POPULAR WIRELESS, October 5th, 1935. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

"SOAP BOX" DAYS—By L. STANTON-JEFFERIES

Popular Wireless & Television Times

THE LONDON TELEVISION SERVICE:
FIRST TRANSMISSION DETAILS
SEE PAGE 100

EVERY WEDNESDAY PRICE 3D

No. 696.
Vol. XXVIII.
Oct. 5th, 1935.

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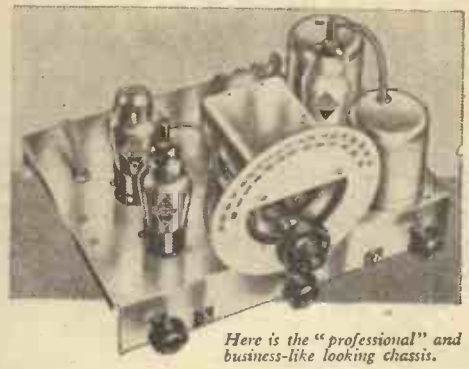

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POPULAR WIRELESS AND TELEVISION TIMES

MANAGING EDITOR : N. F. EDWARDS. TECHNICAL EDITOR : G. V. DOWDING, Associate I.E.E.

REPORTS WELCOME
2,500 KILOWATTS!
MORE LICENCES
MALTA'S RADIO

RADIO NOTES & NEWS

A 5-METRE TALK
TALLINN PUZZLER
NOT ENGLISH
MIKE PRODIGY

Advance, Estonia!

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 has been 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 off 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 Villebon-sur-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.

Moscow's Broadside.

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 2,500 kilowatts, and the director of this super-propagandist will be Dimitrov, the Bulgarian who figured so prominently in the Reichstag fire trial. Plans 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 your own ears these days, even if you are in the wool-gathering business.

Still Going Strong.

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!

Hail 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 waveband—where he was supposed to be—nor on Hilversum's wavelength, where he habitually spent half his time.

And now, owing to a Paris reshuffle, Radio L'L has gone from 210·7 metres. Though not powerful, L'L was a likeable chap, and most British listeners respected him for

(*Continued on next page.*)

THE LATEST PYE MODEL

Sir Seymour Hicks, the famous actor, performing the christening ceremony on the Pye "Empire" receiver, which made its debut at this year's Show.

LOOKING FOR COUNTRIES TO CONQUER BY RADIO

pronouncing his L's exactly like we do, so that he was readily identified. He has resigned in favour of Radio Cité, who is to perform on 280·9 metres. Tiraspol, the Russian, is alloted to the same wavelength, so let us hope these two dancing partners get on well together.

An Idea, But . . .

MUCH 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 conscripted 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 picture is that, if it were tried with existing apparatus, the general who looked in at G.H.Q. would probably go cross-eyed.

On Five Metres.

A STRIKING demonstration of the possibilities of ultra-short-wave working was recently given by the South Shields Amateur Radio Club. The occasion was a lecture on this subject, and the speaker, Mr. Pollard, did not attend the meeting personally, but had a loudspeaker there deputising for him.

Mr. Pollard told the meeting that he was talking to his audience from his own home in North Shields, three miles away. For half an hour he told them of the advantages of 5-metre work, the loudspeaker proving his point by working from a tiny two-valver on an indoor aerial. Even this aerial bore witness to the good cause, for it was less than eight feet in length and was erected below street level.

Puzzle from Tallinn.

READERS who fancy themselves as puzzle-solvers might care to help me with the following message, received from Tallinn on a post card: "Jam Buitl S.T600 notable 600 asstoshed (what ST next recline now)."

My theory is that the first words mean, "I am built S.T.600, notable (i.e., famous) S.T.600." And I think the next word "asstoshed" signifies "I am astonished." So far, so good. But what about those last five words in parentheses?

They might mean "What is S.T. doing next? I now lie back" (apparently at his ease, awaiting the answer).

Or they might mean "*What* an S.T.! His next will now knock me back."

Or they might mean "What next? Reply now," which latter incidentally is difficult, because my unknown correspondent gave no address. However, I expect he'll write again, so if anybody can solve the above with certainty I shall be very glad—and somewhat "asstoshed"!

No More Worlds.

SOMEWHERE in the heart of the G.P.O., London, there sits an unhappy man, mournfully regarding a map of Creation. He looks upon the countries of the world and sees a flag stuck in every one that can now be reached by the 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 Ceylon. You could not telephone to Ceylon. "Oh, can't you?" said the engineers, and they called 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 Ceylon, you will be able to do so at about £2 per minute. And now the flag-sticker, trying to find other spaces, is coming up against Alexander's problem—no more worlds!

RADIO TOPICALITIES

Following the success of the Stanelli Stag Parties and others, put on by well-known radio artists, the ladies have demanded that they shall be given an opportunity to display their talents at the microphone without the assistance of males. A distinguished cast of these girl radio stars is to be assembled on October 17th in the National programme.

The party will follow the lines of its successful predecessors, all the announcing and compering being done by the ladies themselves. Here is an opportunity for those lady listeners who believe that radio entertainment is too much the prerogative of the alleged stronger sex to draw pleasure from a truly feminine broadcast.

* * *

The first broadcast of a Melluish burlesque, "I Spy," will be heard by Midland listeners on October 9th. Martyn Webster will produce and Reginald Burston will conduct the B.B.C. Midland Orchestra and B.B.C. Midland Revue Chorus. In amusing dialogue and lively verse the Melluish Brothers "take off" the conventional ingredients of the spy story—Russian adventuress vamping a young politician, doped wine, and stolen plans. There is a comical denouement when the plans are finally recovered.

* * *

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

* * *

Ronald Frankau makes a welcome return to the West on October 12th, when he will be the star attraction in a relay from the Pavilion, Bath.

Old Timers.

THESE 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.

THE 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 such shudders as have not been known since the famous film director said "No," or rather since he *should* have said "No" but actually murmured "Nothin' doin'. I t'inks we better don't."

Stoke's Radio Show.

STOKE-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 Mike.

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 "Bow-wow, meow, moo, whoa, giddap, and hy-de-ho," but long words like "hippopotamus."

Her latest words are "Arkansas" and "Katydid"—this latter being an insect, and nothing to do with "What Katy did at School"!

ARIEL.

Broadcast TALKS will be LIVELIER

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, definitely 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 power of this idea is obvious. The series is scheduled for Saturday night transmission.

Controversy will be the keynote of yet another series, when in the 7.30 p.m. period devoted to adult education—horrid phrase!—the poor old British Constitution will be discussed. In the first few of the twelve talks planned the subject will be treated in an explanatory way—but later on all political parties will take "pot shots" at it, including the Fascists and the Communists.

Controversy Welcomed.

As soon as you begin to talk about international affairs it is hardly possible to avoid controversy. But with its new determination to be lively the B.B.C. Talks Department actually welcomes the chance to put over a challenging series. It will be called "European Exchanges"—the idea being young men from foreign countries, such as Italy, France and even Russia, discussing their different points of view with Englishmen.

So much for controversy. Now let Mr. Siepmann himself tell you something of the guiding principles shaping his department's new broadcast talks programme.

"Roughly, you may divide the talks into three types," he said, "taking the first as Entertainment, the second as Education, and the third as Controversy.

"Then there are, I should say, three special points to be considered when deciding a talks programme. First, the subject, then the standard of that subject, and thirdly the time at which the talks shall be broadcast.

"You will find, I think, that the new schedule takes all these things into account. 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

Charles Siepmann reveals his plans for the coming months in an interview with Alan Hunter.

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.

"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 head 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 re-visit 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.)

AFTER THE BERLIN FIRE

This is what Hall IV at the German Radio Exhibition looked like after the fire. This hall contained the two Berlin ultra-short-wave television transmitters which were destroyed.

GRID CIRCUIT DECOUPLING

How the coupling effect due to the use of biasing resistances in a mains receiver may be overcome is described

By G. LENNIE, B.Sc.

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 valve, but, as we shall show, reduce amplification.

MAINS VALVE BIAS

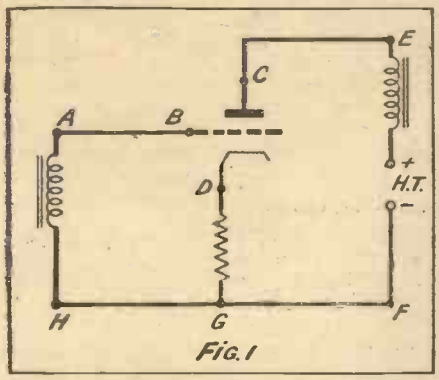


FIG. 1

A bias resistance is connected in the cathode circuit of an indirectly heated valve between the points D and G, as shown.

Figure 1 shows the bias resistance in the cathode circuit of an indirectly heated valve. For the moment the point G will be considered as having zero potential. In the absence of any signal the cathode is made positive by the drop in voltage across the resistance. The grid is thus at a negative potential as compared with the cathode.

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 varied potential across DG. This varied potential is also communicated to the grid circuit with the result that the two circuits form a plain reactive system where the current variations of the anode circuit react on the grid circuit.

At no time should the grid-bias voltage be positive, otherwise there would be a current flow between the cathode and the grid. This is arranged for in the initial calculation of the bias resistance value. The signal currents from the previous valve therefore merely set up an oscillating current between the grid and the zero potential line via the secondary of the L.F. transformer.

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. Now 32 ma. flowing in a resistance, say, of 700 ohms causes a voltage drop of 22. This voltage is causing the grid bias to increase by that amount just when the grid is at its maximum positive with the signal voltage supplied by the transformer. The bias on the grid is now 55 volts. This has moved the working point by 22 volts with a consequent reduction in amplification.

ADDING A CONDENSER

In order to minimise the coupling effect of the biasing resistance a condenser is joined across the points A and B, in other words, directly across the resistance.

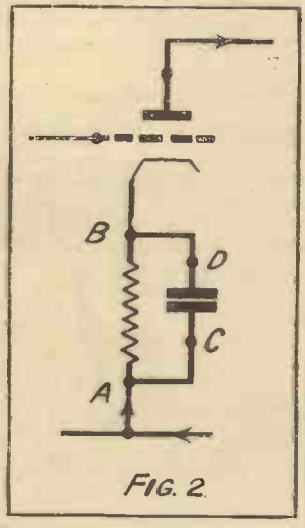


FIG. 2

This then is the coupling effect of the bias resistance, and as we cannot eliminate the resistance we have to find means of side-stepping the coupling.

There is one method of avoiding the coupling and that is by short-circuiting the resistance. As the reactive voltage is alternating, the "shorting" may be accomplished by a condenser. But when a condenser is charged the plates of it assume polarities and, in our case, it is not so obvious what effect these polarities have on the grid.

Supposing we try a condenser across the resistance: the bias circuit now consists of a resistance with a condenser in parallel and a combination supplied with an alternating current. See Fig 2. Electrons are flowing in the direction of the arrow. Through the resistance, so long as electrons flow, there is a difference of potential. Things are different with the condenser. As soon as electrons flow into plate C a similar quantity leaves plate D. Thus C becomes negative and D proportionately positive.

"Short-Circuiting" the A.C.

But the plates will not assume their maximum potentials until the maximum number of electrons have accumulated on plate C. When this maximum number, which is dependent on the applied voltage and the capacity of the condenser, are on plate C, it means that no more can be accommodated, hence the current ceases. Thus the greatest potential is across the condenser when the alternating current is zero.

The ideal condition would be that in which the voltage across the resistance and condenser due to the speech current was zero. As this could only be obtained by an infinitely large condenser, a compromise must be made. If we assume a capacity of 1 mfd. across the 700 ohms resistance it can be shown that at 50 cycles, which may be taken as the lowest frequency we expect to amplify, the voltage across the combination with a current variation of 32 ma. is 20 volts. This is practically the voltage which the resistance itself would set up without the condenser. Thus the 1-mfd. condenser is of very little help in short-circuiting the speech current. But if we use a capacity of 25 mfd. the voltage becomes 4. A condenser of 50 mfd. 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 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.

AN ALTERNATIVE METHOD

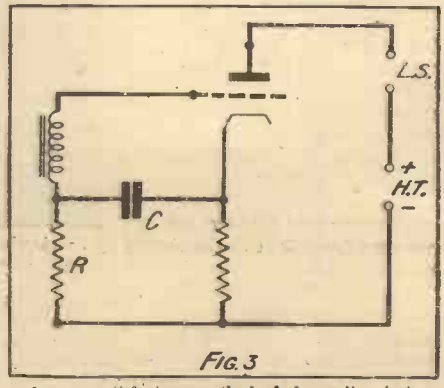


FIG. 3

A very satisfactory method of decoupling is to join a condenser and resistance (C and R) in the manner depicted above.

ON THE SHORT WAVES

A STABLE DETECTOR
In this article W. L. S. gives short-wave enthusiasts an entirely new detector circuit to try, and one which works exceedingly well, too.

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.

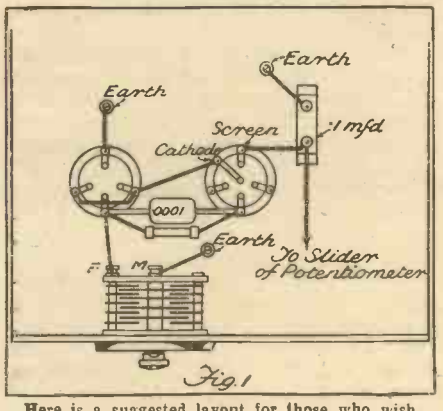
"Electron Coupling."

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 heptode, or the triode-hexode, as a frequency-changer.

The so-called electron-coupled oscillator does not depend upon electronic 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 detector and, strangely enough, has been sadly neglected from that point of view. Call it the "cathode-tap" circuit if "electron-coupled detector" offends you; call it anything you like, for it works very well.

A GOOD LAYOUT



Here is a suggested layout for those who wish to wire 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 join 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.

Indirecly-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 L.T. fed to it up the smaller section of the coil, and the volts 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 continuous 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.

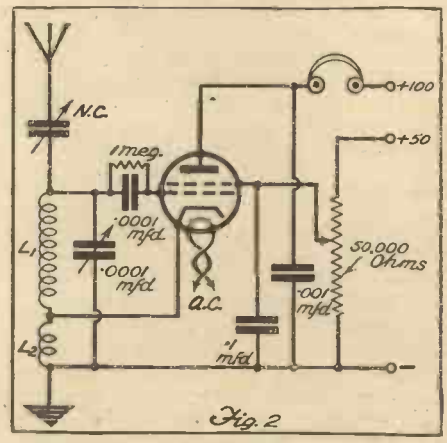
So much, then, for the actual circuit. Now what about its advantages? Well, first of all, the frequency at which it oscillates is practically independent of H.T. and L.T. voltage variations.

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, 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 ·1 of a volt 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.

CIRCUIT DETAILS



The circuit itself. Note the tapping of the cathode on to a point above earth potential.

ON THE SHORT WAVES.—Page 2.

WHAT READERS ARE SAYING

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 station up to the same strength 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 into touch with Mr. H. French, The Briars, Cottam Hall Lane, Nigal, Preston.

J. M. (Sherborne) reports reception of X E B T (Mexico) on 50 metres, Y N I G G (Nicaragua) on about 49, T I E D (Costa Rica), on about 44 metres, and C O 9 G C (Santiago de Cuba), on about 48 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 of valves 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 lead-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, 25, Abbey Road, South Shore, Blackpool.

S O S from E. A. C. (Maidenhead). 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 G6MD

This amateur transmitting station is situated at Rutherglen, Scotland. On top of the receiver, to the right, is a "D X. Hound."

L. E. L. (Bodmin), 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 a really excellent superhet. 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 !)

SHORT-WAVE NEWS

WORK is proceeding apace on the enlargement of the Empire station at Daventry. In addition to the two new transmitters and the new building that are being constructed, a greatly extended aerial system is being erected. The B.B.C., in short, does not intend to rest until it has the best short-wave broadcasting system in the world.

One of the forthcoming series of broadcasts in the Empire programme is called "High Spots." Transmissions will be made from various high spots in the British Isles. The first is—no, not the top of Snowdon, but the roof of the Albert Hall !

Another innovation (for Home as well as Empire listeners) is the broadcast from Brooklands on October 19.

Have you Heard Prague ?

A station that is attracting a good deal of attention from listeners who occasionally tune above 50 metres is Prague, O K - 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 "beamed" 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 weak side, but conditions for the Far East appear to be improving.

Forthcoming events in the programme of the A.-A.R. & T. S. include a special transmission to them from Y V 2 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. Orton, Kingsthorpe, Willowbank, Uxbridge, for further particulars.

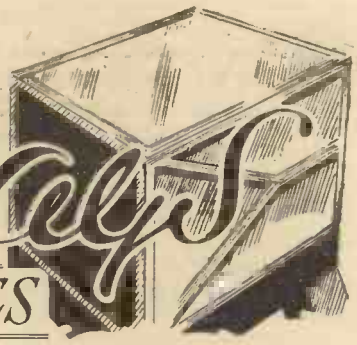
Another new broadcasting station working outside the recognised bands is Tela, Honduras (H R M), on 20·71 metres. Several readers have already reported this station, although his hours appear to be irregular.

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, which, I suppose, 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.**

"SOAP BOX" Days



by L. STANTON-JEFFERIES

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 neat 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 backwoods of Clapham saying reception was good that night would fill us with added zest for this new toy.

