contained some striking examples of the way in which ordinary simple folk, without any particular background of education—musical or otherwise—had gained pleasure from his broadcasts.

One letter, from a servant girl, commenting on a topic of no particular interest to me, revealed a passionate keenness for good music. And the Doctor tells me that every day he gets such letters, showing that it is not merely a few intellectuals who enjoy music.

Noticing in the corner of the room a standard B.B.C. amplifier and moving-coil loudspeaker, I asked Dr. Boult how his enjoyment of music via the radio compared with the real thing—with listening in the studio or concert hall.

The Question of Light and Shade.

“What I especially wanted to know was whether he suffered any aesthetic loss through the natural squeezing up of the dynamic range to take the range from the very loud imposed by the broadcasting chain.

“Curiously enough,” he confessed, after pondering the matter for a moment, “it does not worry me in the least. I suppose the truth is that I am listening not so much to the changes in dynamic volume, but to the quality or tone of the orchestral needs. Curiously enough, this time I went along to the hall itself. And, do you know, I was quite right—they were not taking public performances! So that really answers your question. If, at the loudspeaker end, I can detect such lapses from perfection of playing, hardly must mean that something comes over when they are performed on the air. This was most interesting, I thought.

For the technical, as distinct from the artistic, purists are fond of telling us that we are never ever approach reality while the eighty decibels of volume ranges produced in a concert hall are squeezed up to only twenty-four decibels by the control engineers of the broadcasting stations.

In the last analysis, is it aesthetic pleasure that matters. Dr. Boult’s experience rather points to an unsuspected truth—that no amount of controlling by the engineers can destroy fine tone. And, on the same line of argument, boosting up by the control man will not give good tone to a performance in which the fortissimos have been skimmed.

“And now, Doctor, the question of an audience. Which do you prefer, studio or public performances?”

The Highest Possible Standard.

“I must confess,” said the Doctor, “that I am happiest when I have taken my coat off and am conducting a concert in the studio—as, for example, in a Sunday symphony programme. I don’t pretend to understand why this should be so—and as against this I must say most of my music-loving listener friends tell me that they enjoy hearing a public performance more than a studio one.”

Came the really delicate question, “Do you now consider that in the B.B.C. Symphony Orchestra you have reached the highest possible standard?” Dr. Bonit smiled.

“The recent Festival proved it. Toscanini’s success with the orchestra proved it. In fact, world opinion has more than endorsed any modest claims we may have made.

“Surely, the full strength of the orchestra? It is now one hundred and nineteen players. Of course, these are sub-divided into sections A, B, C, and D for various orchestral needs. One aspect perhaps it is. But I cannot see any other way of doing it. We cannot tie a label on any particular section, for the whole section realises that the content of each section varies from time to time. What we might do is always to add the number of players to our information on to which section is performing.
AMATEUR craftsmanship is a fascinating as well as an extremely useful diversion, and everyone who possesses a modicum of patience and can handle the metalworking is much easier than metal-working, but I at least have never found that to be the case. An elementary knowledge of wood-working is very useful, though, but it is my experience that jobs in metal are more frequently encountered in the home, and where an alternative is offered between doing something in metal or in wood I always take the former course.

May be that is sometimes because it is easier! The most useful tool apart from such things as pliers and screwdrivers is undoubtedly the soldering iron, and if there is electricity in the house an electric iron is a first-class investment.

You can get a very good one for about 7s. 6d., and if it is rather on the light side that is an advantage, because it will enable the smaller work to be tackled. And as it is kept at a more or less even temperature all the time by the mains, the need for a heavy iron (one having a large bit) will not be felt.

Keep It Clean.

The main purpose of a large bit is to hold the heat, but a "lively" electric iron of a light weight will generate and maintain enough heat for all ordinary purposes.

It is wrong to suppose that an electric iron never gets dirty. The surface of its bit will tend to oxidise, and therefore it requires to be cleaned and re-tinned at intervals.

Tinned sheet iron (usually referred to as "tin"), copper and brass, all solder with the greatest of ease. Soft iron is a more difficult proposition, and so is steel, while aluminium cannot be dealt with without special treatment, and is a metal which I avoid for that reason!

When soldering lead, a soft solder and a deft touch is needed, or the lead itself will melt away before you realise what is happening.

Soldering gives you a pretty good join when it is properly done, but there is not a great deal of strength in it, and it is useless to try and build up strength by mere weight of solder. It should be remembered that the solder itself is an extremely soft alloy.

The end-to-end join between two pieces of a broken piece of brass or copper should be reinforced by a flat piece of similar metal (or perhaps a piece of "tin" might do), as is shown in the diagram.

And when making right-angled joints between metal rods it is often advisable to supplement the soldering with a rivet or screw, as below. The rod shown vertical is hollowed a trifle at its end so that it partially fits round the other, and then a small hole is drilled, as shown, to take a small brass pin or nail at a driving fit. If the whole job is well cleaned and Fluxite liberally used, the solder will run into it in such a way that a most effective joint results. It takes a little time, but it is well worth it.

You may remember the model self-controlling electric boat I described in "P.W." some time ago. The skeleton of this called for about fifty right-angled brass rod joints. Well, many might have been satisfied to use solder alone, but I riveted the whole lot as well, for experience had proved the advantages of the method.

Thereafter, I was able to solder in the vicinity of any of these joints, or apply stresses and strains, knowing that they wouldn't start to burst apart at the slightest provocation.

No, for goodness sake never think of solder as a kind of metallic glue which adopts the strength of the medium to which it is applied!

Iron and Steel Not Difficult.

And another thing, don't be scared of working in iron or steel. It isn't half as hard as you might think. Soft steel, as a matter of fact, is quite easy to handle, except in so far as soldering is concerned, though it will solder well enough if you keep the job clean, use the Fluxite thor-oughly but sparingly, and see that the iron is hot before you apply it.

Of course you can't employ small tinsnips to shape even soft steel, but it will cut readily enough with a hack-saw, can be trimmed up with a file, and will not be difficult to drill so long as you use good drills.

For brass and copper those sixpenny boxes and cards of drills will prove fairly satisfactory, but for iron and steel it is worth while to go to a good shop and pay your threepence or sixpence each for drills.

Starting the holes in exactly the right place is not always a simple matter. Sometimes it is not convenient to use a centre punch, and in any case I don't like the things. I paid sixpence for an Archimedean drill at Woolworth's, and this was supplied with a nice little bunch of drills.

A Useful Method.

I don't find these any good at all for drilling holes in metal, but mighty useful for starting holes, for an Archimedean type of drill does not tend to wander like a twist drill.

Nuts and screws are sometimes clumsy things as compared with a neat rivet, and so I often employ rivets instead. They make for much more permanent job. Soft copper rivets are no good, though, where there is any real strain on the job. For

(Continued on next page.)
much of my riveting I employ the humble nail.

I recently had to hold two pieces of steel tubing together. The obvious thing to do was to braze them, but as the tubes made a snug fit and the larger one was nice and thick, I merely drilled a hole through and used a stout nail as a rivet.

Making It Quite Secure.

I well countersunk the hole at each side of the outer tube, and cut the nail so that about a sixteenth of an inch projected at each side. Holding a flat iron firmly against one end, I steadily hammered the other until the nail spread out at each end and just filled up the countersinking with a bit to spare.

A touch or two with a fine file, a spot of paint, and the job was done! But shortly, owing to a considerable twisting strain on the one tube, a slight movement was noticed. So I ran in another “nail rivet” at right angles. There won’t be any further movement!

May be not a “professional” job, but one that is fully effective. It is worth noting that the tricyclic concerned with the operation had been taken to our only local cycle shop, which had estimated the cost of the repair at one guinea. It took me about half an hour to do.

What one has to foresee in a task where riveting is employed is the likelihood of any strain being imposed upon the rivet which will tend to shear its ends off. Seldom, if ever, in the normal way will there be any danger of its heads being pulled off, so long as they have been well-spread, little longer without, but the result will be quite satisfactory.

A set of taps and dies proves invaluable to the amateur worker in metal. These things are quite easy to handle. But if you can give a hole a thread so that the bolt will screw through it instead of merely lying in it, the whole ones of retention is not then on the nut—and you know what nuts are for coming loose.

Again, if you have taps and dies you can make your own metal screws. Run a length of thread on the end of a piece of rod, for instance. I find that a set comprising taps and dies of 2, 4, 6 and 8 B.A. sizes will serve all my own requirements. This is the kind of thing you can do. There was a camera fitment which had a butterfly nut that had stripped its thread. About 7 B.A. I should think. Anyway, a 6 B.A. tap ran straight in and cut a nice new thread in the nut. But now the screw was too thin, and as it was about three inches long and sat in a kind of ornamental base plate, an ordinary screw couldn’t be used.

But it was no hard task to take a piece of brass rod that happened to be lying about, run a 6 B.A. thread down it and replace the original screw for this. It is true that there was a rather finicky bit of fitting to be done, but there would be no useful purpose in describing that at length.

Among the other useful and inexpensive tools which I possess are a small anvil and a pair of tin snips with specially shaped blades which enable you to cut circles and shapes easily.

The anvil thumbcrews on to a bench, table, or even chair, and I hammer things flat on it in preference to hammering them on a vice. Vices are mostly of cast metal, and fracture rather too easily if hammered. That is, the small ones do.

JOINING METAL TUBES

Simple rivets made from wire nails are ideal for joining telescopic tubing.

GIVES GREAT STRENGTH

A threaded hole removes much of the strain from a nail.

Because in this event the strength of the rivet is its tensile strength, and in the case of, for example, a stout nail, that will be tremendous.

I should mention that it is quite unnecessary to heat the nail. It may take a little longer without, but the result will be quite satisfactory.

A set of taps and dies proves invaluable to the amateur worker in metal. These things are quite easy to handle. But if you can give a hole a thread so that the bolt will screw through it instead of merely lying in it, the whole ones of retention is not then on the nut—and you know what nuts are for coming loose.

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NEXT WEEK

Don’t Miss Our Special Triple-Gift

S.T. 700 NUMBER
Recording in programmes is playing an increasingly large part, so much so that the B.B.C. has had to introduce special control apparatus for it, which is described in this article.

By a Special Correspondent.

Subleties of production that were either impossible or very difficult to achieve are offered now by the B.B.C.'s latest gadget—what they prosaically call the Recorded Programme Mixer. Really it is a robot sub-editor, a magic mixing "brain" under the control of the producer.

"P.W." readers are already familiar with most of the B.B.C.'s recent recording activities: the extensive equipment at Maida Vale, the mobile recording unit, and the well-thought-out scheme for making the activities-the ten Separate Channels.

Ten Separate Channels.

An imposing affair it is. The Unit in Operation.

Ten channels are provided on these channels. They can be worked out, I can assure you. Indeed, the real fascination of this Mixer is the everlasting winking of the cue lights—but then I have a child mind, perhaps!

The Unit in Operation.

The Producer starts. He presses a key associated with the channel he wants at that moment, whereat a little green light comes on at the multigram desk. The gramophone engineer then knows which pick-up to lower. He performs accordingly, and fades up the associated potentiometer. This, note, brings the pick-up into full action.

As soon as he touches his pick-up potentiometer though, a contact works, to light up a green lamp on the mixer panel. This shows the Producer that the channel he actually wants is ready for him. Given this, the Producer starts. He presses a key associated with the channel he wants at that moment, whereat a little green light comes on at the multigram desk. The gramophone engineer then knows which pick-up to lower. He performs accordingly, and fades up the associated potentiometer. This, note, brings the pick-up into full action.

As soon as he touches his pick-up potentiometer though, a contact works, to light up a green lamp on the mixer panel. This shows the Producer that the channel he actually wants is ready for him. Given this:

(Continued on next page.)
THE ROBOT EDITOR
(Continued from previous page.)

...he then fades up his own potentiometer to as much or as little volume as he needs. As soon as he does this another circuit automatically comes into action, lighting up a small white disc on the Mixer, showing very clearly the number of the channel, in use. The real reason for this is to remind the Producer that he has that channel in action—and to guard against his leaving it in action when he has done with it.

Cuing for the remainder of the channels—from seven to ten, devoted to recording—is performed in a similar way, the lights corresponding to those on the multigram desk, being, of course, in the studio or other programme source.

A Special Talk-Back Scheme.

As if the extensive cue lighting arrangements were not enough, the ingenious engineers have also provided a talk-back system, mainly for use during rehearsals. The Producer at the Mixer can thereby make use of the commentator’s microphone already mentioned, to give instructions to artists in the various studios.

At the centre of the Mixer panel is a master indicator lamp operating automatically when the main pot control is faded up. There are other essential keys, playing through and makeshift marking notes first of all.

With a batch of records taken, say, by the mobile recorder unit it is of the utmost importance to the Producer to be able to reproduce with needed any selected portion of any record—and time is against him when he tries to locate the required portions by the old procedure of playing through.

Counting the Grooves.

A lot of special work has been put into the solution of this very real problem. The result is a series of indicators now embodied in the Mixer. Two of these indicators are arranged respectively to show the number of the record—for there may be several to a programme, of course—and the number of the groove being cut at a given moment.

The operator is therefore able, during the recording, to log the exact position on the record of any item of special interest—such as the scoring of a goal in a ball game, and to use this log for guidance during a subsequent broadcast. That is to say, during the reproduction of that record, for example, the News Bulletin.

The two main recording indicators are, of course, only a part of the general scheme of indication of records and individual grooves. It is all very well to know which groove is being recorded—but how is the operator to know which groove he is reproducing! Quite easily now, because above each of the turntables on the multigram desk is fitted a graduated scale marked in grooves. A pointer is attached to the pick-up arm, the whole mechanism being arranged so that, as the pick-up moves across the record grooves the associated pointer moves along the corresponding groove numbers on the scale.

Mr. H. L. Fletcher, who is the B.B.C. official in charge of the broadcasting side of the Recorded Programmes section, gave me a further insight into the use of the Mixer when I watched him “playing” the controls during a rehearsal of a programme.

For the sake of example, let us assume Cambridge goes ahead. Right. We note that happens on, say, disc forty at groove number forty. Then, well, Oxford draws level, shall we say? That happens on disc four at groove twenty-three. Someone falls into the water—another ‘highspot’ occurring, shall we say, on disc six at groove ten. So that when the show’s over we have a log of ‘highspots,’ which, with intervening commentary—also recorded through the Mixer, you understand—can then be accurately reproduced on the multigram desk with its turntable indicators.

Used in Empire Programmes.

“Or, take a real-life example of what we can do with this Mixer. I had to go to St. Giles’ Fair with the mobile unit, and I recorded my impressions on the spot. The discs were brought back here to London, extracts decided upon, and the resulting composite programme land-lined to Midland Regional.”

Still another important use of the Mixer is in cutting into a programme being broadcast from a studio, which is also wanted for later consumption through Empire stations. We just give a flick to Maida Vale over the land-line when we are coming to an exciting part, and at the right cue they start recording. We can then have the discs back here in no time and play them through the Mixer as desired.”

Well, there it is. Don’t you think I was justified in calling it the robot sub-editor? It takes tangled threads and makes a good story. Even a human “sub” cannot do better than that.

THE ROMANY BAND AT THE HAMMERSMITH PALAIS

Oscar Rubin, the leader, and the Romany Band of the Hammersmith Palace de Danse, who have recently joined the list of bands who broadcast.

| Popular Wireless, October 26th, 1935. | 139

for further cueing and for telephone liaison work generally between the Mixer room, control room, and Maida Vale.

I come now to what is perhaps one of the most striking features of the whole Mixer system. I refer to the recording indicators. It has been found in recent months that much time is wasted in producing recordings through lack of a record of the programme content of any part of a record. One cannot, obviously, tell what a record is all about simply by looking at it—careful

Owing to the fact that it is not very convenient to make soldered connections to aluminium, it is a good plan, when using an aluminium chassis for a set, to provide yourself with a length of copper busbar, or copper wire conductor for that matter, which can be used as a common earth.