I had nearly forgotten. Some time before the concerts from 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.

> 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.

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 ten. Imagine having to 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." Please excuse the word, Mr. Engineer, but it conveys a lot to me.

The first microphones used were just the ordinary type of carbon granule telephone. As far as I remember we had six, suspended from the roof, stands, piano-lid, etc.

"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.

(*Continued on next page.*)

A SCENE AT THE OLD 2LO

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.

"SOAP-BOX" DAYS

(Continued from previous page.)

He had had a non-stop run of quite 25 minutes. Such is enthusiasm on the one hand and a "deaf" ear on the other.

It has a pretty sequel, too. I related this little narrative in the second number of "The Radio Times," and received no fewer 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 had 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 take a stroll on its own at the slightest touch. It was a valve box, but we christened it the "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 gradual but sure improvement day by day both in the technical and in the programme side.

In the early days we were beset with many (and goodness knows how many) difficulties, but they were initial problems. Hard nuts to crack at the time, maybe, but when once you have obtained a degree of perfection, then the difficulty is first to maintain that degree, and secondly to improve on it. This applies not only to the engineering side of broadcasting, but also to programme technique, and incidentally to an organisation that is, perhaps, the finest of its kind in the world.

Because, if the various units of such a colossal concern as the B.B.C. are not working in closest co-operation there is loss of energy and the possibility of all sorts of mistakes.

I realise perfectly that it is possible to sit back and criticise any programme that is broadcast, from one point of view or the other, but if the critics of the B.B.C. knew how difficult a matter it is to arrange a programme so that no listener is disgruntled, then they would save both the paper and the ink.

The Best Obtainable.

In every programme there is such a thing as "policy" to be considered, and "policy" means all the possible implications of a broadcast besides its mere value as entertainment at the moment it goes out. Before the speaker, singer or instrumentalist is engaged there is much discussion by the departments concerned on the relative merits and suitability of those engaged.

AT THE CONTROLS

A later photograph of Mr. Stanton-Jefferies adjusting the amplifiers at a Covent Garden broadcast in conjunction with the musical score.

So be a little kind to the B.B.C. when next you feel like throwing your wireless set on the nearest dust heap, and remember that you have some of the finest specialists in the world collected under the roof of Broadcasting House. In other words, "don't shoot the organist, he's doing his best," and incidentally the best obtainable, and I say the best in the world, because I know 'em all, and I've been to places, too.

I didn't intend to finish like this at all, but having left this organisation recently for pastures new (incidentally with much regret), I know what difficulties there are to overcome before a programme can be put on the air.

My next article will also deal with earlier days and the advent of Broadcasting Proper.

"CURVED WAVES"

SOME little time ago, in "On the Short Waves," I referred to a reader who had evolved a theory to replace the "quasi-optical" idea about ultra-short waves and their propagation. He has since come forward with more detailed suggestions which I feel are sufficiently interesting to quote and discuss.

This reader, Mr. Alexr. Thomson, suggests that the medium in which radio waves are propagated is the earth's magnetic field. "It is a well-known fact," he says, "that a magnetic field is disturbed by an electric current passing through a wire. The possibility is that if there were no terrestrial magnetism there could be no electricity. Thus I contend that a radio wave is an electro-magnetic wave inasmuch as it is a magnetic wave produced electrically."

What About the Skip Theory?

As is well known, the longer radio waves have great penetrative powers and carry for considerable distances during daylight; the shorter the wavelength becomes, the shorter is the distance that the direct ray appears to carry.

A. T. suggests that the shorter the wave is the more is it attracted back towards the earth by the magnetic field. This does not seem to explain the well-known phenomena associated with skip-distance, but he even succeeds in fitting in the Eleven-Year Sunspot Cycle into his theory!

"With regard to sunspots—these are obviously outpourings from the interior coming to the surface of the sun. The material thrown out is a metallic vapour. This affects the sun's magnetic field, in which the earth is moving, and in turn affects the terrestrial field."

A. T. then gives a table that he has worked out, giving the degree of curvature for waves of various lengths from 1 metre to 30,000 metres, and working out therefrom the approximate distances that one might expect radiations on these wavelengths to travel, together with an arbitrary "penetration factor" for each wavelength under consideration.

While I disagree strongly with some of A. T.'s statements, I like the way in which several well-known effects fit in with his theory, and I think it warrants investigation.

Investigation is Worth While.

If a group of listeners were to carry out tests, ignoring sunspot activity, weather conditions, and so on, and concentrating solely upon the manner in which magnetic storms affected propagation, we might come up against some interesting facts.

I don't know, off-hand, a suitable source of information concerning data about the earth's magnetic field, but possibly someone can put me wise to one. Certainly it is well known that magnetic storms coincide with a sudden increase in the number of sunspots, and the fifteen-monthly "peak" in short-wave conditions would work out according to plan!

The whole thing seems a good subject on which to start a discussion.

W. L. S.

A PORTABLE IN THE WEST

An interesting account of experiences with a compact radio receiver during a camping trip, with a few remarks on short-wave reception.

By G. L. GRISDALE, B.Sc.

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 reaction and for use with phones, 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 for low tension 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 rucsack.

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 sufficiently wide band was covered with the 0·0003-mfd. tuning condenser.

The Filament Resistance.

The intervalve transformer, although intended to be used in a parallel-fed arrangement, was used, or rather misused, direct to the anode circuit of the HL210 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 inselectivity 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 receiver could be picked up, or at least detected as a carrier wave, on the portable 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 some 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. Poste 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 tuning 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. From 5.30 to 6 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!

It is one thing to pick up, say W 2 X A F on a home short-waver, to bring in the family to listen with gaping mouths and popping eyes to the slightly wobbling 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 of static 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 superhets going from 12 to 80 metres.

There are now four superhets where there were only two for 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 superimpose 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 *ad*versity of course!

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 talks over the trans-atlantic telephone circuit.

Sinister-minded readers may ask why 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, evesdropping when we listen to "Five Hours Back." That same snappy programme is probably being heard by millions of housewives in America—for it is their lunch hour.

True, W 2 X A D does make 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 di-pole aerial, 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 more natty 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. The 'Five Hours Back' 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 around 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 realise how wireless, in girdling the earth, may annihilate space but cannot catch up with time! Which is definitely to-day's bright thought, don't you agree?

A. H.

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 1931.

OF TECHNICAL IMPORTANCE

FOR GREATER UNDISTORTED POWER OUTPUT AT MODERATE VOLTAGES

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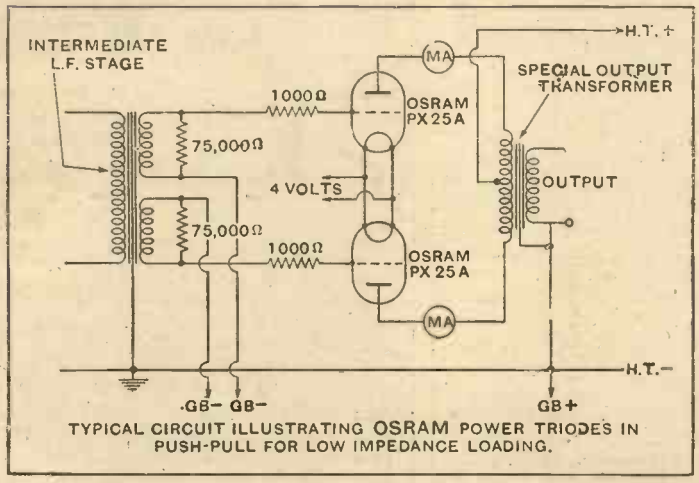


TYPICAL CIRCUIT ILLUSTRATING OSRAM POWER TRIODES IN PUSH-PULL FOR LOW IMPEDANCE LOADING.

CHARACTERISTICS	TYPE PX25A	TYPE DA30
Filament Volts	4.0	4.0
Filament Current	2.0 amp	2.0 amp
Anode Volts	400 max	500 max
Ampln. Factor	3.2	3.5
Impedance	865 ohms	910 ohms
Mutual Conductance (at working point)	3.7 ma/v	3.85 ma/v
Load Resistance (for "Low Loading" push-pull) (Anode to Anode)	2,800 ohms	3,400 ohms
Price each:	**25/-**	**30/-**

WRITE FOR NEW OSRAM VALVE GUIDE

NEW POWER TRIODES

TYPE **PX25A** TYPE **DA30**

"Low Impedance Loading" is a method of using a pair of Output Valves in a push-pull circuit to obtain a considerable increase in undistorted power, without resort to high H.T. voltage or the necessity for positive grid drive.

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.*

OSRAM VALVES—DESIGNED TO ASSIST THE DESIGNER

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

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

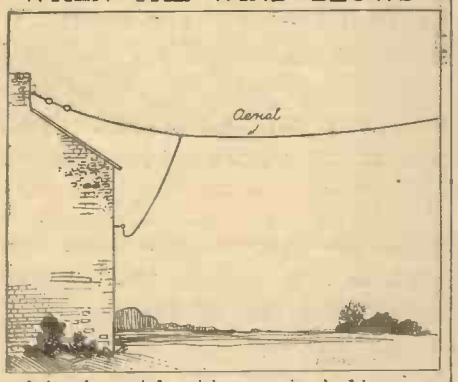
FADING is a radio evil which has not yet been entirely eliminated and which, indeed, may never be completely abolished from radiodom. For the causes of fading lie beyond the control of the receiving set owner and, also, of the transmitting station. In commercial working fading may become an intolerable 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 unconquerable, 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

WHEN THE WIND BLOWS



A loosely erected aerial or swaying lead-in can cause fading in windy weather.

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, its 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 "atmospherics" (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 be mistaken for the genuine variety of fading.

Further Possible Causes.

An H.T. battery, when it is about to "give up the ghost," usually signalises 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.

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 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.

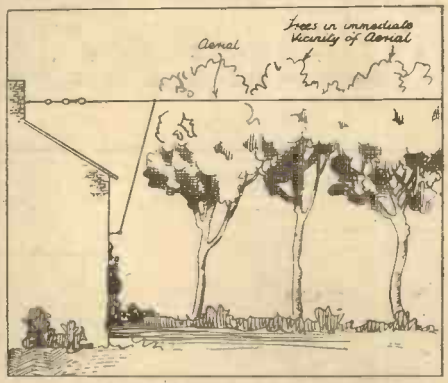
The reason underlying the above effect is known. The aerial wire and the ground form two plates of a large condenser, the intervening air comprising the dielectric or insulating medium of the condenser. Now, by varying the relative positions of the plates of an ordinary radio condenser one readily alters 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 taut 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

VARYING SCREENING



The screening effect of trees may vary considerably as the leaves and branches move in the wind.

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

(*Continued on page* 102.)

PROGRESS IN TELEVISION

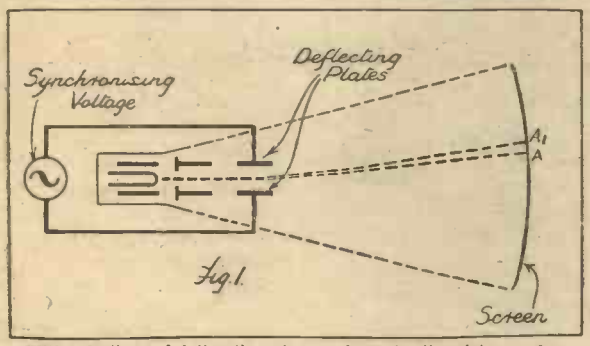
A new method of applying the picture pulses to the cathode-ray tube so that they do not cause distortion is described here.

By CARDEN SHEILS

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.

DISTORTION DUE TO DEFLECTION



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, A1, in this diagram.

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. Here, however, they are superposed 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 A on the screen, to another spot, such as A1. This naturally also tends to blur the picture.

The second method is really based upon the number of electrons 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 off 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 quite 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.

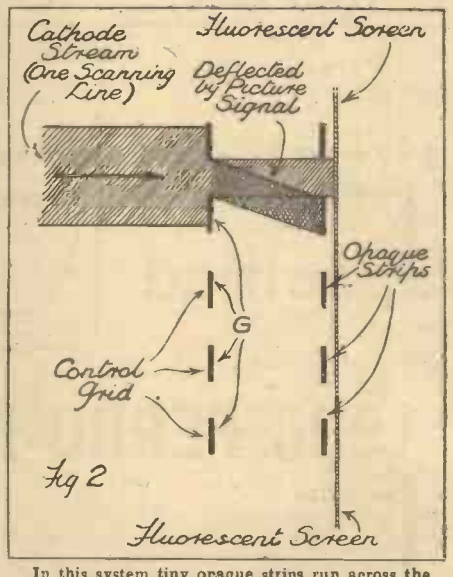
Better Definition.

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-fifth of a millimetre thick, one for each scanning-line, consecutive 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



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.

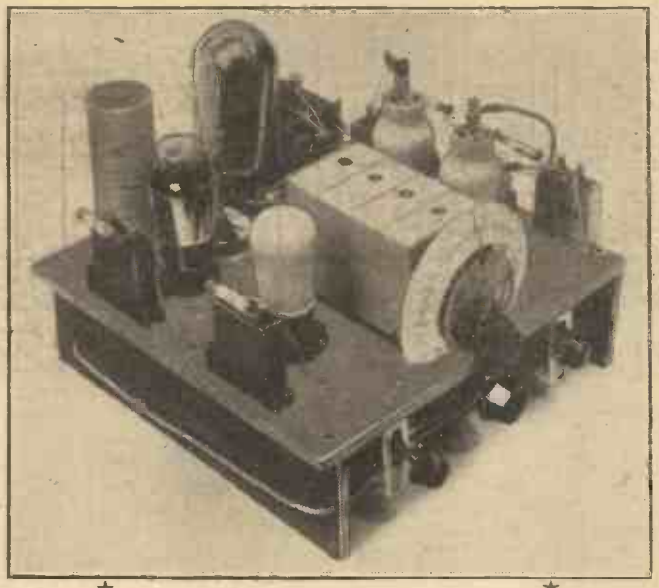
Naturally, owing to the fixed positions of the lines, the tube has to be constructed to suit one particular method of transmission. Thus for 240 lines scanning the cathode-ray tube would have to be divided so as to give 240 fluorescent lines on the screen. Interlacing could be carried out provided a suitable number of lines was used, but the number of lines could not 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.

The 1936 "Ferro-Power"

Designed and Described By K. D. ROGERS.

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.



CLEAN REPRODUCTION—FIRST-CLASS QUALITY—TREMENDOUS POWER AND RECEPTION OF MANY FOREIGNERS AT FULL STRENGTH ARE OUTSTANDING POINTS OF THIS NEW RECEIVER. IT EMPLOYS A STRAIGHT CIRCUIT WHICH IS AS SENSITIVE AS A SUPERHET ARRANGEMENT AND INCORPORATES MANY UNIQUE QUALITIES OF ITS OWN.

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 when I say that the set will give full volume on a large number of foreign stations 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 with 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.

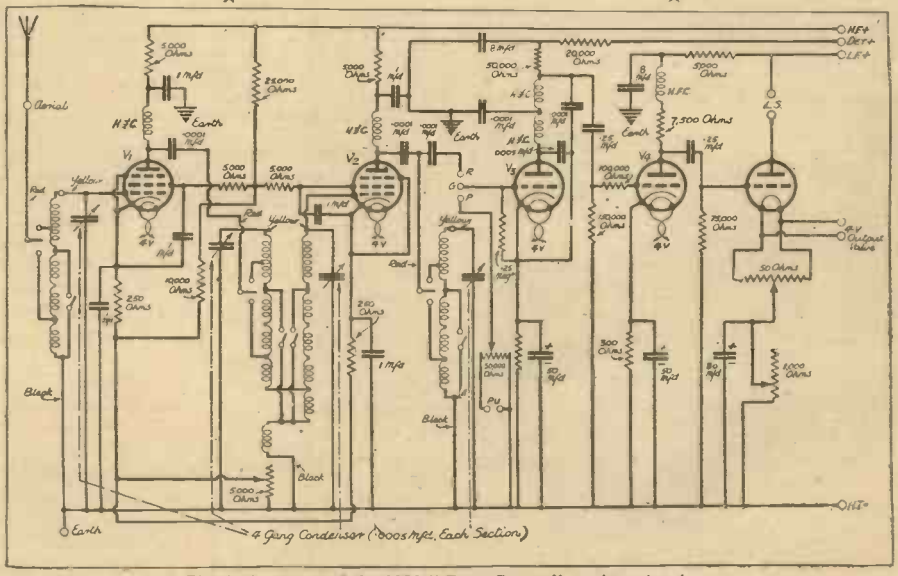
But one does require a peak carrying power of 5 watts to avoid overloading *on every occasion.* Many sets with output valves capable of 2 or 3 watts will deal faithfully with quite a large number of programmes at a fairly good average strength level. But sooner or later there comes a big bang on the 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*)



This is the circuit of the 1936 "Ferro-Power" receiver chassis.

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 the L.F. amplification that is available. But to those who want not only a docile set that will give nigh perfect quality on the locals but will allow them to treat dozens of foreigners as full strength locals by turning up the volume control, I sincerely recommend this set.