This is secured along the length of the chassis on the underside, and is itself directly connected to earth. Aluminium conductors from other parts of the circuit which need to be joined to earth are then very simply soldered to the nearest convenient point on this wire.

Not only does it get you out of a difficulty of making soldered connections to the aluminium chassis, but when using a single way earth in this way you avoid the possibility of what are sometimes called “loop” circuits in the metal of the chassis.

It forms a very simple thing, but it has often been found that to connect different earth leads—that is, leads intended to be connected to earth—to all points on a chassis has led to a curious kind of instability very difficult to track down.
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DFG-C, 45 amp. hrs., 9/-
DMG-C, 70 amp. hrs., 12/-
DHG-C, 100 amp. hrs., 15/6.

For wireless H.T. get the Exide dry battery

GETTING A VACUUM
An Insight Into Modern Methods of Exhausting the Air from Valves.

By J. F. STIRLING

Nature, the philosophers of old used to say, abhors a vacuum and, no doubt, if they could be taken on a tour around a modern radio valve factory and have pointed out to them the ingenious and painstaking methods by which a high degree of vacuum is produced within present-day valves, they would be all the more inclined to reiterate their classic assertions.

There is no doubt of the fact that a vacuum is one of the most difficult things to produce in Nature. Indeed, there is no such thing as a perfect vacuum—here on earth, at any rate. The highest recorded vacuum ever attained on earth was produced in the laboratories of one of the large American electrical concerns. It had a calculated pressure within it of a little less than one ten-billionth of an atmosphere. The ordinary pressure of the atmosphere will support a column of mercury about 760 millimetres high. The highest attained vacuum would only support '000,000,075 mm. of mercury, which is equal to a pressure of about '000,000,001 lb. per square inch. The radio valve contains one of the highest degrees of vacuum which is commercially obtainable. Usually the vacuum in the valve corresponds to a pressure of about one hundred millionth of an atmosphere or that equaled by a column of mercury '000,001 mm. high.

Specially Designed Apparatus.

If we reckon the capacity of the average valve as being equivalent to about 90 cubic centimetres, a vacuum of the above order implies that there are still left in the valve more than thirteen trillion molecules. Compared with the original number of air molecules present in the valve in its unexhausted state, this is a very insignificant number, and the molecules present in the evacuated valve are not sufficient to cause an appreciable interference with the electron stream generated by the filament. Needless to say, valve vacua are not produced by such simple means as an ordinary mechanical or rotary suction pump. Such pumps usually gave merely small degrees of vacuum, and for the evacuation of radio valves they would be utterly useless, no matter how carefully and accurately they were made.

The vacuum pump which produces the extremely high degrees of vacuum so necessary to modern valve working is based upon the fundamental invention of Dr. Irving Langmuir, the American physicist. The Langmuir or "mercury-condensation vacuum pump, is, of all commercial types of vacuum pump, the most successful. It is rapid in action, highly efficient, and it is not sufficiently complicated to necessitate frequent overhauling and repair.

Two Pumps are Used.

Let us examine the working principle of this ingenious pump. The pump by means of which all our valves have been exhausted.

The principle of the Langmuir vacuum pump is not dissimilar to that of a steam injector whereby water is drawn into a boiler by means of a blast of steam. In the Langmuir pump the steam blast is replaced by a blast of mercury particles. A quantity of mercury (quicksilver) is placed in a suitable receptacle at the bottom of the pump, the mercury being heated by means of an electrical heater-element placed below it.

The valve or, in practice, the series of valves which are to be exhausted are connected to the upper end of the pump, special air-tight connections being employed. The pump, also, is connected up to an ordinary high-speed mechanical rotary vacuum pump, usually of the oil-sealed type. This quickly removes the greater proportion of the air from the valves and, also, from the interior of the Langmuir pump.

Boiling Mercury is Employed.

The heating element of the Langmuir pump is now switched on. Almost immediately, owing to the low pressure within the apparatus the mercury begins to boil. Its particles fly upwards and, in reality, they act as heavy projectiles, each of which carries with it a tiny particle of the residual air within the apparatus. The air particles are sucked out of the apparatus by the auxiliary high-speed mechanical pump.

The boiling mercury particles, however, are condensed by being directed on the sides of a double-walled cooling jacket of the apparatus through which cold water is continually flowing. This condensed mercury returns to its receptacle. It is again heated and passes off as vapour, the process of mercury boiling and mercury condensation being an automatic and continuous one.

The particles of air which the mercury vapour carries along with it cannot condense like the mercury vapour does. Nor can they return to the interior of the apparatus — the stream of heavy mercury particles in vapour form being sufficient to prevent this. The unwanted air particles are thus one way, and one way only, to proceed, and that is via the outlet of the apparatus which is connected up to the auxiliary mechanical air pump. Swiftly, therefore, the residual air particles which have been dragged out of the apparatus and the connected-up valves by the heavy mercury particles are sucked out of the mercury-condensation pump by the external mechanical pump, and in this manner a degree of vacuum of the high order mentioned at the beginning of this article is produced in the attached valves.

Why the Valves are Heated.

Usually the valves are heated during their evacuation period. This is because the glass sides of the valve hold very tenaciously a considerable quantity of air particles, and after the valve has been evacuated the air slowly boils out of the inner glass sides of the valve, thus spoiling the vacuum.

In order, therefore, to prevent this deteriorating after-effect the valves are heated during the time of their exhaustion, so that the air which has penetrated into the glass and metalwork of the valve may be boiled off and removed by the Langmuir pump along with the "free" air within the valve.

The use of "getters" has a lot to do with the attainment of high degrees of vacuum in commercial valves. Exactly how "getters" work is not really understood. They are substances such as magnesium, arsenic, sulphur, iodine, phosphorus, thorium and zirconium and their compounds, which are introduced into the valves in small quantities prior to their evacuation by the air pumps.

The Langmuir and similar pumps evacuate the valves to a predetermined stage of high vacuum. The valves are then sealed off. They are then carefully handled (Continued on page 179.)
ON THE SHORT WAVE

OWING to the enormous popularity of the super-regenerative receiver for 5-metre work, the two terms "super-regen" and "ultra-shorts" seem to have become permanently tied together in the minds of most radio enthusiasts.

This is rather a pity, since it tends to hide two very important facts: (1) that the super-regen. is by no means the only suitable type of receiver for ultra-short waves, and (2) that its activity is not confined to the ultra-shorts, but may be valuably employed on other wave-lengths.

There are so many different types of readers of these notes that I can't hope to please them all. The man who is chiefly interested in the reception of long-distance amateur C.W. work will find much to his taste on this page. But the reader whose chief joy is the loudspeaker reception of short-wave broadcasts may well listen to a little homily on the super-regenerative receiver.

Any oscillating detector may be converted into a super-regen. either by adding another valve or by converting the circuit arrangement in such that addition. Further, such a set is eminently suitable for the loudspeaker reception of the stronger short-wave broadcasts, although, admittedly, it is not much use for anything else.

Fig. 1 shows how anyone's detector circuit can be treated to turn it into a fully-fledged super. A second valve is added, with two large coils, L1 and L2, in its grid and anode circuits. These may be conveniently wound on one ribbed former, or may be purchased from one of the several firms marketing "quench coils." The usual number of turns is 1,000 for the grid circuit and 730 for the anode.

Varying the Frequency.

The variable condenser shown across the grid coil is not really necessary, and in any case need only be of the "pre-set" type. A fixed condenser of about 0.002 will be quite satisfactory, but a pre-set makes it possible to vary the quench frequency, which is a refinement that may on occasion prove worth while.

What, exactly, is the function of this second valve? It is purely a low-wave, i.e., low frequency, oscillator, usually operating just above the audible frequency limit—say 18 kc. or thereabouts.