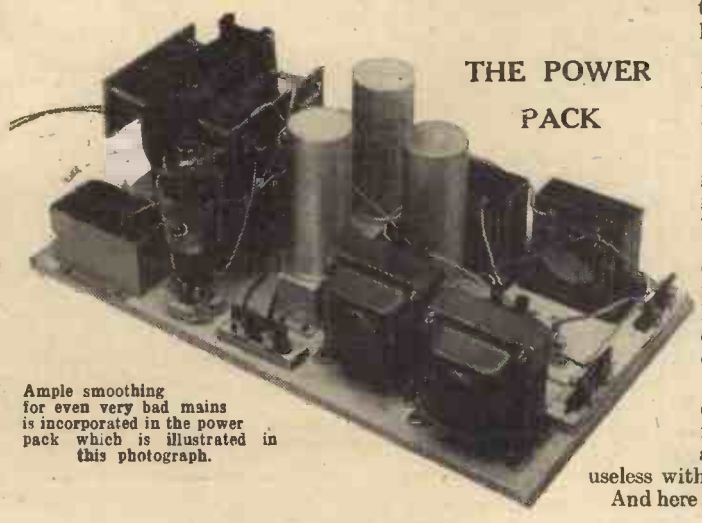
VALVES AND LOUDSPEAKER

V1 & V2	Cossor	M.V.S. Pen.
V3	Cossor	41 M.H.L. (Met.)
V4	Cossor	41 M.P.
V5	Marconi or Osram	P.X.25
Rectifier	Marconi or Osram	M.U.14

LOUDSPEAKER :
W.B. "Stentorian," type E.M./W.

I do not want builders of it to write to me after, however, saying that they find the set "easily overloads." 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.



Ample smoothing for even very bad mains is incorporated in the power pack which is illustrated in this photograph.

THE POWER PACK

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.

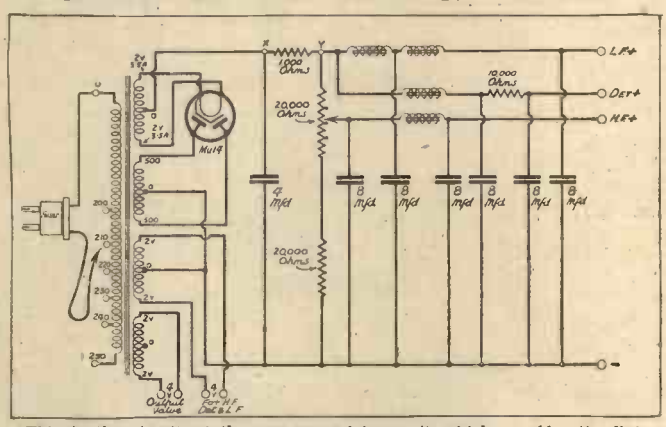
Valve Tolerances.

The percentage of success with that type of A.V.C. with modern valve tolerances would be ridiculously low, 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.

So I have not included A.V.C. at all, for ordinary unamplified A.V.C. is useless with a set of this calibre. And here I am going to throw a small bomb into the camp of the pro-A.V.C. fans. Admittedly A.V.C. is quite a pretty technical achievement for keeping the level of *signal strength* constant. You can sweep from one end to the other of the wave-length scale with the sure knowledge that you will not suddenly get a sudden crash of volume as you get into tune with a comparatively near transmitter. But here, in my opinion, the usefulness of A.V.C. ends to those who want a set that is to give good programmes, and is not to be merely a station-getter. Its anti-fade properties are so often accompanied by bad background noise.

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.

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. And that is possible from a large number of foreigners. Many do not fade at all. And here is my point. If a station 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 Varley power transformer, type E.P.38.
3 Dubilier double-electrolytic condensers, 8 and 8, type 9203E.
2 Wearite L.F. chokes, type H.T.410.
2 Ferranti L.F. chokes, type B.10
1 T.M.C.-Hydra 4-mfd. condenser, type 75.
1 Bulgin 1,000-ohm power resistance, type V.P.R.5.
1 Bulgin 20,000-ohm power resistance, type P.R.13.
1 Bulgin 20,000-ohm power-potential divider, type P.D. 6.
1 Bulgin 10,000-ohm power resistance, type P.R.11.
1 Bulgin combined main plug and fuses, type F.18.
1 Bulgin socket for above, type P.29.
1 Bulgin 5-pin "Steatite" valve holder.
1 Peto-Scott triple-electrolytic condenser bracket.
1 Peto-Scott single-electrolytic condenser bracket.
4 Graham Farish "Pop" terminal blocks.
1 "Metaplex" baseboard, 18 in. × 10 in.
1 Coil B.R.G. "Quikon" connecting wire.
Screws, flex, etc.

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 five 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.

PRICE 21/- —complete with volume control

The Edison Swan Electric Co. Ltd., 155 Charing Cross Road, London, W.C.2.

Distributors for the British Thomson-Houston Co. Ltd., Rugby

B.T.H MINOR PICK-UP AND TONE ARM

EDISWAN RADIO

R.P.267

PIFCO TEST INSTRUMENTS ENSURE 100% EFFICIENCY FROM RADIO

Buy to-day one 42/- Pifco Rotameter-de-Luxe (Moving-coil) or one 29/6 Rotameter (Moving-iron) and you will receive a complete set of 3 Pifco Valve Adaptors costing 15/-, in velvet-lined case for 7/6.
A Rotameter and set of Valve Adaptors will form a complete test set for your radio.

PIFCO VALVE ADAPTORS

Each adaptor has a 5-pin base with top sockets for "plug-in" testing of 5, 7 or 9-pin valves under working conditions without alteration to set wiring. Four nickel-plated terminals complete with strapping links are fitted, to connect meter in either grid or anode circuit of valve.

ROTAMETER-DE-LUXE

(9 Ranges including valve test) Every conceivable test, also valves, can be made with this amazing instrument (400 volts—500 ohms per volt). Black bakelite finish; complete with leads In handsome velvet-lined case. Price 42/-.

PIFCO

Ask your dealer to-day to show you Rotameters and Adaptors, or write for Pifco Testmeter Folder, post free, from PIFCO LTD., SHUDEHILL, MANCHESTER, or 150, Charing Cross Road, London W.C.2.

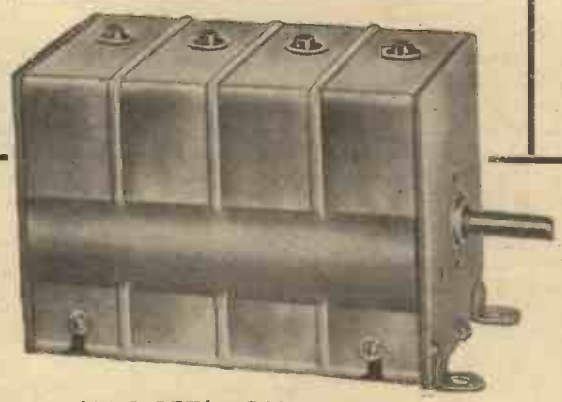
ROTAMETERS and RADIOMETERS

PIFCO ON THE SPOT WILL TRACE YOUR TROUBLES LIKE A SHOT

POLAR

SPECIFIED FOR THE 1936

FERRO-POWER

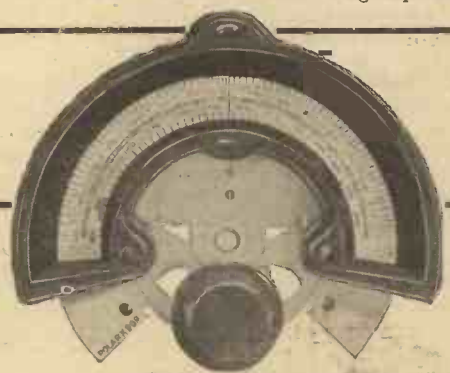


POLAR 'MIDGET' FOUR-GANG CONDENSER

One-piece steel frame—aluminium vanes. Ball-bearing shaft. Sections matched within ½ per cent. or 1 mfd., whichever is the greater. Trimmers operated from top. Small overall dimensions. **22/-**

Also made in

Two-Gang	11/-
Three-Gang	16/6
Three-Gang Superhet	16/6
Four-Gang Superhet	22/-



POLAR SEMI-CIRCULAR DRIVE

Slow motion. Bevelled scale in wavelengths. Moulded Escutcheon. Lampholders provided. **5/9**

Other Polar Drives include:

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Arcuate	5/9
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Micro Drive Horizontal	7/9
Micro Drive Semi-Circular	7/9
Micro Drive Arcuate	7/9

Send for fully illustrated Catalogue of Polar and N.S.F. Components.

WINGROVE & ROGERS, LTD.,
188/189, Strand, London, W.C.2.
'Phone: Temple Bar 2244. Works: Old Swan, Liverpool.

CA 7619

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 mu screen pentodes are employed with Ferrocart coils.

Band-pass intervalve 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 the intermediate, 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 even 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. Special attention to smoothing and to decoupling has been paid, with the result that the fullest amplification is possible without the slightest trace of trouble so often associated with intense magnification.

The detector is what may be termed semi-power-grid. It is not fully a power grid detector, for the full 200 volts of anode potential are not applied to the valve. 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."

Resistance-capacity 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; far 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.

Fairly heavy H.F. by-passing is necessary with a set of this nature so that you must not be surprised that a total of ·0007 mfd. has been used in the anode circuit of the detector. This reduces the high note response above 8,000 cycles, but a high note lift is provided in the anode circuit of the first L.F. valve in the form of a 500,000 m/hy H.F. choke, to compensate for any loss due to the by-pass condensers.

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, and allows 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 set deserves a good speaker—don't spoil it by using an inferior type or make.

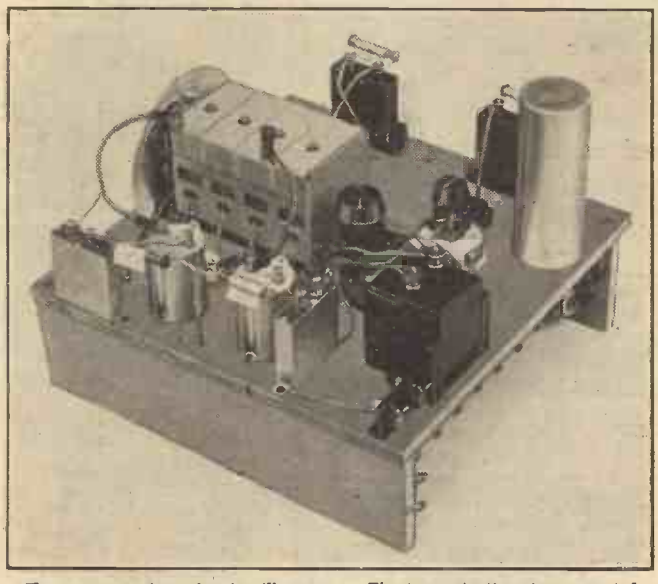
Wide Wave-Range.

One point I may mention here is the extremely wide wavelength range of the receiver. 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 800-metre mark, and the highest is above 2,000 metres.

Thus the great majority of Europe's broadcasters come well within the tuning scope. This fact, coupled with the set's sensitivity, enables an exceedingly large "bag" of stations to be obtained. And the selectivity is such that with a full 100 ft. aerial within a few miles of Brookmans 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.

THE COMPLETED RADIO ASSEMBLY



How your receiver chassis will appear. The two potentiometers mounted behind the gang condenser do not have to be touched once they are properly set.

THE PARTS EMPLOYED IN THE RECEIVER-CHASSIS SECTION

1 Set Colvern "Ferrocart" coils, types G.10, 11, 12, 14.
1 Polar "Midget" four-gang tuning-condenser.
1 Polar Semi-circular drive for above.
2 Bulgin 7-pin chassis-mounting valve holders, type S.W.42.
3 "Clix" 5-pin chassis-mounting valve holders, with soldering tags.
1 Bulgin 5,000-ohm wire-wound volume-control, type V.C.29.
1 Erie 50,000-ohm graded volume-control.
1 Varley 1,000-ohm power potentiometer, type C.P.59.
3 Bulgin H.F. chokes, type H.F.10.
2 Wearite H.F. chokes (one H.F.P. and one H.F.P.A.).
1 Dubilier double 8 and 8 mfd. electrolytic condenser, type 9203E.
1 T.C.C. 80-mfd. electrolytic condenser, type 541.
2 T.C.C. 50-mfd. electrolytic condensers, type 521.
4 T.M.C.-Hydra 1-mfd. condensers, type 30.
2 T.M.C.-Hydra 1-mfd. tubular condensers.
1 T.M.C.-Hydra ·0005-mfd. tubular condenser.
4 T.M.C.-Hydra ·0001-mfd. tubular condensers.
1 Dubilier ·0001-mfd. condenser, type 665.
2 T.M.C.-Hydra ·25-mfd. condensers, type 30.
2 Erie 250-ohms 1-watt resistances.
1 Erie 300-ohm 1-watt resistance.
1 Erie 750-ohm 1-watt resistance.
4 Erie 5,000-ohm 1-watt resistances.
1 Erie 10,000-ohm 1-watt resistence.
1 Erie 25,000-ohm 1-watt resistance.
1 Erie 75,000-ohm 1-watt resistance.
1 Erie 100,000-ohm 1-watt resistance.
1 Erie 150,000-ohm 1-watt resistance.
1 Erie 250,000-ohm 1-watt resistance.
1 Bulgin 5,000-ohm power resistance, type P.R.9.
1 Bulgin 7,500-ohm power resistance, P.R.10.
1 Bulgin 20,000-ohm power resistance, P.R.13.
1 Bulgin 50,000-ohm power resistance, P.R.17.
1 B.T.S. 50-ohm baseboard-mounting potentiometer.
7 Graham Farish "Pop" terminal blocks.
2 Peto-Scott component mounting-brackets, type 22/1.
1 "Plywax" baseboard, 12 in. x 12 in., with 3½ in. wood runners.
Brass bolts and nuts, screws, flex, shielded flex, etc.

BARRY KENT CALLING

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 intrigued listeners from time to time.

* * *

New Booking Arrangements.

"Central Booking" has been restored to the B.B.C. About eight years ago Rex Palmer organised and ran a central booking department for all artists. When Mr. Palmer went to H.M.V. the idea was dropped. It has now been revived, this time under Mr. Howgill. The plan is to relieve producers and other programme builders of all responsibility for detail.

When a play or a programme is allotted to a producer, the artists will be listed automatically. This is all very well from the angle of organisation. It looks tidy and efficient. But there is a snag. Producers like to be concerned with casting. Most of them have very definite views about artists, and I do not see this new organisation working out at all well.

* * *

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 however there 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 Dawnay 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 "comeback." I understand that his contract in commercial broadcasting is about to terminate; and rather than renew it he would prefer to resume with journalism 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

(*Continued on next page.*)

BARRY KENT CALLING

(Continued from previous page.)

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

ON THE AIR

Candid comments by our broadcasting critic on recent programmes.

I HAVE ceased to frown. Listening this week has been much more worth-while 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 said to me the other day: "If this sort of thing goes on, in a few years' time listening-in will be as dead as mutton."

* * *

I have listened to most of the new talks this week. Here are my comments on two of them. Comparisons are odious, but when Cloudesley Brereton compares the French with other nations, especially the British, comparisons become interesting. Cloudesley Brereton didn't attempt to say whose national characteristics were the better. He merely gave facts as his experience had taught him. And in so doing he must have corrected a few misunderstandings that the average Englishman has in regard to the French.

It was amazing the amount of information Mr. Brereton got into his talk. This talk, with the second to follow, is an excellent introduction to the term's French lessons. I do hope Mr. Brereton will have further opportunities to broadcast, for he strikes me as being an out-of-the-common broadcaster.

* * *

A Recorded Talk.

"The Genius of Spain" was the title of Dr. Pastor's talk. This talk was intended to introduce the Spanish lessons. Dr. Pastor's introduction was more learned than Mr. Brereton's, and I fear that to the average listener it was less informative. The talk was recorded and consequently accompanied by a pronounced whirr throughout.

Dr. Pastor gave a geographical and historical survey of Spain. He ended with a few extracts in Spanish from a modern Spanish writer. This convinced me 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 pep 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 Hastings many years ago now. It seems a thousand pities that the art was allowed to become old-fashioned. Norman Long is almost the only radio artist we hear sing at the piano.

* * *

Say what we may about syncopators, the brand is unrivalled among singers for clearness of diction. Those 30 Syncopated Minutes were remarkable for the ease with which listeners got every word. First there were the Two Messenger Boys, and then Hildegarde. They sang newish songs, apart from the Messenger Boys' "Dinah." I would like to hear that this song had been put aside for a bit.

* * *

Michie-Longstaffe Variety.

The Michie-Longstaffe variety turned out well. Recipes are usually something of a gamble, but there is little risk run with a Longstaffe concoction. This isn't suggesting that anything Michie is doubtful. Michie, to me, isn't as household a word as Longstaffe. Or it wasn't. It will be soon. I liked the way he compered the show. He lays the law down a bit, but perhaps this is ultra-pep.

Vic Oliver is as good on the air as he is on the stage. Good praise, this!

Joan Miller had a collection of "Americanisms" that almost makes me change my opinion of American humour.

Edwin Lawrence, like most Lancashire comedians, was really funny.

Walter Williams made his audience sing his choruses. I am sure this helped him to warm up. Certainly it makes for warm listening.

Lola Sharl and Pat O'Brien balanced the programme with a different type of song. After all, the programme was intended as a mixture.

* * *

I believe it was the late Silas Hocking who said: "The better the story the better the book." This is very true. It is true of plays, undoubtedly, especially radio plays. The better the story the better the play. "Within the Law" is a good story. It made a good stage play. It made a good radio play.