We all know that the ordinary reacting detector is only in its most sensitive state when it is right on the very verge of oscillation. Some of us realise that this is the very spot on which it is impossible to keep it! The "super" does it by dragging it to and fro across this verge at the rate of some 15,000 times per second.

The operation is quite simple, in the case of a conventional circuit. The valve is in a state of violent oscillation, and the charge on the grid condenser cannot leak away quickly enough. The resistance of the circuit, momentarily, becomes positive, and the oscillations die out.

When the charge has leaked away, through the grid leak, oscillations recommence. We thus have the detector in a state of oscillation, at the frequency dictated by the tuned circuit, but also interrupted at a regular frequency settled by the time-constant of the grid leak and condenser.

The circuit shown employs no grid condenser, but the large condenser (006), from the remote side of the H.F. choke to earth, gives the desired form of operation. The H.F. choke is specially wound (using about 30 turns on a ½-in. former) for ultra-short or short wave work, and is therefore ineffective at the quench frequency.

The tuning condenser (C1 and C2) is of the split-stator or series-gap type, so that the spindle is at earth potential.

This same "self-quench" scheme can be applied to the detector circuit shown in Fig. 1, simply by employing a very large reaction condenser (say 006 fixed) instead of the 0001 variable, and juggling with the values of grid condenser and leak until the familiar hiss of super-regeneration is heard.

Another effect of the "supering" is to flatten out the tuning considerably, with the result that selectivity is, frankly, on the poor side. But that does not matter to the man who only wants really loud reception of the better-known stations.

A "super" using the circuit of Fig. 1, without any L.F. at all, will give about the same amount of volume that one usually associates with a detector-and-two-L.F. receiver. Add a stage of L.F.—possibly a pentode—and the output is colossal, if the whole thing is operating as it should.

Fig. 2 shows a simple "self-quench" receiver. Quenching coils are done away with, and the detector supplies its own quench-frequency by virtue of the values of grid condenser and leak.

Simple Operation.

The operation is quite simple, in the case of a conventional circuit. The valve is in a state of violent oscillation, and the charge on the grid condenser cannot leak away quickly enough. The resistance of the circuit, momentarily, becomes positive, and the oscillations die out.

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Fig. 1, above, shows a super of the type in which a separate quench valve is employed. In Fig. 2, right, quenching is achieved by grid chocking.

The long-wave oscillator is the culprit—its oscillations are introduced into the anode circuit of the detector by the means shown. Instead of putting our phones straight in the detector plate circuit, the reaction coil of the second valve is interposed, and our detector is therefore forced to stop oscillating and start again at the frequency dictated to it by the second valve.

The effect of this is to produce such enormous sensitivity that the background noise becomes considerable. A loud rushing is heard in the phones, and when a powerful transmission is tuned in, this rushing disappears and leaves a kind of "blank space" representing the carrier-wave. No whistles and squalls are heard, but one tunes in signals—just the modulation.
ON THE SHORT WAVES—Post 2

Points from the Post-Bag

May I, for a change, open the ball this week with a mild grouse? I so often mention readers' grievances in a semi-apologetic manner that I think I'm really entitled to one myself.

Will readers who write to me and ask for full details of transmitting circuits (and even, in some cases, constructional details of transmitters) please take this as a reply? I simply cannot, on grounds of time alone, give individual attention to queries that require the drawing up of diagrams; and, in any case, I am not supposed to give any information about transmission to persons who do not hold a transmitting licence.

A Valuable Book.

I am sorry about this, and should be only too glad to lend a helping hand if I had the time. Readers who are in any doubt what- ever about transmitting matters should write to the R.S.G.B. for a copy of the "Guide to Amateur Radio," priced at 6d., and obtainable from headquarters at 53, Victoria Street, S.W.1; this will give them all the information they require.

In case you should accuse me of giving free publicity to the R.S.G.B., let me say that I mention this book simply because it is the only publication of the kind of which I know.

Two letters have come out of the bag side by side. One is from W. J. W. (S.W.8);

FOR SPEAKER WORK

saying all sorts of nice things about the "Simplex." Two, built at a cost of 7s. 6d., including head-phones (6d. !). The other is from a reader who doesn't seem to like my suggestions; letters like yours are scarce, and I don't propose to make the change just yet.

A long letter from L. M. B. at Hankow puts forward the overseas reader's point of view in no uncertain terms. A summary of the position in Hankow is: Market flooded with American superhets. British sets are looked upon as "Very good, but too expensive." From the listener's aspect the chief trouble is the long distance from the nearest stations, and the terrible noise-level. Poor service, absence of books, trouble in erecting good aerials, and so on, all help to make things more interesting.

Rather a Tall Order

Concluding paragraph: "If you can design a set that can beat our American friends, and we can point to it and say 'British' with pride, I am sure you will become a hero. But don't forget we have only a very limited supply of cash to spend on wireless."

Rub my fevered brow, somebody—it's pretty difficult when you happen to know the prices of some of the American sets out in China ! J. B. (Ayrshire) sends in a log after three weeks' experience with the "Simplex."

It seems to include a very representative bag. He uses a mains unit for H.T., and says that the "Simplex" is the quietest short-wave set he has ever handled.

A. W. (South Africa) enthuses in no mean fashion about the "Guide to Amateur Radio," which he has just obtained from the R.S.G.B. He suggests that I should recommend text-books, etc., from time to time in these columns.

He wonders whether anyone can identify a strong German station heard on about 27 metres, broadcasting all the latest deutsche music and announcing in English and German. Incidentally, it's funny to read of a South African listener who talks about a tremendous second harmonic from Johannesburg, but can't get Nairobi at all ! It shows how perspectives vary—those two are always about the same with us, do burglary being the weaker of the two, if anything.

P.S. (Cheadle Hulme), a picture of whose "den" appears on this page, calls attention to his idea of a "den set" screwed to the wall (on the right) so that he can put it in the outside room and just serves to amuse him with the local programme while he is working. A good idea that others might copy.

Local " Fanz" Required.

M. S. (Harlow), who used to be a " regu-
lar," now wants to meet another fan within easy distance of him. Will anyone answering to that description please go and look up Mr. M. Selby, Tye Cottage, Tye Green, near Harlow, Essex ? Thanks !

C. T. (Grimsby), a " B.C.I. " Two users, reports that conditions have been good, and that he had "nine months of very good radio " with it. He winds up with three questions: (1) What time does La Paz (C.P.5) broadcast on 19 metres ? I don't know; can somebody help us ? (2) When is the best time to listen for Australian and New Zealand amateurs ? I should say between 4 and 6 p.m. on the 40-metre band, and again between 7 and 8 a.m. on both 40 and 20. (3) Is L.Y.I.A.G the correct call for a Lithuanian amateur ? Yes.

I should simply love it, dear reader. But, luckily for me, letters like yours are scarce, and I don't propose to make the change just yet.

Armistice Week—End, November 9th-11th, will be a red-letter day for Empire listeners this year. The follow-

ing programmes are to be broadcast from the Empire station: The Jewish Ex-Servicemen's Remembrance Parade, from the Horse Guards Parade; Excerpts from the British Legion Festival at the Albert Hall; Relay of the Ceremony at the Cenotaph; and the Eve of Armistice Day Commemoration, from the Scottish National War Memorial, Edinburgh.

These transmissions (partly by means of electrical recordings) are being put out on the various short wavelengths from 2 p.m. on November 10th till 3 a.m. on November 12th.

The Royal Wedding on November 9th is not being included in the Armistice pro-

gramme. The service will be relayed in its entirety, and the scenes outside Westminster Abbey before and after the ceremo-

nies will be described by Howard Marshall.

Conditions at the time of writing show

A Listener's Den

This is " P. S. 3°" of Cheadle Hulme, Cheshire, in his " den." Reference is made to his apparatus in the text.

no sign of falling off. The 31-metre band is as consistent as the 40, which is usually a good sign. The 18-metre band is splendid during the hours of daylight, but fades out rather early. The 20- and 40-metre amateur bands seem to be crowded to bursting point, and there is much activity on 10 metres as well.

I am confident that a British station will succeed in working all continents on "10" before this winter is through. North and South Americans, South Africans, and one Indian station have all been heard at good strength, and the Belgian station ON4AU has had a two-way contact with Australia, which shows that it can be done.

From the broadcast listener's point of view, things are perhaps a little dull. There are no new stations on the air, and the old ones are so consistent that there doesn't seem much to do except sit back and listen to programmes.

I strongly urge those short-wave broadcast enthusiasts who have not yet invaded the amateur bands to do so at once. The American amateurs on 20 metres are putting out high-power telephony that compares, sometimes, more than favorably with the broadcast station on 19 metres.
DOES THE ETHER EXIST?

Sir,—I have always understood that science concerns itself with facts and principles, and that theory is speculative explanation of phenomena that assists in the discovery of further facts and principles.

Before relegating the ether theory to Mr. Wright’s "scientific mausoleum," we should, I think, have definite justification for abandoning it, and should, moreover, be in a position to provide a substitute that elucidates our phenomena more satisfactorily.

As far as I can gather, Mr. Wright’s only aversion towards the “farcical” ether theory lies in that it presupposes atoms and molecules being hard, impenetrable particles, whereas research indicates that the atom may be a wave-form. Relative hardness and impenetrability are, however, facts which no theory can refute. The cohesion of a diamond, for instance, affords an outstanding contrast to a room full of air, with its vulnerability to permeation by escaping gas.

And, personally, I cannot conceive of a wave-form existing independently of a medium—of movement without something moving. The analogy of the well-worn pebble being dropped into the same old pond will continue to meet my requirements till more acceptable explanations prove themselves more appropriate.

But assuming, for the moment, that the atoms of our various elements are complexities of wave-forms, what can be the objection to the possibility of space being permeated by other less complex or less evolved wave-form combinations that are far as yet intangible.

Mr. Wright, I observe, has not attempted an explanation for the constancy of the velocity of light propagation across his “void” in the absence of a medium. We know that the speed of light varies upon the density and elasticity of the medium employed, and it is not reasonable to assume that the same laws govern the propagation of light and electromagnetic energy.

In concluding, with apologies to Mr. Einstein, I entreat the supposition of warped nothingness till someone can put forward a rational objection to our old ether theory.

Yours truly,

G. F. Lamb.

3, Chamber Street, Hull.

[This letter wins our Guinea Prize in accordance with the conditions on this page.]

THE ETHER AGAIN.

Sir,—There is no doubt that when Mr. R. F. Wanless inquired the existence of the ether he aroused a controversy that is likely to die hard! Having noticed an interest in the subject by a fellow-townsmen—a Mr. Wright—I am tempted to add my contribution to the increasing correspondence of this "etherial" topic.

Although of the same trend of opinion as Mr. Wright, I venture to suggest that his "exposition" has merely gone round the edge of the subject, and has failed to suggest an alternative to replace the Mechanical Ether theory, which he concedes in the wake of several other abandoned scientific theories. Indeed, in his piece he leaves us with “nothing” or “something.” I feel I introduce a little relativity.

Does Mr. Wright refer to the Space-Time Continuum of relativists when he states that “it may be possible to attribute to space itself unsuspected properties which would include the faculty of wave propagation,” or is he referring to that passive emptiness which stretches to the very boundaries of the Universe? If the former, then I feel that his term “space” should be modified to, perhaps, “space-time,” since modern physics recognises a world of difference between the two.

But enough of this fastidiousness. If we are to assume that the ether is analogous with relativity space, then all that remains to be done is to evolve a coherent system of wave mechanics based upon the “warping” of space, in order to account for all the phenomena.

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No matter how far one goes back the wireless listener has always been up against “interference,” in one form or another. In the early days of long-wave signalling “atmospheres” were the chief source of trouble, and the designer did his best to balance them out or drain them away, with circuits known as static eliminators.

Then as the ether grew overcrowded with broadcast programmes “mutual” interference became the bugbear, and the search for razor-edged selectivity began. It is still proceeding, in spite of broadcast improvements, and the superhet, second-channel suppressors, and the like.

The Well-known “Tube Noise.”

And so is the struggle against “man-made” static, which, owing to the increasing use of electric motors of all sorts, threatens to become the most troublesome form of all, particularly in the big cities. So much for the well-known sources of interference.

With the opening out of the ultra-short-wave bands and the more intensive use of high-frequency amplification, a comparatively new and unknown form of interference is beginning to make itself felt. It does not arise from any external cause, but comes from inside the valve itself, and is called “tube noise.”

It is confined to the high-frequency stages, where any irregularity, no matter how slight, is inevitably amplified up by the remaining valves, and grows in volume as it passes forward to the loudspeaker.

When a high-frequency valve is forced to handle a very weak input, as it is when receiving ultra-short-wave signals, “tube noise” in the first valve may well be of the same order of intensity as the incoming signal. In this case it will “swamp” the signal, and so set a definite limit to the range of reception. At the present time, with short-wave television on the horizon, the designer must do his best to get as long a “reach” as possible, and so he is forced to face the problem of “tube noise.”

Gushes of Electrons.

To some extent the trouble arises at the point inside the valve where the electron-stream is first formed. Electrons do not come away from the cathode in an absolutely steady stream, as one might imagine, but are liberated in a series of gushes, which vary both here and there along the length of the cathode, and from time to time at any one spot. In a low-frequency valve this does not matter much, because the current “averages out” into a more or less constant value. But in the first H.F. valve there is enough “ripple” effect left to be magnified into a roaring noise by the time it reaches the final output valve.

Another source of trouble is due to electrons which “stray” away from the main discharge stream. Instead of following the straight path between cathode and anode, they shoot off, and finally lodge themselves either on the glass wall of the bulb, or on the insulators or supporting wires of the electrode system, or, it may be, on the support which carries the “getter,” used in the final process of evacuating the space inside the bulb.

In most valves the anode consists of a flattened cylinder which is open at both ends. This allows some of the electrons to leak through by a sort of “fringing” path into the space between the anode and the bulb. If they lodge on the inner glass wall they form negatively charged patches, which vary here and there according to chance. This is not a stable condition, sudden changes of distribution will occur from time to time, which naturally produce “crackles” in the loudspeaker. “Wall” gushes, which vary both here and there because the current “averages out” into a steady stream, as one might expect to find it in a long range of reception.

The prevention of tube noise is a problem which troubles the manufacturer of super-regen. fame. We may expect to see ingenious cures developed.

The strength of the “stray” currents set up between the electrodes and the glass bulb may be sufficient, in the case of a transmitter, to heat the glass to melting point and so “blow” the valve. Even when the glass is covered with a conducting film, a heavy guard-ring is frequently used to reduce the eddy currents.

In order to reduce the overall level of tube noise to a minimum, particularly when receiving ultra-short-wave signals, the latest move is to fix a wire-gauze cap over each end of the anode. The cap is spaced away from actual contact with the anode, and is connected by an internal lead to the cathode of the valve. However, it overlaps the open ends of the anode sufficiently to prevent would-be “stray” electrons from getting into the open space between it and the glass wall of the tube.

Should any electron attempt to overshoot the anode, by taking a curved or fringing path it is eventually “trapped” by the wire-gauze cap, and so led back to the cathode, where it can do no harm.

The prevention of tube noise is a problem that is exercising the minds of radio research engineers all over the world, including Sir Arnon D. of the “super-regen.” fame. We may expect to see ingenious cures developed.

A Special Anode “Trap.”

Metallising the glass surface of the valve tends to prevent these positively charged “charges,” because the metallic film is connected to the filament, and so is kept at a uniform earth potential.

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THE LINK BETWEEN

By G. T. Kelsey.