* * *

A fairly large cast was easily distinguished. Joyce Kennedy gave a memorable performance as Margaret Taylor. She appeared to be living the part perfectly. I also liked Aubrey Mather's Edward Gilder, Victor Stanley's Joe Garson, and especially Vivienne Chatterton's Agnes Lynch, whose comedy, though a trifle overdone, relieved the tenseness of the drama rather cleverly, I thought. "Within the Law" pleased me enormously, and compensated for the recent shortage of good radio drama.

* * *

Geoffrey Boumphrey has a very pleasant way with him. His second talk, this time on German town-planning, was most picturesque, and though it was hurriedly given, it held one's attention completely.

* * *

Introducing the All Blacks.

Rugger enthusiasts must have been delighted with Dr. Harrop's introduction of the All Blacks, and with their settled policy for the tour. Everything augnrs well for an exciting series of matches fought out in the friendliest of spirits. The making of friendships seems to be one of the foremost objects of the tour.

* * *

A delightful bit of community-singing came from The Granada, Tooting, on Saturday afternoon. Harold Ramsay was at the organ, and among other things he played a Popular Medley. Everybody at The Granada joined in. It was a treat to hear. No organised community-singing could have been better done.

C. B.

RADIOTORIAL

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

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

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

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

QUESTIONS AND ANSWERS

CURIOUS INSTANCE OF H.F. INSTABILITY.

W. L. (Gorton, Manchester).—"The set is now perfectly stable, and although I know exactly how I put it right I did this 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 metallised baseboard, and is fastened there by two screws. About half-way up the screen there is a hole for a bolt, with nuts on either side of it.

"All that is necessary to stabilise the set is to remove one of the wires from this bolt—the one from the moving vanes 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 the 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 in wiring appears to be, there are several possible explanations for the marked improvement it has effected.

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

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

There is yet another possibility, not unconnected with the foregoing, and arising from the fact that a common earthing-path to two circuits, though theoretically satisfactory, may cause interaction.

Just as the B.B.C. advises neighbours not to use the same earth, so the set designer often advises that neighbouring circuits should be earthed at separate points, to prevent mutual interference, in a powerful set where stage-gain is high.

So although the alteration in wiring appeared to be a small one it serves to show what big snags 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 leads are taken from a car battery, and a suitable resistance is inserted in one to reduce the current to that required for charging, a small wireless battery can be charged from the car's battery.

Usually the side lamp (or lamps) make suitable resistances. The important point to remember is that the two positives, of the batteries must be connected together. *Not* + of one to — of the other.

ALL THE VALVES BLOWN OVERNIGHT.

W. W. (West Ham, London, E.15).—"The set was going great guns overnight. Big Ben booms 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—everything quite O.K. Accumulator fully charged, and nobody—I know for certain—has touched the set since I switched off the previous night.

"I check over the set with a 'Pifco' meter, and still find nothing wrong. I take out the valves one by one and on testing find that all five valves are blown!

"Every one of these valves was brand new on Thursday, and this blow-out happened on Tuesday. 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 use of the set proves that there is nothing wrong with it now, the only explanation that fits the circumstances is that one of the discarded valves was the cause of the trouble.

It may not be apparent, at first, how one valve can result in a whole set of them becoming "blown"; but we can assure you that it may happen, and the one faulty valve cause the destruction of them all.

How this can occur will be appreciated if it is remembered that the H.T. and G.B. batteries are nearly always left connected permanently to one electrode of all the valves, viz., to the negative side of the filament.

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 for the H.T. *or the G.B.* (if high bias is used) to come into momentary accidental contact with the other side of the filament of any one of the valves.

It is unlikely that the H.T. would cause the trouble, because it is not well-placed to "get at" the + side of the filament, ; since the set is now working well, its insulation between H.T.+ and L.T.— is obviously O.K.; so the only route for an H.T. leak would have been inside one of the valves, and their construction 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 modern valve—necessarily very close. The small space between the two electrodes, filament and grid, is a perfect insulator. So negative bias to the grid and positive bias connected to the filament do not matter—*unless a*

(Continued on next page.)

RADIOTORIAL QUESTIONS & ANSWERS

(Continued from previous page.)

faulty valve allows grid and filament to make contact. A very small vibration might do this, especially if it is accompanied by sudden electrical voltage changes—as, for example, when a multi-mu valve set, having its volume control and switch combined, is switched off rapidly from full volume.

Such an accidental contact in the one valve might easily involve all the other valves in the set.

SWITCHING OFF THE PICK-UP FOR THE S.T.600.

G. P. W. (London, N.W.1).—"I find the superb quality of the '600' is as noticeable on gramophone records as on wireless reception. But I wish there was a way of switching off the pick-up instead of having to disconnect every time, when changing to radio.

"What do you recommend for this?"

All that is necessary is to mount one of the ordinary on-off switches on the terminal strip, near to the pick-up terminal. The lead to the pick-up terminal can then go via the switch, which in the "off" position will disconnect it.

THE SUPERHET PRINCIPLE.

W. L. R. (Tolworth, Nr. Surbiton).—"I have been reading your paper for a number of months now, but my constructional work has never gone beyond the straight three-valve set.

"I am now contemplating the building of a superheterodyne at some future date, but before doing so I want to be able to understand what I am working on. I would be much obliged if you would explain the working principle of a four-valve superhet.

"Also, could you tell me what is a variable-mu I.F. valve, and a double-diode second detector?"

The working principle of the superhet is highly ingenious and rather complicated, so only the briefest description can be attempted to outline the fundamentals. The full name of the arrangement is "supersonic heterodyne": you probably know what the word heterodyne means—the interaction of two currents of different frequencies, to produce a third (and, incidentally, a fourth) frequency.

If the two original frequencies are not widely dissimilar, the third—or beat-note—frequency will be comparatively low, perhaps 1,000 beats a second. And it can then be *heard*, as listeners who have suffered from heterodyne interference know only too well!

It is easy to arrange, however, that the beat-frequency is above the limit of audibility, in which case it cannot affect the ear and is known as "supersonic." The superhet is, therefore, a set in which the original frequency of the incoming signals (carrier-wave) is mixed with another frequency (oscillator) to form a third high frequency, known as the intermediate frequency (I.F.).

Two very important advantages are (1) the intermediate frequency (I.F.) represents a much longer wavelength than the original, and is therefore more easily amplified to any desired strength, and amplification has to be on one frequency only for all stations; (2) the alteration of wavelength makes the set extremely selective, since interference is "thrown out" by the mixing.

There are, literally, dozens of ways in which the principle can be applied to four valves. A typical arrangement would be to use a multi-electrode valve such as a pentagrid as the first, or frequency-changing, valve. Its various electrodes would be able simultaneously to handle the tuned input, the self-generated oscillations to mix with this, and the necessary H.F. rectification to enable the beat frequency to be picked out.

For the second valve (I.F. amplifier) an H.F. pentode might be used, and this would be a comparatively straightforward stage, feeding the second detector.

The second detector might be a double-diode triode, one of the diodes being used for automatic volume control, the other for the detection, and the triode section of the valve for further amplification. The fourth valve would be the output valve.

Regarding your other queries, the function of a double-diode second detector has already been outlined above; a variable-mu I.F. valve is one in which the application of grid bias controls the amplification factor, so enabling the valve to amplify much or little, as required at any moment. It is only by virtue of such valves that A.V.C. has been made possible.

CHARGING FROM THE D.C. MAINS.

S. E. 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 friend is in 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 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 *trickle charging*.

There is a great difference between trickle charging and the ordinary charge given to an accumulator by a dealer when it is taken along to him for treatment.

The dealer can arrange to pass a fairly heavy current through it for just a few hours, which will "bring 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 well and truly charged 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.

By the morning the 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.)

RADIOTORIAL 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 the most. So a simple way to run such an arrangement is to check the voltage and the specific gravity regularly, and charge more as soon as the battery seems to need it; or slack off the charging 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. Instructions for taking the readings are given with the instrument, which is easy to use and quite inexpensive).

Your rate of charging will depend upon the resistance 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 specially 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 this would be the best way to tackle the problem, since unskilled interference with the mains is dangerous, 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. 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 developments, such as transport—and wireless."

Mr. Siepmann has spent three solid years as Talks Director, and his final programme—for he now takes up the new post of Director of Regional Relations—shows that he has been working with his colleagues on sound lines. The complete schedule reveals, I think, a growing realisation that not only must the listener's interest be invoked, but the talker's mode of presentation *must* be "microphonic."

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 1935 All-Electric Adaptor.

I built this up from a Peto-Scott "C" kit, and found it very easy to construct. It has a very nice "commercial" appearance, and takes up little room.

It worked from the word "go," the first station received being W 2 X A F, at a genuine R9. I am using the unit with a seven-stage Ekco superhet, and have already received a large number of broadcasting and telegraph 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 crackles, and the unit kept getting out of tune. After five minutes everything was all right.

I cured this by spreading the pins of the valve gently, although they seemed previously 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 1935 "Kelsey." I have been an amateur radio man since the first number of POPULAR WIRELESS, the very crude crystal set described in that issue being my first receiver, while I owe my introduction to short waves to the first Kelsey adaptor.

Yours faithfully,
ALVIN PRYOR.

16, Enys Road,
Eastbourne.

THE LONDON TELEVISION SERVICE

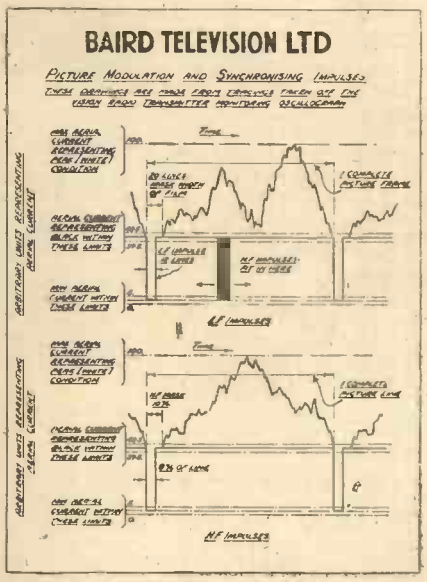
First Transmission Details

As we go to press details have reached us regarding the exact form of the high-definition television transmissions for which preparations are being made at Alexandra Palace.

Next week we shall go into the matter more fully and shall give a full description not only of the Baird method of transmission—described hereunder—but also of that of the Marconi-E.M.I. System.

As regards the Baird 240-line high-definition television, the accompanying drawing gives complete details of the waveform for picture modulation and synchronising impulses. From this it will be seen that, using the arbitrary aerial current units of zero to 100, the total modulation for synchronising (black) extends between the tolerance limits of zero to 5 and 37·5 to 42·5, while the picture modulation (black to white) extends between the tolerance limits of 37·5 to 42·5 and 100.

It will be noted that the high-frequency synchronising impulse is rectangular in shape



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

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

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

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

THE LINK BETWEEN

By G. T. KELSEY.

ONE can hardly appreciate the tremendous improvement that has taken place in commercial receiver design during the last few years until one is suddenly brought face to face with one of the "has-beens" of about 1929 or 1930 vintage. And then, my goodness, *what* a difference!

I don't think even I realised just what progress had been made until this week, but now I most certainly do know. And my immediate reaction is that I cannot speak too highly of modern sets!

I had intended to leave radio severely alone during my annual pilgrimage to the sea, but alas! the elements thought differently about it, and as there is nothing particularly attractive in battling with a 70-mile-an-hour gale and torrential rain, I have been amusing myself with the set which is installed in the bungalow I am occupying.

And *amusing* myself is about the most apt description. The "set" in question is of the commercially built type, and I should think roughly about five or six years old. The set itself is complicated enough, but the power pack from which it works would rival a power station except that the power station would probably have fewer controls!

Not a Brilliant Performance.

As for results, when, by banging the power-pack case one has succeeded in stopping the buzz, it is possible after dark to get the long-wave National, Luxembourg and Radio Normandie.

But the Brookmans Park transmitters, which are less than a hundred miles away, are quite out of the question. Even on Luxembourg and Radio Normandie fading is very troublesome, and the stations do not stay put for more than about five minutes at a time.

I confess to wandering a little off the beaten track in dishing up this moan in "Link Between," but it is done for a very good reason. Alas! I cannot think that this is the only set of its kind in existence, and although I should hate to think that there are any other "relics" quite as bad as this one, there must be many hundreds of sets still knocking about and, in fact, in use, which would be better off on the dump heap!

I cannot think that their owners are unaware of what they are missing by hanging on to the old-timers, but I do believe that many listeners who would otherwise purchase new sets are purposely holding off in anticipation of still lower prices. The unbroken downward trend of prices during the last few years is responsible for that.

But there must be a rock-bottom somewhere, and after a careful survey of present market conditions, it is my sincere belief that the lowest ebb has been reached in the models which are now available. Any further reductions can only be made, in my opinion, at the expense of performance, and that is most unlikely.

Now, then, is the time to buy. Throw out your duds and begin to enjoy radio at its best. And to put you on the right track I propose to conclude my notes this week by referring to three set catalogues which you can obtain through the medium of our post card literature scheme.

"Fototune" Dial Receivers.

First of all, the K.B. catalogue in which their range for 1935-36 is shown. How many people realise, I wonder, that it is now possible to get an all-mains set for something under £7? The K.B. model 433, which is described in this catalogue, costs only £6 17s. 6d., and it is an all-electric design complete with built-in moving-coil speaker!

Among the features of the other and more expensive receivers which are included in the catalogue, mention should be made of the new K.B. tuning innovation known as the "Fototune" dial. It makes station selection and identification child's play.

Incidentally, there is a very good battery set in the K.B. range this year at £5 17s. 6d. (370).

"The Real Thing."

A model for everyone is perhaps the most apt description of the Marconiphone catalogue of sets for the new season. At any rate, it would be impossible to imagine a more comprehensive range or, for that matter, a more distinguished-looking one.

The all-mains sets vary in price from 8½ guineas for the cheapest table model to 52 guineas for the very last word in radiograms. There is, too, a very excellent battery model at £7 12s. 6d.

Incidentally, all Marconiphone sets this year are described by the makers as "The Real Thing," and while it is true that I have not tested every set in the range, those that I have tried have made it very plain that the slogan is justified. (371).

Ekco Highlights.

I do not know whether I am hitting the nail on the head when I say that the Ekco policy for this year is "highest performance obtainable at keenest possible prices," but I must say that one is left with that impression after a glance at their current catalogue.

Without a doubt their range of sets this year is better than ever, and yet in general the level of prices is appreciably lower. The Ekco catalogue is one that should be seen by all who are contemplating the purchase of a new set, for this enterprising firm seems to have the happy knack of producing just the types of sets that are wanted. (372).

A PORTABLE IN THE WEST

(*Continued from page* 85.)

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 reception of the more distant amateur stations on the 160-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 may 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 these 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 perfectly suspended, the downlead may have been 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 due to quite the opposite cause. A poorly constructed, insensitive, badly tuned set will usually be so inefficient in working properties that it will not be sensitive enough to be influenced by the rhythmical variation of the aerial system's capacity consequent upon a swaying aerial.

More Noticeable with Sensitive Sets.

As, however, the set increases in efficiency and in its capability of being accurately tuned, its sensitivity to effects of the above nature increases in like proportion. That is why, in some respects, false fading is indicative of much radio virtue within the receiver rather than otherwise, although, of course, there is no doubt of the fact that such a phenomenon is a nuisance and one which should be eradicated by tracking down its cause.

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 velocities of light passing in different directions through quartz is, of course, well known), and a Karolus cell is used in conjunction with it. The precise details have not so far 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 *run* before we are able to *walk*, and that it would be much better to concentrate on the perfecting of black-and-white television instead of complicating the problem still further by going in for 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 was enormously complicating the problem, in fact it does not complicate it very seriously.

There is no doubt in my mind that if we could have 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; this arises 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 that 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.

(*Continued on next page.*)

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 198 volts is applied to the ends of the resistance (usually an electric lamp or lamps in this case), and if the current is one ampere there will be 198 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 at 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 choke. 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 microfarads. 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.)

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 show a surprising indifference 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 slightly 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 Resistance-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 presently 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 (apparently) 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-mains set really as silent 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 filaments are 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 receiver. 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.

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INDEX TO ADVERTISERS

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SENDING SOLIDS BY RADIO

Popular Wireless & Television Times

EVERY WEDNESDAY PRICE 3D

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Vol. XXVIII.
Oct. 12th, 1935.

THE B.B.C. TELEVISION SERVICE:
Transmission Secrets Revealed.

BUILDING THE 1936 "FERRO-POWER" RECEIVER

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INCREASING YOUR VOLUME

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ON THE SHORT WAVES

POPULAR WIRELESS AND TELEVISION TIMES

MANAGING EDITOR : N. F. EDWARDS. TECHNICAL EDITOR : G. V. DOWDING, Associate I.E.E.

GAY MADRID
RADIO "POT-HOLES"
PARIS LISTENS
THE "FILADYNE"

RADIO NOTES & NEWS

HELP FOR SCHOOLS
"BRIGHT" PICTURES
CHESHIRE'S RECORD
THAT AIR MAIL

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 Burghead, 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. Daventry also is looking forward to a nice new Empire outfit. General outlook, fine and dandy.

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 Huizen, Brussels, Warsaw, and *Vienna?*

The gayest dog in all of the kennels 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 it.