As those of you who follow these notes regularly will be aware, the problem of "man-made static" interference is one to which I have repeatedly called attention, for I do regard it as a serious menace to the enjoyment of broadcast entertainment. I am thinking perhaps more of the future than of the immediate present, for as the march of electrical progress goes on the trouble is bound to get worse unless effective steps are taken, and goodness only knows the nuisance is bad enough now.

I was talking the other day to Mr. K. M. Lee, the technical director of Messrs. Belling & Lee, who, as most of you probably know, is one of the greatest authorities on this subject in the country, and some of the things he told me concerning the problems he had encountered and had been called upon to track down a source of interference unless

It seems almost incredible, doesn't it? It appears in many cases that the static was being picked up by wires in the vicinity of the motor, and was then being transmitted to the affected listeners all that distance away. But doesn't that example, which was only one of many he quoted, illustrate how very widespread the trouble can be?

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IS THE OSCILLATOR OSCILLATING?

F. P. (Sandeford, Surrey).—Is there an easy way of checking whether a superhet's oscillator valve is oscillating properly without having to poke fingers into the set ? I add this bit about the fingers because it is a means set, and having had one painful shock I have made up my mind never to risk another.

If you have a milliammeter, or can beg or borrow one, you can test quite safely as follows. Insert the milliammeter in the circuit of the plate lead that goes to the oscillator's plate, at a point where this will be the only current flowing: in other words, insert it anywhere in a separate H.T. - for - oscillator lead, or near the plate terminal of the osci lator itself if there are no other connections with this lead to H.T. -

With the milliammeter inserted in this manner the reading will be that of the current flowing to the oscillator plate. Make a note of the reading under normal conditions.

Also run a pair of short leads from a pair of switch terminals to the oscillator grid coil. An ordinary on-off switch will do, with one lead to one side of the coil, and the other side of the coil to the other switch terminal.

When such a switch is in the " off " position your circuit remains as before, and the milliammeter should show a normal current reading. But if the switch is then turned to the " on " position, the effect is to shut the oscillator coil, and to stop that circuit's oscillations. This would immediately affect the anode current, and would show up as a change in the milliammeter's reading.

So if the switch, when wired as described, alters the milliammeter reading every time it is switched on, you can safely assume that the valve was oscillating correctly when its coil was not shorted (or for the purposes of the test).

HOWLS WHEN THE AERIAL IS REMOVED.

S. E. (Grantham).—" The set goes very well indeed, but there is one thing about it which I do not quite understand. When I take-off the aerial wire it goes into oscillation at the lower end of the tuning."

"I might add that this does not occur if I put the reaction control right back. But I have taken a hint out of Mr. Scott-Taggard's book, and I keep the aerial coupling rather low, and advance reaction a little, which gives very sharp tuning."

"Does it show anything wrong because it goes into oscillation when the aerial is off ?"

"No, the effect of removing the aerial is always, in ordinary circumstances, to add damping—that is to say, to " hold the set down." So it is only to be expected that removing the aerial will tend to increase any self - oscillation that may be present; and if this is considerable the removal of the aerial damping is likely to cause self - oscillation."

LESS SENSITIVE AFTER FITTING SCREENED DOWNLEAD.

J. M. (Westcliff-on-Sea).—Having learned of others who had got rid of electrical interference by using a screened downlead, I tried this with very gratifying results as far as the removal of the interference was concerned.

QUESTIONS AND ANSWERS

S.T. 700 WEEK

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RADIOTORIAL

QUESTIONS & ANSWERS

(Continued from previous page)

when working on the pick-up. But are you sure it is the H.F. valve that is running away with the battery juice?

If you buy a suitable battery and give it anything like ordinary use you should get far more life out of it than one month, even with the H.F. valve switched in. And failure to do so may not be the fault of the H.F. stage, but is far more likely to be caused by a dual condenser, faulty insulation, or some similar foe to the H.F.

Your best plan would be to borrow a milliammeter and make sure that no current is flowing when the valves are switched off—we have often described the method in these columns. Such a quick battery-failure as you describe is more likely to be due to a fault than to the current taken by the B.D. valve.

THE WIRE FOR LOUDSPEAKER EXTENSIONS

C. G. R. (Winchester, Hants).—"Does the wire used to connect the set to an extra loudspeaker (moving-coil), affect the results obtained from this?"

"I ask because my set has a pair of 'Extra Loudspeaker' terminals on it, and I have treated myself to an extra loudspeaker to save moving the set from room to room. (The set's speaker is built into the cabinet.)"

"I find that the reproduction from the new loudspeaker is not half as good, when in the room for which it is intended, as when it is kept in the same room as the set, though it is a little difficult to decide just how bad it is with both loudspeakers going together. So I thought it might be the wire used to connect to the other room, which is rather thin, cotton-covered stuff that I had on hand, and used because it would go down into the cracks of the floorboards better than flex."

"If you think this might affect the results I would take it up and put new wire down, but I do not want to go to the trouble of doing this unless there is a chance of improving matters."

Yes, we should try new wire—for two reasons. In the first place that old cotton-covered stuff may be failing in its insulation, and if the "come" and "go" leads are close together there may be leakage between them, with consequent loss of power to the loudspeaker.

Secondly, there is the question of the ohmic resistance. If the loudspeaker's transformer is at the set end (which is quite common practice), the "extra loudspeaker" terminals should have only the few ohms represented by the moving-coil joined across them. So low-resistance flex must be used, or you will have big losses in the leads themselves.

AN ADVANTAGE OF AUTOMATIC GRID BIAS

E. S. (Lancaster).—"I have been trying to decide whether to bias by resistance or battery, but I do not understand, the following which is the explanation given:"

"Another advantage of the resistance-operated grid bias is the automatic regulation obtained. The grid bias battery can only hold the grid's mean voltage steady, but the bias resistance tends to offset any abnormal fluctuations. Hence the name—automatic bias."

"Please explain what is the advantage of the resistance over the battery?"

The advantage referred to depends on the fact that the battery-operated grid bias remains constant, according to the tapping chosen on the grid-bias battery; and is not affected by the H.T. applied to the valve. But the resistance-operated bias is not constant in the same way. When the H.T. on the plate is increased, more current flows through the bias resistance, and this causes the grid-bias voltage applied to increase.

The application of this extra bias tends to decrease the flow of anode current which causes it, so there is an automatic tendency to correct any fluctuations when abiasing resistance is used.

Once the operation takes place instantly and without external adjustments of any kind, it is known as automatic bias.
A Films Debate.
The B.B.C. has always had trouble about dealing with films either in criticism or talks. No doubt this is partly due to the feeling in the film industry that the B.B.C. designs somehow to impose its own form of organisation on the British film world. If there ever were such an idea, it has been abandoned. Anyway, the B.B.C. is now going ahead with a debate on the following resolution, which will be included in the National Programme on November 9th:

"That the Public Does Not Get the Films it Wants." The Cinema Exhibitors Association will be represented by Mr. Ormiston, M.P., who will oppose the motion. This is a debate that promises to be good.

Talks Changes.
There is a noticeable lightening of talks these nights, and I am told the process will continue. An attempt is being made to get more entertainment into the presentation of the spoken word. Examples are the "Young Ideas" series and the "Decision" series, both of which are dramatised, although handled by Talks officials.

Mr. Moray MacLaren, the romantic second-in-command of the Talks Department, is in charge of this infusion of entertainment values, and, judging from correspondence, it is already a marked success.

B.B.C. Development.
For the first time since it began the B.B.C. is looking more than five years ahead. A general stocktaking of future requirements and probable developments is now in progress. No doubt the imminent of Television is at least partly responsible for this, but there are also signs of more considered statesmanship in the councils of Broadcasting House.

Although it is too early to say anything of expectations and plans, it is comforting to know that the interests of the listeners of the next generation are not to be neglected.

Raymond Swing Again.
Raymond Swing, the brilliant American commentator on current affairs, who is now familiar to British listeners through his weekly "Transatlantic Bulletin," arranged by the Columbia Broadcasting System and the B.B.C., will do two or three special talks before Christmas, and then resume his feature in January. In the interval the B.B.C. will draw corresponding comment from the Dominions.