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 beacons that provide navigators with their positions.

Radio Dead Spots.

AT 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, detested 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 swamps, 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 British 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 I 5 O Y, Mr. M. J. Cown, of 74, Wheatfield Crescent, Crumlin Road, Belfast.

PROGRAMME CONTROLLER

Mr. Cecil Graves, recently appointed B.B.C. Controller of Programmes. Mr. Graves is well known for his pioneer work in connection with Empire broadcasting.

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 Bicêtre, the French Minister of Posts and Telegraphs is establishing a listening centre so elaborately planned that our own Tatsfield listening-post will, by comparison, be a mere aside. Already in the new Paris station about twenty short-wavers have been installed, and the idea is to keep a watch on every wavelength of importance, to detect wavelength grabbing and wobbling, and to record all 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 stunts 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 bang 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-downest 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 pluck 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 while 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 reorganisation of broadcasting, her radio-equipped air services, and her beam terminal 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 *quid pro quid* 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. Eckersley's in early B.B.C. days.

Capt. West predicted that within four years the nooks 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.

COMMISERATE 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 Brooklands, the home of British motor track racing, of the Mountain Championship Race on October 19th. This race, one of the most thrilling events of the year, takes place over a circuit 1·2 miles in length, which has to be covered ten times, all cars starting from scratch.

The field is made up of some of the fastest track cars in the world—witness the fact that last year's race was won by Whitney Straight at an average speed of 78·29 m.p.h. on a course which boasts two exceptionally severe bends.

A running commentary will be given by F. J. Findon. There should be plenty of material for him and plenty of excitement for listeners.

* * *

Soccer enthusiasts will be pleased to learn that there will be a running commentary on the second half of the F.A. Charity Shield match to be played at Highbury on October 29th. This annual event takes place between the current winners of the English Cup and the League champions—represented on this occasion by Sheffield Wednesday and the Arsenal respectively.

* * *

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

* * *

Billy Mander's (all male) concert party "The Quaintesques" (including the "Quaint Six Novelty Band") will broadcast again to Northern listeners from Leslie's Pavilion, Rusholme, on October 17th.

* * *

Variety for Scottish listeners on October 15th comes from the Edinburgh studio when the programme will be provided by Ian MacLean (comedian), Horace Wilson (tenor), Janette Sclanders (soprano), Jan Wien (banjoist), and Napp and Mack (comedians).

James Urquhart, Elsie Brotchie and Ian Sadler will take part in a sketch, "The Carrying Code," by Jack House and Allan MacKinnon, and the programme will be supported by Harry Carmichael and his Band and Barbara Laing 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. Acton-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 radio 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 broadcasters and programme-providing prodigies, but it is seldom that the veterans get their 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.

AIR mails are not an unmixed 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 eight-page letter on diaphanous dream-paper, as light as thistledown, to save postage. He writes glowingly, from a full heart, but in a microscopic caligraphy 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 bitter complaints about the long-waver, and one poem! This latter came from a Belfast reader, and begins:

"Why cannot we
listen to Droitwich?
To hear him is
surely a roight
which
We ought to enjoy;
But, honest, me
bhoy,
There's 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 chests, 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.

The B.B.C. Television Service

TRANSMISSION SECRETS REVEALED

Germany has forged ahead with television, Britain is still waiting the commencement of the first high-definition service. But preparations are going on, despite the silence which shrouds the new project, and details have just been announced of the technical aspects of the transmissions. They are discussed below by

K. D. ROGERS.

AT long last a move has been made in the releasing of the technical details of the two television systems which are to be used by the B.B.C. when the London television service starts next year.

Everybody knew that the Baird system used straight scanning and that 240-line definition was to be employed with 25 pictures a second.

We knew that the Marconi-E.M.I. method was to use what is called interlacing, and was to consist of 25 complete pictures per second, each of 405 total lines in two frames.

ONE METHOD

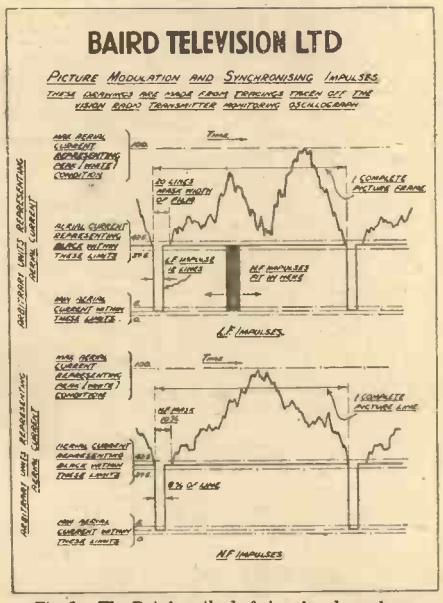


Fig. 1. The Baird method of signal and synchronising transmission. No interlacing is employed.

But what we did not know was how the signals would be sent out—what sort of synchronising impulses would be provided, how the interlacing was to be arranged. In fact, other than Baird and E.M.I., no one knew definitely what the television receiver would be asked to do.

The radio reception side was clear enough, but what that tricky piece of apparatus called the "time-base" (which carries out the scanning of the cathode-ray tube) had to do, was obscure.

Helpful to Manufacturers.

Now everything is more straightforward, though naturally no more has been divulged than is necessary in accordance with the agreement between the parties concerned and the B.B.C. But we know what has to be done to receive the Baird television, and even know much of what is required for us to receive television sent out on the Marconi-E.M.I. interlaced system.

Up to the present time manufacturers of television receivers could not get on with their final models because, though they had a good idea of what was required, they could not be quite sure until official information was provided by the two companies whose systems are to be used at the Alexandra Palace.

In order to understand the official information one must have a certain amount of knowledge of television and cathode-ray tube operation. Experimenters will be able to go right ahead from the official details reproduced here. Others may like a few words of explanation.

The Synchronising Pulses.

The whole crux of the matter rests in the fact that to regulate the scanning of the cathode-ray tube beam the time-base must be controlled by some form of synchronising impulses sent out by the television transmitter.

These impulses are sent out at the end of each line and also at the end of the frame. That is, in a 240-line picture at the end of the 240th line.

The line impulses (at the ends of the lines) cause one section of the time-base to "trip" and to start "tracing" another line across the tube. The picture or frame impulses cause the other section of the time-base to trip and to start scanning another complete series of lines.

Thus, in the Baird system, for instance, a definite synchronising impulse is sent at the end of each line to trip the line-scanning section of the receiver, and a different signal (differing in length) is sent to trip the "frame" portion of the set.

The frame synchronising is longer than the line impulse, and the pause between two frames or pictures is greater than that between two lines. So in the Baird system, for instance, we find the line synchronising impulse is 8 per cent of a line in time, a further pause of 2 per cent being allowed for recovery of the time-base before modulation is again sent out.

A Pause in Modulation.

In the case of the frame synchronising the impulse takes up the same time as 12 lines—and a further pause of 8 lines is allowed before modulation is begun again. See Fig. 1.

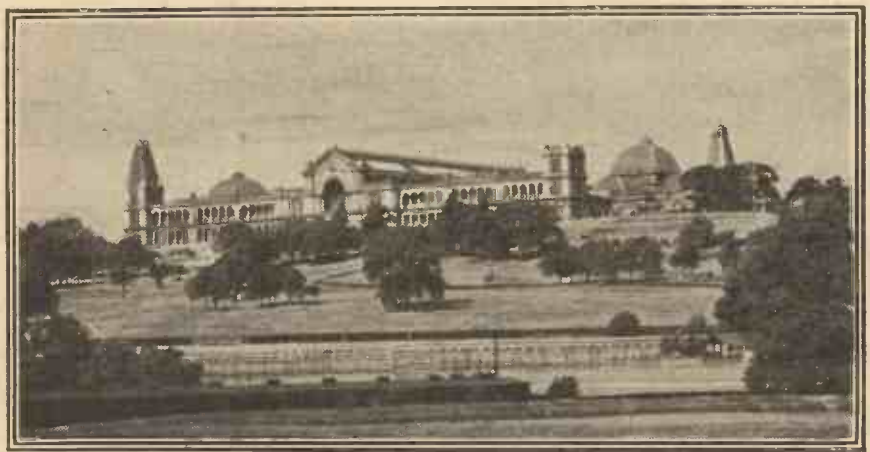
Both the Baird and Marconi-E.M.I. systems use a scheme whereby out of 100 per cent possible current strength the unmodulated part is about 30–40 per cent. This leaves variation of strength from 30 or 40 to 100 per cent for picture modulation, and a decrease in strength below 30 per cent for the synchronising impulses.

Thus, in the Baird diagram we have a mean value of 40 per cent. Above this is applied the picture modulation, and below it the synchronising impulses.

Thus, if the cathode-ray tube is so set that the line scanning is only just visible and the screen is to all intents "dark" when no modulation is applied, then with modulation the scanning spot can be made

(Continued on next page.)

THE SITE OF THE LONDON STATION



A general view of Alexandra Palace showing the dismantled tower whereon the mast for sound and vision aerials will be erected.

THE B.B.C. TELEVISION SERVICE

(*Continued from previous page.*)

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—in fact, 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 carrier strength is increased, while when it falls on a dark part the carrier strength falls. If a total black is present the carrier drops to its average of 40 per cent.

Thus, maximum current in the aerial means "white" and "average" current (40 per cent) means black. Less than average is sometimes referred to as "blacker than black," in other words, it has no effect on the picture which is already black.

This "blacker than black" is the state of affairs during synchronising.

One point should be made clear before we reproduce the verbatim reports of Baird and E.M.I. You will read that certain lines are masked off to form a black edging, and others are obliterated when the frame synchronising is sent out. These "removals" come out of the 240 or 405 lines mentioned as the definition. Thus, though we get the effect of 240 or 405 line "definition" or "fineness" of detail, we actually see fewer lines. In the case of the E.M.I. there are only 385 in the actual picture—i.e. 385 "active" lines.

And now for the actual wording of the two official statements of scanning details.

DETAILS OF SIGNAL RADIATED BY THE BAIRD APPARATUS.

The accompanying drawing (Fig. 1) gives complete details of the waveform for picture modulation and synchronising impulses. From this it will be seen that, using the arbitrary aerial current units of zero to 100, the total modulation for synchronising (black) extends between the tolerance limits of zero to 5 and 37·5 to 42·5, while the picture modulation (black to white) extends between the tolerance limits of 37·5 to 42·5 and 100.

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

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

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

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

INTERLACED SCANNING

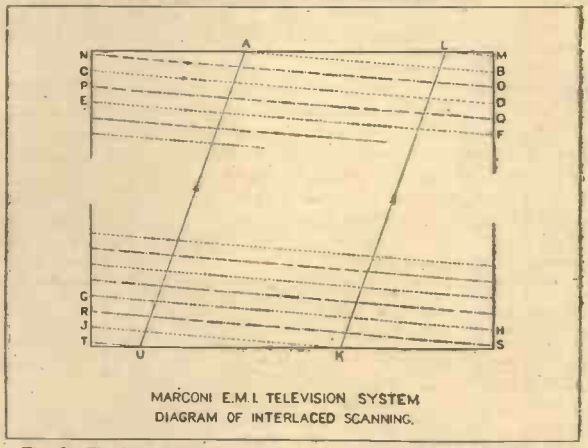


Fig. 3. The interlacing is carried out as shown above, alternate lines being scanned.

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 flicker 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 utilising only a fraction of the radiated band, but naturally the quality of the received picture will depend upon the degree to which the receiver makes use of the transmitted band width. The transmitted waveform is shown on Fig. 2.

(1) *Line Frequency.*

10,125 lines per second, scanned from left to right when looking at the received picture.

(2) *Frame Frequency.*

50 frames per second, scanned from top to bottom of the received picture.

(3) *Type of Scanning.*

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

(4) *Interval Between Lines.*

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

(5) *Interval Between Frames.*

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

(6) *Picture Ratio.*

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

(7) *D.C. Modulation.*

The picture brightness component (or the D.C.

(*Continued on page 129.*)

THE SECOND TYPE OF TRANSMISSION

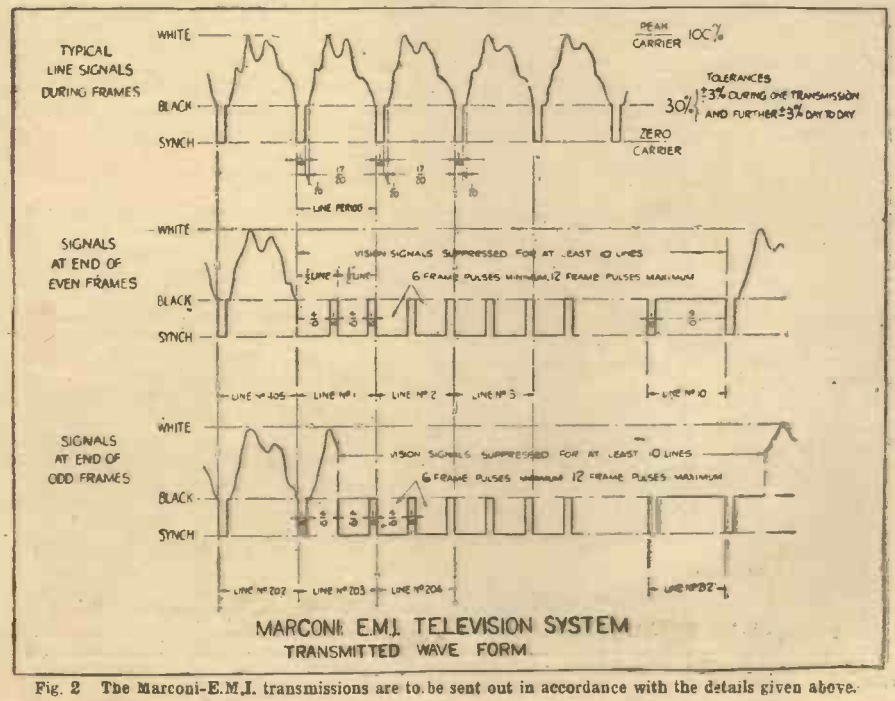


Fig. 2 The Marconi-E.M.I. transmissions are to be sent out in accordance with the details given above.

From Our Readers

AN "OLD TIMER'S" EXPERIENCES.

SIR,—I have been reading with interest your readers' early experiences in radio, and think 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 5 S C was soon to be opened. I managed to get a tuning-coil, 12 in. long by 4 in. diam., and wound with an enormous number of turns of enamelled wire; slides; 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 variometer set in "P.W." and tried again, and this time we heard the marvellous speech and music coming "through the air."

Wireless shops sprung up like mushrooms then and, fortunately for me, one of the local ones went bankrupt, and at the sale I procured a transformer and valve very cheaply and soon I had a stage of L.F. added to my crystal detector. Valves in those days cost 30s. each! Leaving school and being lucky I soon was able to have a 2-valve set going. How exciting it was bringing in the foreigners—no hundreds of kws. disturbing the ether in those days, but we got plenty of stations, though an extra pair of hands to control those multitudinous knobs and swinging coils would have been welcome. How many modern "fans" know that we used variable grid leaks then, and found them useful, too?

By this time, needless to say, "P.W." arrived regularly.

The Days of "Magic."

So we (wonderful how wireless "fiends" got together) progressed on through reflexes, unidynes, straights, etc., etc., to the days of the "Magic Three." And it was magic! In fact, three of the "Magics" we built are still going strong giving magic notes to their owners!

To-day, as I write, I am listening to my latest set, "Eckersley's National Three"—a marvel of the age. Everyone (many of whom have *good* sets) when they first hear it say "How plain the speech is," or "That is a *good* orchestra that's on." And I get almost any Continental station I try for.

When one hears people who have taken up radio in the last few years boasting of receiving such and such a station on their such and such a five or six valve super, we old-timers just smile and know that we could tell better ones than that—and not "fisherman's tales" either—of the days when a 5 kw. station was a powerful station, as most were just anything from ·5 to 1 kw.

For the pleasure I've had during the last 12 or 13 years I can only thank "P.W.," not forgetting Ariel's cheery notes.

I expect in another ten years or so we will be writing about our early experiences in television. It won't be "P.W.'s" fault, I know, if they are not just as happy and romantic as the radio ones were.

Yours truly, *Robt. C. Gallacher.*

Braefoot, Centenary Ave., Airdrie, Scotland.

[*This letter wins our Guinea Prize in accordance with the conditions given on this page.*]

"ROUND THE WORLD IN 10 HOURS."

SIR,—I have been a regular reader of "P.W." since 1926. My first set I built was a one-valve "Reflex," described in this paper quite a few years ago now. On this receiver I picked up 2 L O quite well on the loudspeaker. Then came my greatest thrill at that 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 a great deal about short waves and listening to America. I asked myself, "What are these short waves and listening to stations over 3,000 miles away?" I did not think much more about it until two friends of mine each built a 2-valve S.W. receiver; and I kept on hearing that they had got this station and that station. "Fancy listening to European stations every night; we listen to America."

Well, this about finished me, so, "unearthing" a pile of "P.W.s," I had a thorough search through them until I came to one describing a 3-valve S.W. receiver called the "H.A.C." I built this set and now, instead of listening to mere "locals," as they are called by "DX" listeners, it is quite a common thing for me to go "Round the World in 10 Hours."

Though it is quite an ordinary thing now for me to listen to Sydney, I still consider it to be my greatest thrill to listen to it broadcasting its early Monday morning programmes whilst I am enjoying my Sunday afternoon's rest.

Trusting "P.W." will keep up its high standard of interesting and instructive articles in the future as in the past.

Yours truly, *L. C. B. Blanchard.*

122, *St. Andrew's Road, Coulsdon, Surrey.*

ONE GUINEA FOR A LETTER!

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

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

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

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

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

AN AMUSING PHENOMENON.

SIR,—During the eight years of my wireless experience I have had some queer things happen to me, but none so amusing as the following:

A five-valve transportable belonging to a friend of mine had refused to function, so he brought it to me to doctor it. As the table was in use I placed it on top of my set cabinet, this being of ample size, and proceeded to find the fault.

This proved to be quite simple, so I turned the set round and switched on to long waves and tuned-in Daventry, which, to our astonishment, was enough to blow your hat off. I then tried the medium waves and found that it refused to work, and this puzzled me for a few moments. Then I pushed over the wave-change switch on my own set to short waves and, lo and behold, my friend's set worked again.

So I carried the set away from my own and the volume was halved, because it was without the aid of my 100-ft. 7/22 copper aerial and three-inch coil, which had been about three inches below it.

Yours truly,

W. S. Blunt.

18, *Freeman's Lane, Burbage, Nr. Hinckley, Leicestershire.*

A SHORT-WAVE ENTHUSIAST.

SIR,—I have read with interest the letters published, so 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-valve 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!

Then there was a wonderful occasion, months later, when I logged my first American station, W 1 X A Z, 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.'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,

G. W. Green.

17, *Jeffries 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.)

ON THE SHORT WAVES

THE SUPERHET

On this page W. L. S. discusses the use of the Superhet for short-wave reception 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 in 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. But I'm not going to admit that a small superhet, for really weak "DX" work on headphones, is any better than the simplest of two-valvers.

In Its Simplest Form.

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 controls can be ganged, a small trimmer being connected across the former. The I.F. may utilise a variable-mu 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 "clonks," 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.

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. Believe me, there's quite enough interference from unwanted signals without generating a lot more in the set itself. Then came the fashion of using a screened-grid detector with a separate triode oscillator, injecting either into the cathode or screen circuit. That wasn't too bad, since the oscillator *was* off-set sufficiently to distinguish between first and second channel positions. It usually oscillated much too violently, however; or, at any rate, we might say that far too much of its output was fed into the first detector.

Next was the heptode, which we thought perfect for a while. Mixing between the oscillator section and the incoming signal occurred purely in the electron stream, and the main disadvantage was that the same amount of oscillator power was used for weak and strong signals. Another was the strong "pull" that the tuning of the detector section had on the tuning of the oscillator, and it was this that led to the design of the triode-hexode.

In the case of this valve, the electrodes used for the oscillator are used as a separate triode, and are not all mixed up with the others. The grid is connected, inside the valve, to the third grid of the hexode, and the *first* grid of the latter is given the signal input.

FOR S.W. BROADCAST RECEPTION

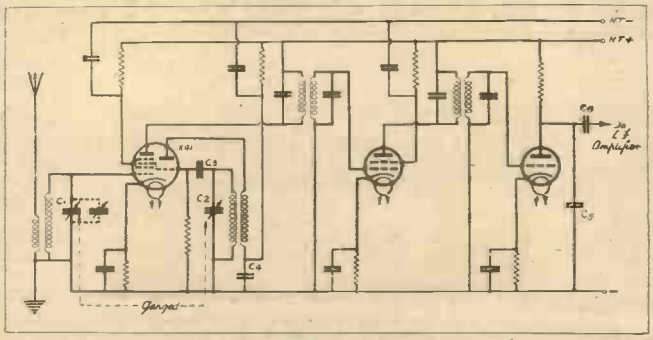


Fig. 1. Here is a typical short-wave superhet circuit using a triode-hexode frequency changer.

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!* 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 decoupling 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 of 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 the slightest need for an H.F. choke in its anode circuit, providing that a condenser from anode to earth 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 biggish 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 *two*, 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.

ON THE SHORT WAVES—Page 2

Points from the POST-BAG

L. J. (Potters Bar), and one or two other owners of the "Simplex" Two, have written and inquired upon my views concerning enlargement of the original set. Do I advise an H.F. stage or some more L.F. ? If so, how, and what with ? If these readers really want to enlarge the set, I strongly recommend the provision of a screened-grid H.F. stage. 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 Unemployed 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—mercly readers. They cannot afford to do or build.

Have You Any Old Components ?

"I am wondering whether there are any of your 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 would gratefully acknowledge any such gifts."

I am going to start the ball rolling by sending off a batch of old short-wave gear. Will readers please back me up and do the same ? The address to which it should be sent is "Maes-Yr-Haf" Educational Settlement, Trealaw, Rhondda, South Wales.

T. B. (Brighton) wants full particulars of the midget five-metre transmitter recently illustrated on these pages. I hope to give details of a still more up-to-date one very soon, T. B., but we can't spend too much space on transmitting gear in these columns.

D. W. (Barnes), who is a young newcomer to radio, built up the "Simplex" Two out of "a lot of junk." Using four-year-old valves and an indoor aerial. he is getting consistently good reception from America, and wants to know whether stations like W1XK and W2XAF value reception reports.

Candidly, D. W., I don't imagine that they have the least use for them. They are received so consistently all over the world that the answering of listeners' reports is now no more than a necessary evil for which a staff must be employed. But write to them, by all means, if you want to.

VP6YB on 20 Metres.

In the course of a terrific letter, J. M. S. (Truro) inquires about the call-sign of the Barbados station working phone on 20 metres. He is worried about not being able to hear India or South Africa. It is VP6YB, whose address was given recently in these notes. That's not much to worry about, J. M. S., they're difficult places to get unless conditions are just right. Thanks for the log and all the "dope."

Z. P. (Liverpool)—at least, it looks like a "Z"—comes out with a real brain-wave. Let four-pin coil enthusiasts purchase their shaving soap in bakelite cases, says he, and the more they shave the more coils will they be able to sport. Four-valve pins can be fixed into the base, and the "former" itself drills quite easily.

A Convenient Milled Edge.

The bases even have a nice milled edge that is easy to get hold of when one wants to remove the coil. This looks like a Heaven-sent gift for the short-wave enthusiast, and I only hope, by way of reward, that I haven't got Z. P.'s initials all wrong after all.

J. M. (Reading) wants to know my opinion 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 than the older types, and I don't suppose you would notice any loss of efficiency over the four-pin plug-in types.

H. J. P. (Hounslow) says kind things about the "Simplex" Two, and inquires

GOOD WORK!

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

when some nice manufacturer is going to produce some cheap formers suitable for "valve-base" coils, complete with drilled holes ! You can buy four- and six-pin formers now from several people, H. J. P.

G. R. (Peterborough) asks whether I prefer four-pin coils, with the aerial coupled on through a "neut," or six-pin coils with inductive coupling. Honestly, G. R. my answer is always "please yourself." With reference to the change from transformer to R.C. coupling, I really think the reduction in background noise is greater than that in signal-strength.

WHAT 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 into the autumn—season of dark evenings and early fade-outs.

Make the best of the shorter wavebands while they are good ; 16 metres fades out quite early nowadays, 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 reception 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 away up to 25 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 be.

W2XAD (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 long time, you can plot some beautiful curves on W2XAD from 4.30 p.m. until 9 p.m. or after. A series of these, showing how much earlier the fade-out is each Sunday, makes interesting data.

South Americans Easy to Receive.

VK3LR (Melbourne) continues to come in well on the 31-metre band on week-day mornings. VK2ME's two Sunday transmissions (morning and afternoon) are both still very good.

If you want South Africa you must listen for Nairobi and Johannesburg during the early evenings on the 49-metre band. For India, almost your only hope is Bombay, VUB, in the 31-metre band on Sunday afternoons.

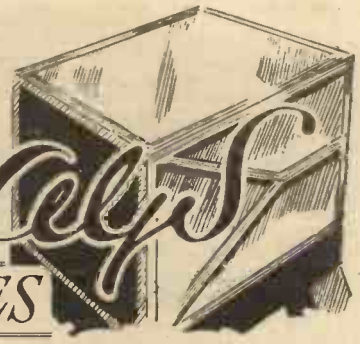
South America is *too* easy—the 49-metre band is full of it every evening. Incidentally, the South American amateurs are extremely good on 20 metres, and quite a number of them are on telephony.

The 40-metre amateur band is interesting 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. S.

SOAP BOX Days



By L. STANTON-JEFFERIES

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 I have previously stated, in those transitional "wireless concert" days, everyone was experimenting and endeavouring to get matters in order for the great day when the Broadcasting Company would be formed and we should be given the word to go ahead.

In Manchester there was Kenneth A. Wright (now a valued member of the Music Department in London), attached to Metropolitan-Vickers Electrical Company, also experimenting on the same lines.

Eventually the great day dawned and the British Broadcasting Company was formed, to supply a broadcasting service for a period of two years, the necessary financial backing being guaranteed by the six leading wireless firms of the country. The first actual date that "Broadcasting" (as distinct from "Wireless Concerts") took place was November 14th, 1922, when the election results were transmitted.

"Fun Started in Real Earnest."

Now the fun started in real earnest. I was appointed London Station Director, though naturally my leanings were towards the musical side of our activities. I think I revelled in this title for a matter of a week or so when Rex Palmer was appointed in this capacity to relieve me of work other than musical, and I became Musical Director. "Uncle Rex's" voice was already familiar to many wireless fans, as he had sung at many of my concerts as Rex Faithful.

I had also heard rumours to the effect that there were *other* members in the company at offices in Kingsway, and such names as Reith, Lewis and Anderson were mentioned, but living in such splendid isolation at Marconi House and with a three-hour programme to arrange daily, it was impossible to get in personal contact, nor did they have time to worry me other than on routine matters.

"My Name is Reith."

I shall never forget a certain evening on which a "celebrity" was broadcasting. I think that he must have been one of the first of this ilk, because the "Press" were there in bundles of ten. Burrows was announcing and we invited most of the gentlemen of the Press into the small studio only to find that there wasn't room for the poor speaker to stand, much less speak—or even breathe after a few minutes.

I suggested to Burrows that I should clear the studio to ease the situation, and was as hospitable as possible. Poor fellows, sitting on the only seats available, viz., two long but very hard wooden forms which were just outside the studio!

I asked our friends respectively which journals they represented, and was about to return to the studio when someone else arrived—a tall stranger. I sat him on the form—there was now plenty of room, as the majority of the others were standing, in preference to sitting on my luxury seats.

I came out eventually, to ask my tall stranger to which paper he belonged—and was, to say the least of it, astonished and shocked when he replied, "Oh, don't worry about me; my name is Reith!" And I had refused him admission to his own studio (such as it was in those days) and sat him on the hardest of seats (such as they were in those days)! Yet, I don't think he bore me any malice.

SINGING AT 2LO

"The Prime Minister of Mirth," George Robey, broadcasting with one of the early "hand" microphones in the London station.

How lucky the B.B.C. has been in its chief. A man of great character, possessing the highest ideals for the cause of broadcasting. His policy to give the public what it *should* like is a sound one. Many do not realise how much he influences the policy and direction of programmes. On one point alone he has remained adamant, that is, the character of the Sunday programmes, and it is his steadfast adherence to ideals that has made British broadcasting perhaps the finest in the world.

As Musical Director, I had not only to look after the musical activities of the London station, but also direct for the provinces. Manchester and Birmingham began operations about the same time as London, and other stations were in the course of construction.

Pianos, orchestral music, instruments, artists, etc., all had to be supplied. It doesn't sound a great task, but when one had to hold auditions, rehearse an orchestra in the morning for a performance at night, together with the usual routine of the office to cope with as well, life was hectic, to say the least of it. Cecil Lewis and I often looked at each other in despair, wondering how long we could hold out.

The Daily Programmes.

In the early days of official broadcasting programmes were issued the previous evening. Newspapers sent their representatives to collect copies at Marconi House, as it was practically impossible to get farther ahead with programme details. By a superhuman effort, however, we managed to get three days ahead, and felt very proud of the attempt. It is interesting to note that the "Radio Times" goes to press a matter of three weeks before publication nowadays.

At first the newspapers were only too willing to print the daily broadcast programmes; but, owing to a change in policy, this was stopped. A well-known firm offered its advertising column in the "Pall Mall" evening paper [now ceased publication] for this purpose, and consequently on the first evening this paper was sold out in record time. I think that this state of affairs lasted for two or three days, and as obviously such a situation could not be allowed to continue by the other newspapers. They looked upon wireless programmes as news again, and published them, so peace reigned once more.

Trouble With Entertainment World.

Looking back, it seems extraordinary that there could have been so much opposition from the entertainment world regarding the "new idea."

In some ways it was the fault of the B.B.C. Not knowing how much money there would be available for programme expenditure (as the actual amount was, of course, dependent on the number of licences taken out), it was decided for the time being to offer artists a flat rate of one guinea.

One talked very grandly about the extensive publicity that the B.B.C. offered, but that was cold comfort to those agents and concert givers who were paying many times more than this amount for the same

(*Continued on page* 126.)

MECHANICAL OSCILLATORS

The fact that a metal rod can be made to vibrate extremely rapidly is of great practical and commercial importance. Under-water signalling, measuring the depth of the sea, and the destruction of bacteria are among the uses to which this discovery has been put. A description of how this fascinating phenomenon occurs is given below by CARDEN SHEILS.

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 stabilise 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.

CHANGES IN LENGTH

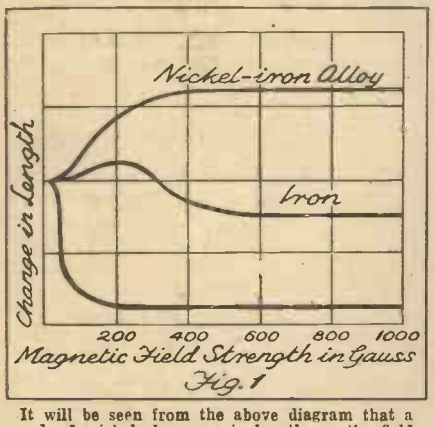


Fig. 1

It will be seen from the above diagram that a rod of nickel decreases in length as the field strength increases (bottom curve). On the other hand, nickel-iron does exactly the reverse, and pure iron (middle curve) first expands and then contracts.

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 stabilising 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 1860, 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

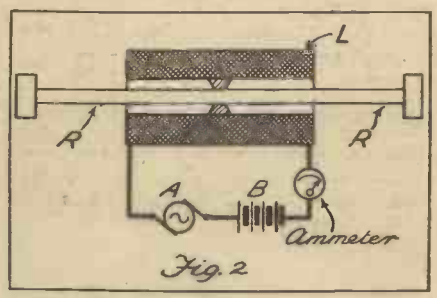


Fig. 2

The rod R can be made to oscillate violently, at frequencies ranging from 100 to 10,000 cycles per second.

* * *

Vibrations of the rod R in Fig. 3 (below) produce intensive agitation of the contents of the flask F. In this way bacteria, and other forms of life, can be killed.

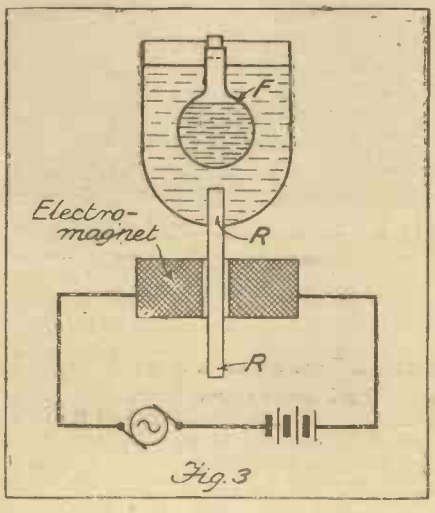


Fig. 3

Within the last few years magnetostriction has been the subject of intensive study, and we now know that the physical length of most magnetic metals and their alloys changes with the strength of the magnetising current.

Fig. 1, for instance, shows that a rod of nickel decreases in length as the field increases, whilst a rod of nickel-iron alloy does exactly the opposite. Pure iron, on the other hand, at first expands and then contracts. The extent of the change is very small—at most only 4 or 5 parts in 100,000—but it is sufficient to produce striking results.

CARRIER-WAVE "CONTROL"

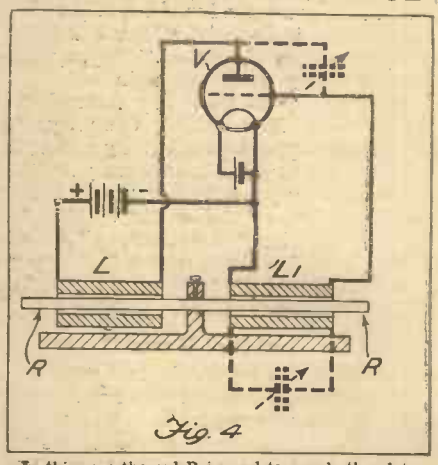


Fig. 4

In this case the rod R is used to couple the plate and grid coils of a valve generator, and this serves as a carrier-wave "control" for broadcast transmission.

Fig. 2 shows a rod 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.)