Lord Clarendon and The B.B.C.
The Earl of Clarendon, whose tenure of office as chairman of the B.B.C. was interrupted on his appointment as Governor-General of the Union of South Africa, will be released from the latter responsibility at the end of 1936, when the chairmanship of the B.B.C. also becomes vacant. Lord Clarendon is known to be still keenly interested in broadcasting.

When Sir John Reith visited South Africa last year to report on national re-organisation of radio there, the Governor-General was an active supporter of his former colleague. It seems probable, therefore, that the Government will invite Lord Clarendon to resume his former post at the beginning of 1937.

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**USING MAINS VALVES**

In a set which is required to give a high undistorted output, say 3 to 5 watts, it may be necessary to use an output valve employing an anode voltage much higher than usual: voltages of 300/400 are often used with valves of this kind. This voltage will, of course, be obtained from the H.T. unit, and if the same unit is used for the anodes of the other valves it will be necessary to introduce proper resistances to keep the working voltage of the other valves down to the proper value, say 150 to 200 volts. It is very important to remember that the voltages should not be applied to the valves unless the latter are actually operating, because if there is no anode current passing, the series resistance will have no effect of reducing the voltage, and the full voltage will be applied to the anodes. A resistance only "drops" voltage when there is current passing, and it does nothing when current is not passing.

In the case of a screen-grid valve it is important that the anode voltage applied to the valve should not vary, and for this reason it is advisable to use a carefully worked out potentiometer scheme for the application of the variable grid bias for the multi-mu valve. Unless this condition is satisfied there are likely to be serious variations of anode voltage as the grid bias is varied.

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**THE "CIRCLE"**

Candid comments on recent programmes by our Broad-casting critic.

To see The "Circle" was worth all the rest of the week's broadcasts put together. Perhaps you say I have a poor sense of values. Perhaps I have, but I do know that in The "Circle" used with valves of this kind.

One noticed that the producer employed one effect only: right at the end of the play one heard the departure by ear of Elizabeth and her lover, Teddy Luten. But the effect was striking, as the departure coincided with a beautiful claim by Crité that his scheme had worked. Elizabeth would stay with her husband. The noise of gears and accelerator outside emphasised the fact that she wouldn't — and hadn't. She had gone.

- Young Ideas - is a variable mixed grill. This week it included Sir Malcolm Campbell offering such counsel to the young as: "Never mind failure. What you eat too easily is seldom worth getting." Then came a detective's talk on the phone to his sergeant, whereupon listeners were invited to name the murderer. The fourth item was an impossible story with a song in it to test listeners' intelligence. There were other things; as well. All were acceptable.

I am always suspicious of a Variety bill that has to be bolstered up by a fantastic presentation. Such a one was: "The Personality Machine, or Hundred Per Cent." Here we had to listen to a long description of a wonderful invention, which, once it was described, almost faded out of the picture. Good turns do not need this sort of thing. Collinson and Dean, for instance, are quite able to fend for themselves. After all, it is Collinson and Dean we want to hear; not the lot of fairy-story stuff we would tell out before. On the whole the bill was very mediocre, as might have been expected from such a title.

The Western Brothers were very much responsible for the mid-week humour. One can still laugh with them. They believe in a new song, though it is plain they exploit the same type of song every time. "It'll Never Be The Same Again" is another winner. "Jolly good show, chap! Jolly good show!"

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The improved—and larger—Mansfield ' magnet brings a substantially higher sensitivity. The increased loudness not being obtained at the expense of "balance." It is comfortably maintained at audible frequency and reaches audible volume—is in the "realism" of the performance.

**BASS RESPONSE—FULLER AND 15 C.P.S. LOWER**

Measurable bass response goes 15 c.p.s. lower than previous models. Audible response— that part of the bass which is at audible frequencies and reaches audible volume— is in these new models much more loudly reproduced. Thus the " bass background " is stronger and more colourful.

**HIGH NOTE RESPONSE—900 C.P.S. HIGHER**

Due to the stronger magnet, new hand-made cone, and larger section-wood, interleaved transformer, far brighter and cleaner reproduction of high notes and overtones has been achieved this year. This does not imply shrillness—in fact objectionable high resonances are conspicuous by their absence.

**ATTACK—CLEANER AND CRISPER THAN EVER BEFORE**

That "forwardness" of tone and the clean, instant response to transients which are so important to realism in reproduction, are, in this new speaker, present to a remarkable degree. Cone material, transformer, and the new accuracy of assembly are chiefly responsible.

The simple substitution of this advanced speaker for your present instrument will bring to your radio an increased volume and a new amazingly colourful realism. Ask your dealer to demonstrate to-day, and hear for yourself!

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**CABINET MODELS**

<table>
<thead>
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<th>Model</th>
<th>Price</th>
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<td>&quot;W&quot; Senior</td>
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<tr>
<td>&quot;W&quot; Junior</td>
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**CHASSIS MODELS**

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<td>EM/M (Emerald)</td>
<td>£50-</td>
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AN ALAN HUNTER INTERVIEW.

"THE 'GU'Nor' GAVE ME MY CHANCE!"

Says Len Berman, who is Leaving Henry Hall's Band.

DA.RK, alert-eyed, smiling Len Berman, drummer and vocalist of Henry Hall's B.B.C. Dance Orchestra, has fallen for the lure of the footlights of Variety. He leaves Henry Hall this week (October 26th), but he tells me that the last thing he wants to do is to desert the microphone.

Although only twenty-five years old, Len Berman is what one might call one of the veterans of the band. He joined Henry Hall's "boys" in 1934, "'cause he thought it would be a 'rad' for going away to sea and being a vocalist.

He owes it all to Henry Hall, he says. It happened one fine afternoon, when a tune called "$Leave the Pretty Girls Alone!$ was all the rage. I heard "Levi Leive's Girlies Alone," and "asked Mr. Hall. And the anonymous drummer of the band stepped right into the line of fire of radio fame.

"How did I get away with this tune?" he said, repeating my question. "Well, I don't know. I suppose it was just my hand-writing, that's all."

"My style?" I asked, and Len Berman answered: "No, I suppose the sort of thing Dick Powell does on the films is really my best line, you know, the light ballad type of number.

A Real Variety Act.

"When I leave Henry Hall's band I shall be through with the drums. The funny thing is that very few listeners realise I am a drummer. They write in fan letters asking whether I play an instrument as well as sing!"

"I have had many letters since it was announced that I was leaving. 'How dare you desert us!' wrote one fan. Another called me a cad for going away!"

"My act? I hope to make it a real variety act. Yes, singing and dancing. I was trained for the stage, you may be surprised to hear. I was in two of Cochran's shows: 'On With the Dance!' and 'Still Dancing.'"

"No, I don't intend to sing into the microphone as an act. People expect more than that from a top of the bill artist. I shall do selected numbers with the mike, of course, but the act as a whole will be a real variety one.

"But it means a lot of very hard work during the next few weeks, as you can guess. Meanwhile, I shall continue with my usual numbers in Henry Hall's broadcasts—until the send-off on my last appearance as drummer in the band.

"I would like you to emphasise that it was 'the Gu'Nor's' confidence in me that got me going away. No, I had not thought of being a vocalist. I was much too busy concentrating on my drums, until that memorable day when he said: 'Would you like to try this number?" Up to then I had sung at concerts and so on, but never on the air."

"And now I'm booked up for the Variety circuit! I start off at Portsmouth on November 4th, and then I come up to Stratford, where I already have a big following.

And then? Who knows? I hope to come back on the air quite often!"

Len Berman joins the ever lengthening trail of stars made by Henry Hall. Phyllis Robbins, Kitty Masters, Les Allen, and now Len Berman. Perhaps the most pleasant aspect of these departures from the fold is the benevolent attitude of Henry Hall himself. He seems to be genuinely pleased to have helped on the stars in their courses!