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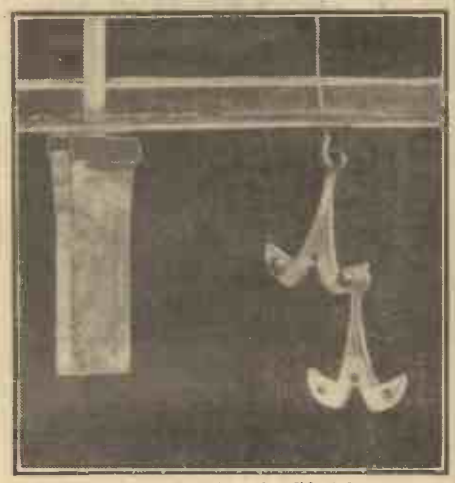
SENDING SOLIDS BY RADIO

The possibility of transmitting substances by radio by de-materialising them and rebuilding 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 transmitter. Nikola Tesla, the famous American pioneer of wireless,

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.

once succeeded in transmitting by radio sufficient energy to light up a lamp at a distance of two or three miles from the transmitting apparatus. Such transmissions, however, were purely experimental ones and were of little practical consequence.

The continued advance of radio science, 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—who 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 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 infantile, if not to say embryo, 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 "radio-ised" 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-materialising 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 can, therefore, have no hopes 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 IMPROVISED BATTERY

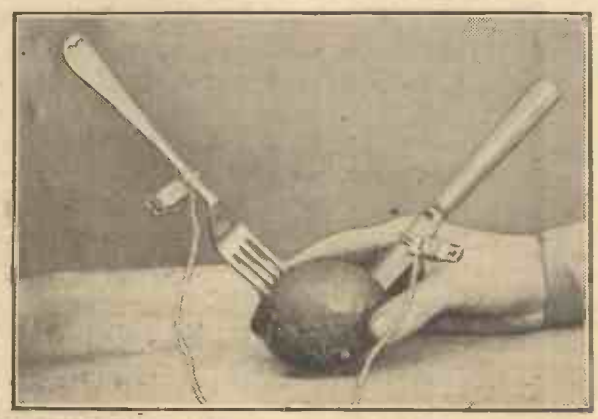
HAVE you ever been held up in your radio or electrical-testing work for want of a suitable small battery? The situation when it occurs is an annoying one, particularly when the testing work in hand is such that the smallest current supply would suffice for it.

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 the 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



A "lemon battery" is quite efficient for delicate testing work.

SINGLE SIDE-BAND TUNING

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

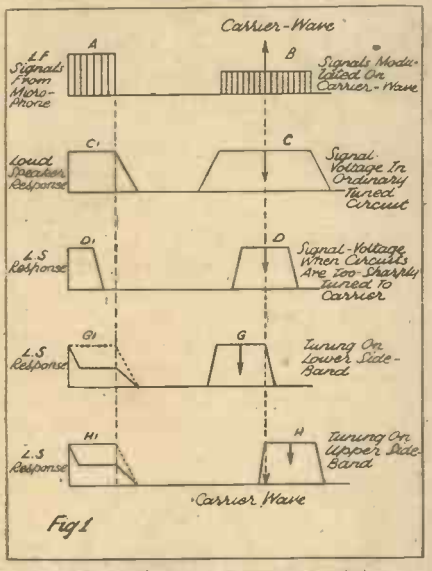
By SEXTON O'CONNOR

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

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.

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 flash-lamp, 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 rules out any 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—A represents the normal width of the signal frequencies as they leave the microphone, whilst B represents the corresponding side-bands after they have been modulated on to a carrier-wave. The energy of the L.F. signals remains the same, so that although they occupy twice the frequency band, their amplitude is halved.

C shows the corresponding signal voltage developed in the tuned circuits of the ordinary type of receiver. There is a "gain" in the amplitude of the signals, but only the middle part of the curve shows a straight-line response. The slope to both the edges shows a certain amount of cut-off on the higher notes. C1 represents the corresponding quality of the loudspeaker output. It covers practically the whole width of the original frequency band shown at A.

D shows the state of affairs when a "razor-edge" circuit is tuned dead on to the carrier-wave so that it covers only a part of both side-bands. The corresponding response in the loudspeaker will, as shown at D1, reproduce only the lower notes, most of the higher notes being lost.

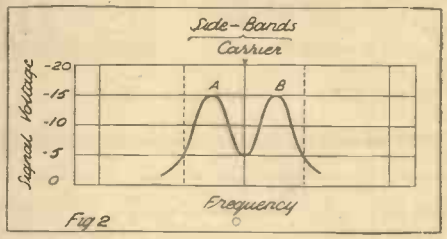
An "Off-tune" Effect.

G and H show the effect of tuning-in to the lower and upper side-bands respectively. The corresponding response G1, H1 in the loudspeaker covers the whole width of the original frequency-band A, though there is a reduction in the relative amplitude of the high notes to the low.

The important fact is that all the notes are present. It is therefore a simple matter in the new receiver to insert a resistance-capacity tone-compensator in the L.F. amplifier-valve, which boosts up the high notes, as shown by the dotted lines in G1, H1, so as to restore the loudspeaker response to the balanced form shown at C1.

The circuit arrangement used to compel the listener to tune-in either to position G or H is too complicated to be shown in detail. It depends, however, upon the action of a tuned "trap" circuit having a

USING A "TRAP" CIRCUIT



The arrangement used to provide "automatic" tuning depends upon a tuned "trap" circuit having a response curve similar to that shown above.

frequency-response curve of the form shown in Fig. 2. This is used in combination with the A.V.C. to apply a paralysing bias to one of the intermediate-frequency amplifiers, which keeps the loudspeaker "silent" until the tuning control reaches one or other of the two critical positions A B. At either point the paralysing bias is removed and the tone-compensator brought into action. Simultaneously a lamp lights up to show the listener that the setting is correct.

A WIRELESS ANNUAL

DURING the last few weeks you will have seen on the bookstalls the new "Chronicle Wireless Annual." And in case this should be as far as your knowledge of the book might go, I propose to tell you a little about what you would have missed.

To start with, as you will have seen from the cover, there are the special television and short-wave sections. There are six long articles in the short-wave section, and these include four constructional items, one of which is an ultra-short-wave set.

The articles on television deal with cathode-ray tubes and high-definition work. They will give you a useful insight into modern aspects of the science of television.

And now to deal with the main body of the book. This includes other constructional articles, and there are many features of a general nature which make the book extremely valuable to every enthusiast.

Typical titles of the general articles are: "The O.B. Engineer at Work," "When the Set Goes Wrong," "Regional Talent 'Spotters,'" and "Aerial Mast Erection."

Printed on a special insert are easy-to-follow wiring diagrams to aid in the construction of sets described in the Annual, which, at the price of One Shilling, is excellent value for money.

A. S. C.

The 1936 "Ferro-Power"

Designed and Described By K. D. ROGERS.

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

AS I write this the haunting strains of "Marta," sung by the Street Singer, are dying away, to give place to "Baffles." The set I am listening to is the 1936 "Ferro-Power" and the speaker the W.B. "Stentorian," E.M./W.

I have been giving it a good try-out, setting the trimmers and tuning scale so that the wavelength readings are correct, and have just returned to listen to the local.

But before we go into the matter of trimming, and so forth, there are many points of construction to consider.

Built in Two Sections.

As you will have seen, the set is built in two sections. The radio portion is on a chassis made from a sheet of "Plymax" and two plywood runners. The power pack is on a plain "Metaplex" baseboard.

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.

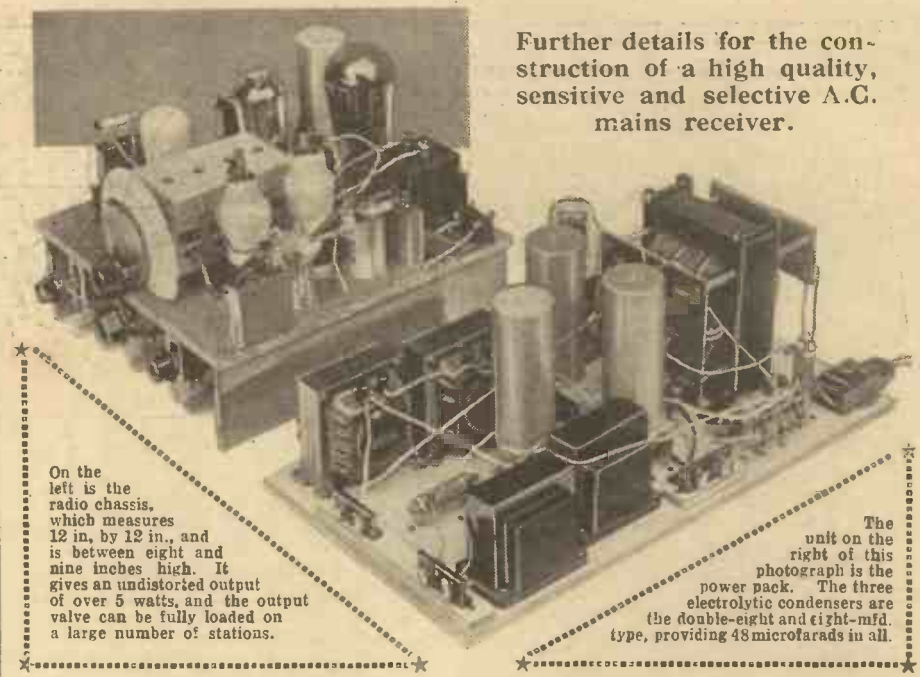
The scale of the variable condenser should be cut across the corners, otherwise these will foul the baseboard. The drive should be fitted to the condenser before it is mounted on the baseboard, otherwise difficulty in affixing it may be experienced.

An Important Point.

It should be noted that the left-hand runner, looking from the front of the set, is placed about three-quarters of an inch in from the edge. This is to allow the screened cable of the pick-up lead to be taken from front to rear of the set completely free from the rest of the set. As the shield of the cable is earthed every precaution must be taken to prevent it coming into contact with any but earthed points, and to "wall it off" from the rest of the set is the best way, especially as that section of the receiver is pretty full with grid and anode circuit components, of the L.F. valves, including unprotected wire-wound resistances.

On first glance at the wiring diagram of the underside of the chassis it appears that quite a number of connections are made by screws to the metallising. This is true, but the connections (marked M.B.) are not connected to metallising *under* the baseboard. No metal covering is there. They are taken by means of round-headed bolts and square washers to the metal surface

(*Continued on next page.*)



On the left is the radio chassis, which measures 12 in. by 12 in., and is between eight and nine inches high. It gives an undistorted output of over 5 watts, and the output valve can be fully loaded on a large number of stations.

The unit on the right of this photograph is the power pack. The three electrolytic condensers are the double-eight and eight-mfd. type, providing 48 microfarads in all.

VALVES AND LOUDSPEAKER

V1 & V2	Cossor	M.V.S. Pen.
V3	Cossor	41 M.H.L. (Met.)
V4	Cossor	41 M.P.
V5	Marconi or Osram	P.X.25
Rectifier	Marconi or Osram	M.U.14

LOUDSPEAKER:
W.B. "Stentorian," type E.M./W. With 1,000 ohms field winding.

THE PARTS THAT ARE USED FOR THE RADIO CHASSIS

1 Set Colvern "Ferrocart" coils, types G. 10, 11, 12, 14.
1 Polar "Midget" four-gang tuning-condenser.
1 Polar Semi-circular drive for above.
2 Bulgin 7-pin chassis-mounting valve holders, type S.W.42.
3 "Clix" 5-pin chassis-mounting valve holders, with soldering tags.
1 Bulgin 5,000-ohm wire-wound volume-control, type V.C.29.
1 Erie 50,000-ohm graded volume-control.
1 Varley 1,000-ohm power potentiometer, type C.P.59.
3 Bulgin H.F. chokes, type H.F.10.
2 Wearite H.F. chokes (one H.F.P. and one H.F.P.A.).
1 Dubilier double 8 and 8 mfd. electrolytic condenser, type 9203E.
1 T.C.C. 80-mfd. electrolytic condenser, type 541.
2 T.C.C. 50-mfd. electrolytic condensers, type 521.
4 T.M.C.-Hydra 1-mfd. condensers, type 30.
2 T.M.C.-Hydra 1-mfd. tubular condensers.
1 T.M.C.-Hydra ·0005-mfd. tubular condenser.
4 T.M.C.-Hydra ·0001-mfd. tubular condensers.
1 Dubilier ·0001-mfd. condenser, type 665.
2 T.M.C.-Hydra ·25-mfd. condensers, type 30.
2 Erie 250-ohm 1-watt resistances.
1 Erie 750-ohm 1-watt resistance.
1 Erie 300-ohm 1-watt resistance.
4 Erie 5,000-ohm 1-watt resistances.
1 Erie 10,000-ohm 1-watt resistance.
1 Erie 25,000-ohm 1-watt resistance.
1 Erie 75,000-ohm 1-watt resistance.
1 Erie 100,000-ohm 1-watt resistance.
1 Erie 150,000-ohm 1-watt resistance.
1 Erie 250,000-ohm 1-watt resistance.
1 Bulgin 5,000-ohm power resistance, type P.R.9.
1 Bulgin 7,500-ohm power resistance, P.R.10.
1 Bulgin 23,000-ohm power resistance, P.R.13.
1 Bulgin 75,000-ohm power resistance, P.R.17.
1 E.T.S. 50-ohm baseboard-mounting potentiometer.
7 Graham Farish "Pop" terminal blocks.
2 Peto-Scott component mounting-brackets, type 22/1.
1 "Plymax" baseboard, 12 in. x 12 in., with 3½ in. wood runners.
Brass bolts and nuts, screws, flex, shielded flex, etc.
3 coils B.R.G. "Quikon" wire.

THE 1936 "FERRO-POWER"

(Continued from previous page.)

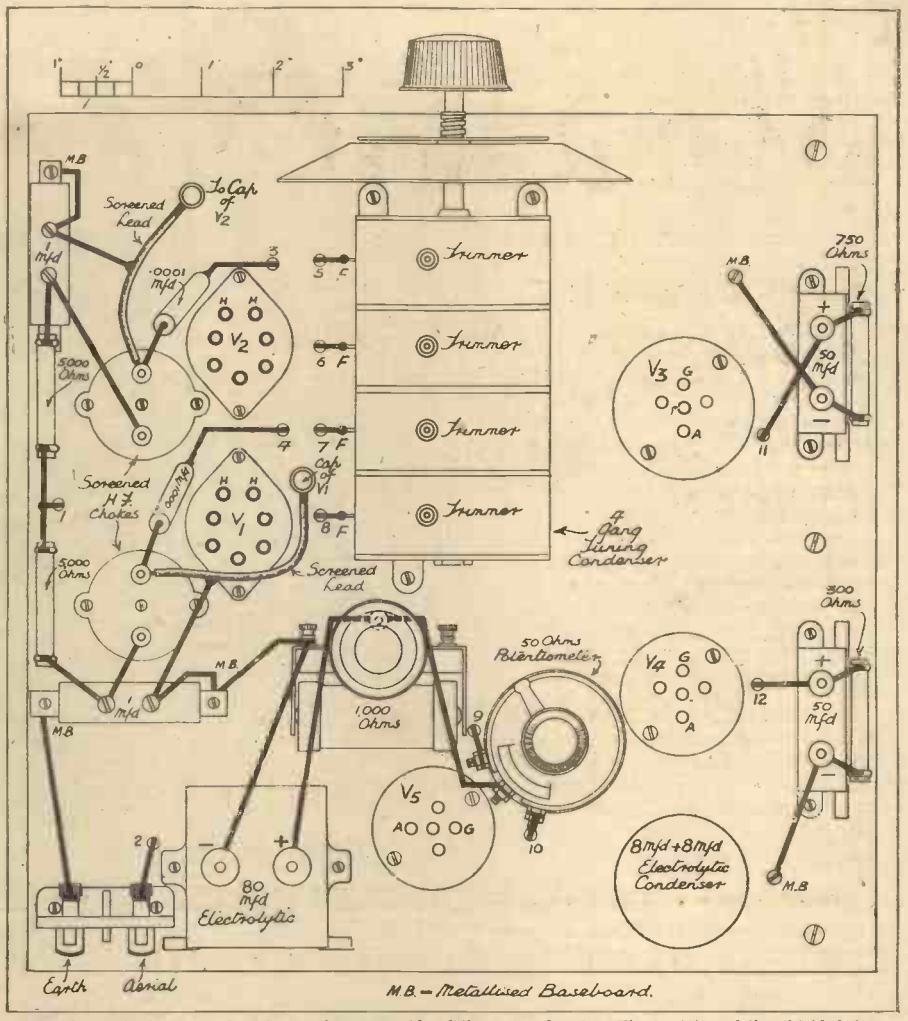
on the upper side of the "Plymax" baseboard.