FROM OUR READERS

(Continued from page 171.)
JUDGING THE TONE (Continued from page 198.)

listening to the naturalness of the tone. Such sounds as the clashing of cymbals or any percussion instruments, the jingling of keys, and nearly all transient sounds, are rich in the higher frequencies and should sound like the real thing. Although the actual loudness of these high frequencies is very small compared with the rest of the music, and they are far below the level of the others, so it is worth while using a tone control to cut down the tone when listening to distant stations, and get the full benefit of good reproduction from the locals.

In conclusion, it is much easier to judge the tone of a receiver if you can compare it directly with a receiver which is known to give good quality. Place the receivers at opposite ends of the room and tune them to the same station at about the same volume. Any faults in the doubtful receiver will then stand out a mile when compared with the good quality reproduction. Even without a high quality set a good comparison of tones can be obtained in this way.

GETTING A VACUUM (Continued from page 188.)

or, in some instances, a current is passed through them. The "getter" now comes into action. It "gets," as it were, many of the residual air particles which have managed to escape the action of the exhausting pumps and it holds them more or less permanently in some sort of chemical combination.

"Getters" cause shiny metallic-looking deposits on the inner walls of the valve. These deposits may be mirror-like, brown or yellow, according to the type of "getter" used and the process of its application.

"Getters" are Extremely Valuable.

"Getters" have been much studied by valve manufacturers, and many secret or semi-secret types of these compounds are now used. The reason why manufacturers have paid such attention to these little-understood compounds is that they are capable of reducing the amount of pumping normally required to evacuate the valves. Hence, by the employment of suitable and efficiently working "getters" the expenses of valve pumping can be lowered.

Dealing with the Earth.

For some reason many people regard the aerial as being something quite distinct from the earth lead. The fact is that we should not make this hard-and-fast distinction between aerial and earth at all.

Looking at it in this way you appreciate that if it is necessary to screen the aerial down-lead, it is equally necessary to screen the earth-lead, and this also is becoming popular practice in places where interference is bad.

Transmission and Reception.

People sometimes say that although the B.B.C. is so very particular to keep up the technical standard of its transmission to such a very high level, it does not particularly concern itself about reception conditions in listeners' homes. This, however, is by no means true. It is obvious that the primary concern of the B.B.C. engineers is to make their transmission as perfect as possible, and, in a sense, if they stopped there no one could blame them. But as a matter of fact they do not stop there; they go a great deal farther. In conjunction with the Post Office engineers a very efficient service has been built up (Continued on next page.)
UNIVERSAL bands, even on ultra Short Wave.

Automatic Volume Control and Tuning Compensation on all wave alteration.

HYVOLTSTAR working on 100 to 250 volts A.C. or D.C. without SOUND DIFFUSION By Means of SOUND REFLECTORS.

REVOLUTIONARY otherwise it would not be used.

the screening must add to the efficiency,

screened coils in highly efficient circuits,

H.F. coils.

necessary to go to the length of screening the

supreme in every

All Waves, all Mains A.C. I.D.C. Receivers. Radiograms

ciency, however, it was not always neces-

fication, and, indeed, it cannot be denied

amplifying valves.

years in the efficiency of high-frequency

thinking in particular of the great improve-

precautions in other parts of the circuit.

corresponding

Improving the Efficiency.

You often find that as the components used in radio sets are improved in efficiency corresponding precautions have to be taken in other parts of the circuit. I am thinking in particular of the great improvements made during the past two or three years in the efficiency of high-frequency amplifying valves. It is not so very long ago that the screen-grid valve was hailed as the saviour of high-frequency amplification, and, indeed, it cannot be denied that it was an immense improvement on previous efforts.

Screening Becomes Necessary.

Notwithstanding its much greater effi-

ciency, however, it was not always neces-

sary to go to the length of screening the

H.F. coils. The coils were very efficient at that time and, as you know, the effi-

ciency of a coil is always greater without a screen than with one. Many people find it rather hard to understand this. They think that, inasmuch as we now use screened coils in highly efficient circuits, the screening must add to the efficiency, otherwise it would not be used.

This impression is not entirely wrong, but it is rather misleading. In fact, it is true that the overall efficiency of the circuit is increased, or perhaps I should say can be increased, when screened coils are used, but that is only because the efficiency is increased in other parts of the circuit and the screening did not prevent insta-

stability which would otherwise be set up. To put it in another way, the screening does not increase efficiency in itself, on the contrary, it actually decreases the efficiency of the coils to which it is applied, but it acts as a safeguard against instability, and so enables the efficiency to be increased in other parts, the result being that the gain in efficiency in one place is greater than the loss of efficiency in another, and there is an overall gain.

Screen-Grid or H.F. Pentode.

The necessity for screening the coils arose more particularly when the screen-grid H.F. valve gave place to the H.F. pentode.

If you are using a circuit in which you have replaced the screen-grounds with H.F. pentodes, and one of which is on you used trouble with instability of the circuit, you can easily get over this by fitting screening cans to the coils. The screens may be as large as the surrounding space will permit;

and which will be presented one a week. These "Datagrams" deal with all aspects of radio, and will; represent the most compact and useful collection of data ever made available to the radio enthusiast.

Remote Control.

From time to time readers send me ideas for remote control. Some of these are very ingenious, and I have no doubt that a number of them would work quite well. But I feel that I never get a sufficiently practical idea. I do need remote control. I can well under-

stand the need for an extension speaker for even for more than one such speaker. But it seems to me that as regards remote control of the set, this is far more trouble than to remove the set into the room or perhaps; it is to be used. As an interesting experiment and field for ingenuity remote control has its possibilities.

Soldering Tags.

When wiring up a set it is always better, in my opinion, to use the soldering tags supplied with most components for the purpose of securing the conductors to the terminals. The soldering tag itself makes a nice flat and uniform surface on which to screw down the terminal, whereas if you wrap a piece of relatively thick wire around the shank of the terminal, this is very apt to work the screw terminal loose afterwards, because the nut probably touches it only at

the larger they are the less damping they will cause and so the less they will detract from the efficiency of the coils. But they must not be too small. The metal of the screens should be of the coil than about three-quarters of an inch all round, or not less than half an inch.

Short-Wave Converters.

I don't know how many of you have in the past used short-wave converters. I think quite a large number of amateurs have been using converters of one kind or another, generally employing a screen-grid valve. This kind of converter is falling into dis-

favour with up-to-date experimenters, how-

ever, who are now going in for the use of the heptode frequency changer. This has a number of important advant-

ages, one of which is that it can be used with an intermediate-frequency amplifier even at relatively high frequencies.

Bad Connections.

Some components are supplied with very tiny fiddling terminal nuts with milled heads, and in such awkward positions that it is practically impossible to tighten them up by the fingers. In such a case it is better, unless you are prepared to use the soldering tags, as mentioned above, to remove the milled nuts and sub-

stitute hexagonal nuts which can then be tightened up by means of a small spanner or a pair of pliers. But I repeat that, in my opinion, it is far better not to rely upon screwing down the actual connecting wires; it is much better to use the soldering tags supplied with the component.

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**MUSIC HALL MEMORIES**

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**Part 1 Contains:**

**LILY OF LAGUNA**

Eugene Stratton

TA-RA-RA-BOOM-DE-AY

Lotie Collins

THE BLIND BOY

Chirguna

OUR LODGER'S SUCH A NICE YOUNG MAN

Vesta Victoria

COAL BLACK MAMMY

Laddie Cliff

I'M THE PLUMBER

Arthur Rigby

AT TRINITY CHURCH

Tom Costello

**Part 2 On Sale Oct. 24th will contain:**

**SHADE OF THE PALM**

Leslie Stuart

MY FIDDLE IS MY SWEETHEART

Chirguna

LET'S ALL GO DOWN THE STRAND

Charles Whittle

THAT'S WHAT GOD MADE MOTHERS FOR

The 3 Scamps

GINGER, YOU'RE BALMY!

Harry Champion

GILBERT, THE FILBERT

Dashi Hallam

TWO LOVELY BLACK EYES

Charles Coborn

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