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

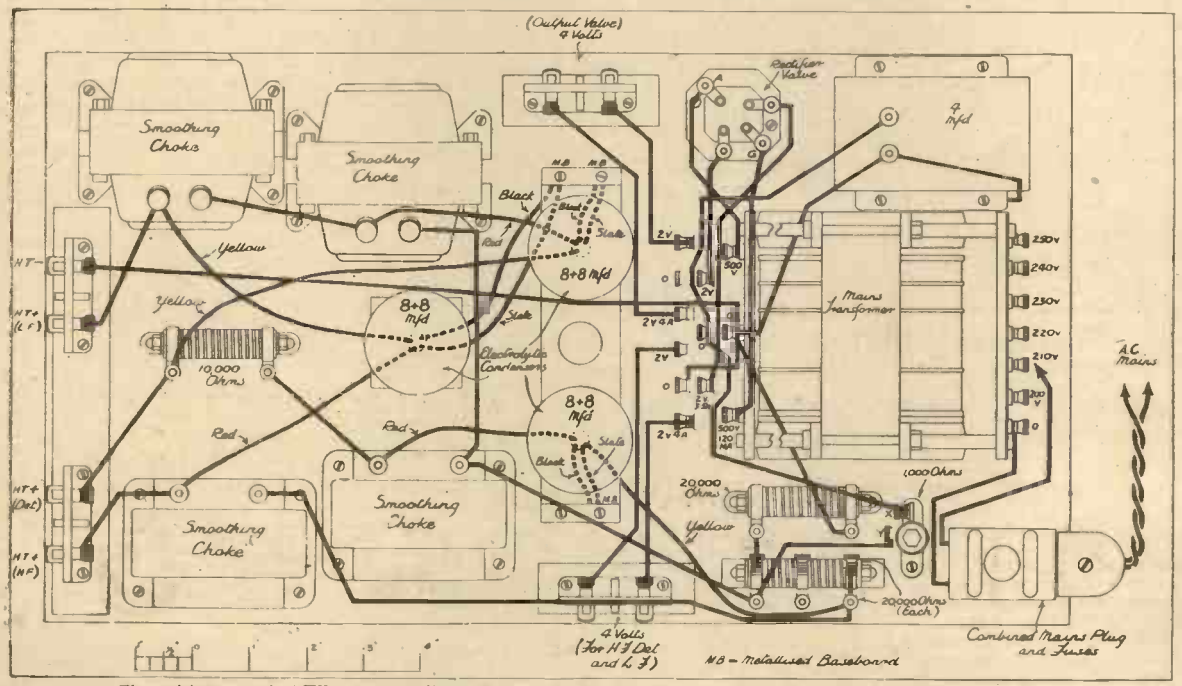
The W.B. "Stentorian" type EM/W recommended for use with the 1936 "Ferro-Power." It should have a 1,000-ohm field, and the ratio used on the transformer is 20:1.

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.



This shows the layout and wiring on the upper side of the radio chassis. The braiding of the shielded flex connecting the anodes of V_1 and V_2 should be bound at the ends with insulating tape after the shielding has been slipped back a little.

THE WIRING OF THE A.C. POWER PACK



The resistance marked XY is removed if the W.B. speaker is used, the field of the speaker being connected in its place.

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

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output valve, there is a voltage of 400 on the anode, and this should not be too close to the earthed metal.

There is one high-voltage electrolytic condenser—a double eight mfd.—in the radio portion of the set. This is mounted on the chassis and the under surface is cut away to form a recess for the fixing nut. The case of the condenser is automatically earthed by being in contact with the metal of the chassis. The leads from the condenser are red, yellow (positive) and black and slate (negative). So we have in the one condenser two eight mfd., 500 v. working electrolytics. They are used as shown for decoupling, both the slate and the black leads being connected to earth.

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 ·0005 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_2 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_1.

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.14. 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_2, the coil and the grid condenser of V_3.

Switching-on The Set.

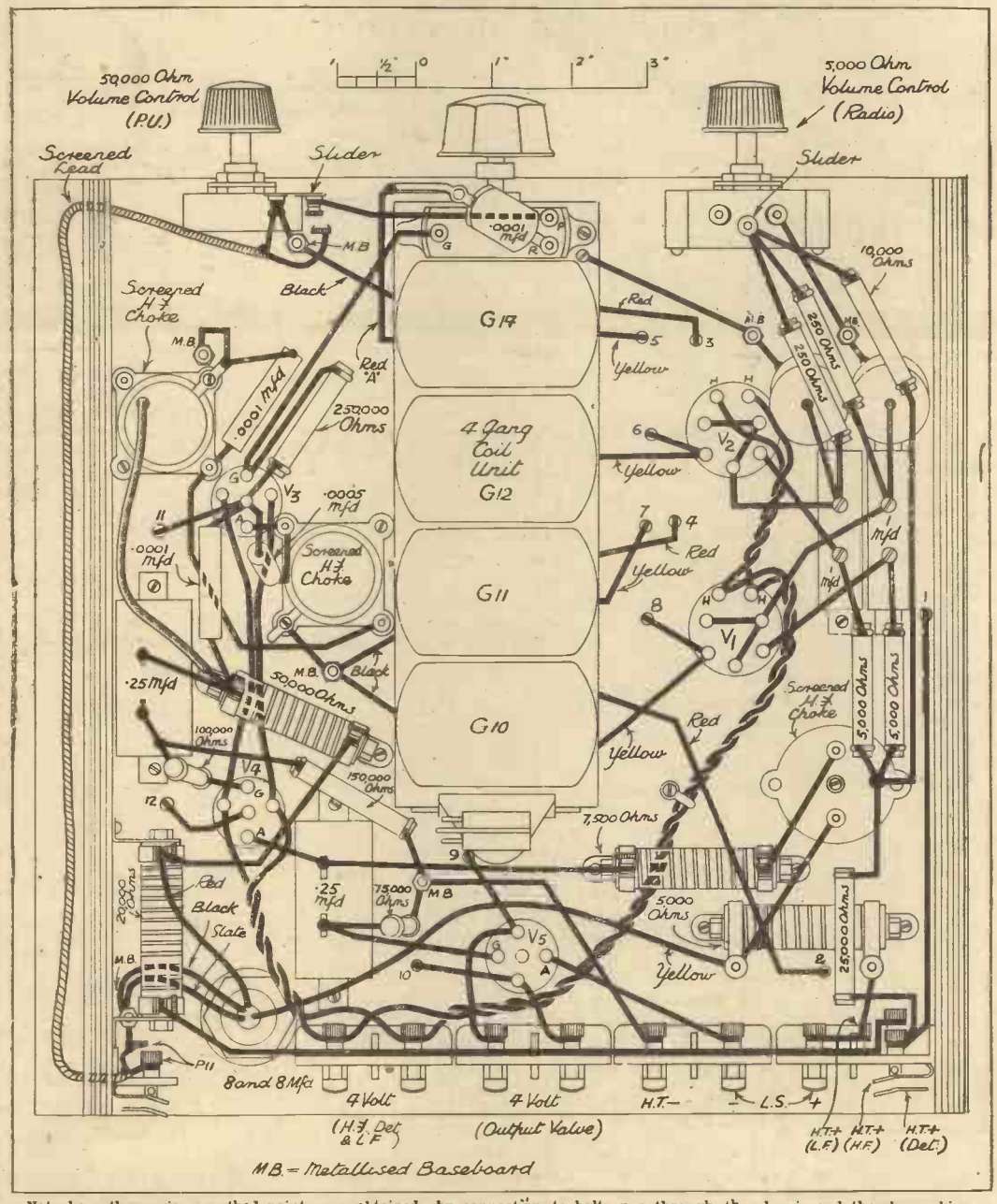
The main switch on the coil unit I have not used. I always prefer to switch the set on and off by the wall-plug switch, rather than to run even shielded mains leads into a sensitive receiver. Those who want to use the switch on the coil can do so, however. I have the set fitted into a radiogram cabinet, with speaker and power pack below, and to 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 50-ohm potentiometer right home through the spindle hole. If you do it will touch the baseboard and short-circuit the grid bias of V_5. Points concerning the power pack and operation of the set I shall leave till next week, when final details will be given.

THE COMPONENTS FOR THE H.T. AND L.T. SUPPLY

1 Varley power transformer, type E.P.38.
3 Dubilier double-electrolytic condensers, 8 and 8, type 9203E.
2 Wearite L.F. chokes, type H.T.410.
2 Ferranti L.F. chokes, type B.10
1 T.M.C.-Hydra 4-mfd. condenser, type 75.
1 Bulgin 1,000-ohm power resistance, type V.P.R.5.
1 Bulgin 20,000-ohm power resistance, type P.R.13.
1 Bulgin 20,000-ohm power-potential divider, type P.D. 6.
1 Bulgin 10,000-ohm power resistance, type P.R.11.
1 Bulgin combined mains plug and fuses, type F.18.
1 Bulgin socket for above, type P.29.
1 Bulgin 5-pin "Steatite" valve holder.
1 Peto-Scott triple-electrolytic condenser bracket.
1 Peto-Scott single-electrolytic condenser bracket.
4 Graham Farish "Pop" terminal blocks.
1 "Metaplex" baseboard, 18 in. × 10 in.
1 Coil B.R.G. "Quikon" connecting wire.
Screws, flex, etc.

UNDERNEATH THE RADIO CHASSIS



Note how the various earthed points are obtained—by connection to bolts run through the chassis and thereby making contact with the "Plymax" metal sheet on the upper surface. The pick-up lead is shielded and the shield is earthed at each end.

INCREASING Your Volume

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

INSERTING A PENTODE

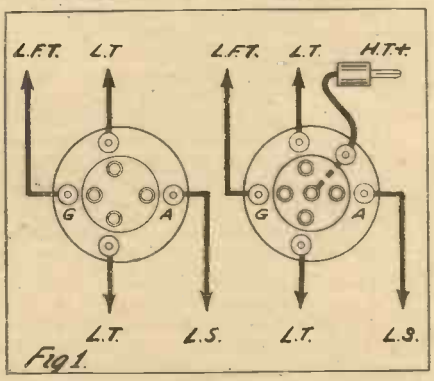


Fig 1.

On the left are shown the connections to a four-pin valve holder when a triode valve is used; on the right the additional connection for a five-pin pentode valve is indicated.

take a lead from the centre pin (terminal between the anode and filament terminals) to a tapping on the H.T. battery, or even to the main H.T. positive terminal. This alteration applies, of course, to a five-pin pentode only, and when one of the older type pentodes, with side terminal, is employed, the four-pin holder may still be employed, a flexible lead merely being taken 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 which feeds the output valve is replaced by one of higher ratio.

PUTTING UP THE RATIO

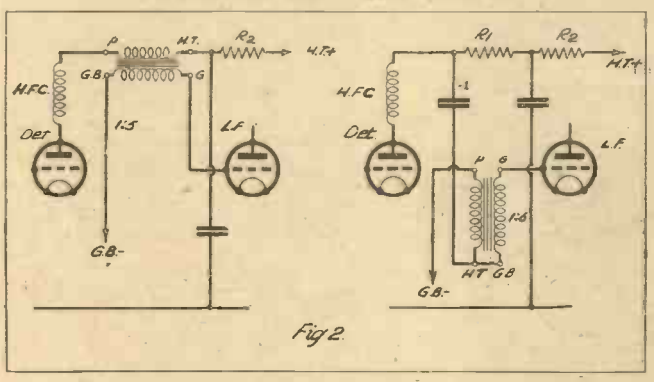


Fig 2.

The effective step-up ratio of an L.F. transformer can be increased by modifying the usual connections shown here on the left, to those shown on the right. R1 and R2 are the coupling and decoupling resistances.

The simplest method is to remove the existing transformer, which will probably have a ratio of about 1 : 3, and use in its place another which gives a higher step-up ratio. It is important, however, that the new high-ratio transformer should be of the best possible quality, for otherwise distortion is almost sure to be introduced. One excellent transformer for the job is the Ferranti, type AF6.

The Auto-Coupled Transformer.

It is quite possible in many cases to increase the effective step-up ratio without going to the expense of a new transformer, the method being as shown in Fig. 2. It will be seen here that the 1 : 5 transformer connections are changed from the "direct" ones to those known as "resistance-feed." A new fixed resistance and a ·1-mfd. fixed condenser are required for this purpose. The resistance carries the anode current to the detector valve, the transformer windings handling only the audio-frequency currents. 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 valve 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 30,000 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.

(*Continued on page* 125.)

PUSH-PULL

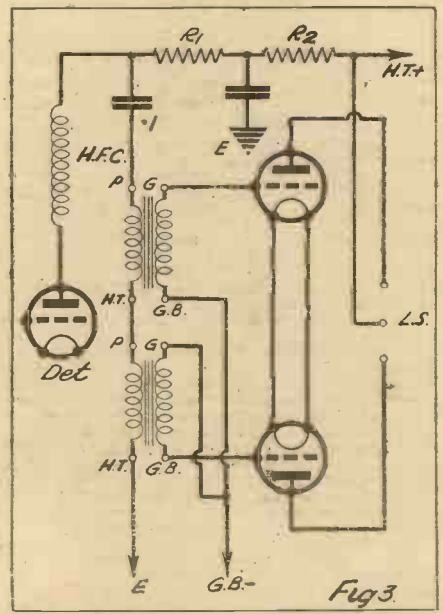


Fig 3.

This circuit shows how two ordinary L.F. transformers of similar type can be used in a resistance-feed push-pull circuit. Note especially the transformer terminal connections.

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

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

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

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

QUESTIONS AND ANSWERS

CURING BREAKTHROUGH.

C. C. Y. (Coventry).—"I could not get the back number describing Mr. Scott-Taggart's experiences with 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 I have come across, improper operation and or improper trimming adjustment is at the root of the trouble. I did not find breakthrough on my original tours, and now that I have specially looked for it I find that Luxembourg and Kalundborg (which is lower on the dial than Luxembourg) are obtainable certainly up to nine miles of North Regional (the worst district for breakthrough) without breakthrough.

"The breakthrough below Oslo is of no consequence, but I mention this because even a trace of breakthrough there has worried a few readers and made them suspect their coils. There is one thing to remember: The S.T.600 is dozens of times as sensitive as most other sets, and so any breakthrough will be enormously magnified, but this only matters if the set is wrong.

"Practically every case of breakthrough is due to something else wrong. For example, if you are misganged, Luxembourg will be greatly weakened, and perhaps not even be obtained. But misganging does not weaken breakthrough, as the wavelength of the breakthrough is vastly different, anyway. The result is that the breakthrough is, perhaps, ten times as strong as Luxembourg, whereas Luxembourg should be more than ten times as strong as breakthrough.

"As soon as you trim correctly on the rear trimmer Luxembourg drowns all traces of breakthrough. If, of course, your set cannot be trimmed, due to radically incorrect components, you will be unable to avoid breakthrough on Luxembourg.

ANOTHER LIKELY CAUSE.

"Another cause of breakthrough is improper anode reaction. On the S.T.600 reaction is always advised for selectivity. Reaction greatly brings up the desired station, but leaves any breakthrough at its former strength.

"By reducing the aerial coupler and volume control and bringing up reaction you can cut out the breakthrough completely. This is the ordinary proper way to operate the S.T.600 on any station, but it is essential if you are experiencing breakthrough. I have found that it is better to reduce the volume control than to reduce the aerial coupler too much.

"The fact that with plenty of aerial coupler and plenty of volume control you can get loud breakthrough does not mean a thing. Those are not the conditions under which you will operate the receiver, and so anything that happens then does not matter.

"The remedies for cutting out breakthrough certainly involve reducing the volume of Luxembourg and other stations at the lower end of the scale. They also involve more careful tuning. Both can be avoided by using a breakthrough choke, which is simply a suitable inductance coil connected in the aerial lead. You can connect this coil next to the aerial terminal outside the set.

"The aerial lead is connected to one terminal of the breakthrough choke, while the other terminal of the breakthrough choke is connected to the aerial terminal of the set. It is essential to use it only when working on the long-wave band. When you switch over to the medium waves you should short-circuit the breakthrough choke.

"I tried twenty-three chokes at Manchester, Rochdale and Bradford, and found the best of all anti-breakthrough coils was an S.T.300 or S.T.400 or S.T.500 coil (either aerial or anode type in each case). You use the whole coil—that is, the medium-wave winding in series with the long-wave winding. This means you ignore all other terminals and connect the aerial to terminal No. 1, and connect terminal No. 6 to the aerial terminal on the S.T.600 in the case of an anode coil; with an aerial coil you use terminals Nos. 2 and 5.

"Probably any tuning coil used in a wireless receiver would work well. It would be well worth trying any disused tuning coil.

"The next best choke was the Lissen Anti-breakthrough choke (Type L.N.5145), which is far more compact and gives excellent results, and which is now sold at 2s. 6d. Other chokes were a failure.

FIXING THE CHOKE.

"Some caution is needed if the breakthrough choke is inserted in the set as a permanency. It should not be too close to other components or wiring, e.g., too near the extractor condenser. Moreover, the aerial lead should be able to go direct to the choke and not have to go near the extractor condenser.

"I suggest a good place for the Lissen choke would be on the baseboard next to the terminal strip and below H.T.+1 and H.T.+2 terminals. The aerial terminal would be shifted to below the two H.T. terminals mentioned. The wire from the aerial coupler would be shifted and connected to one side of the breakthrough choke, the other side of the breakthrough choke being connected to the newly positioned aerial terminal. A two-point switch could be mounted on the terminal strip to short-circuit the choke when medium waves are received. This switch needs to be of low capacity.

"With the tuning coil or anti-breakthrough choke, which should always be first tried outside the set as suggested, you can have faulty trimming, faulty reaction and faulty operation, and you will still get Luxembourg! So there is a good deal to be said for recommending the choke wherever in the country there is any breakthrough."

ALTERING THE RATIO OF THE L.F. TRANSFORMER.

G. R. (Horsebridge, Sussex).—"As I understand it, if the L.F. transformer, ratio 1 : 3, is connected with the primary in the detector's anode circuit, the voltages produced across the secondary will be three times as great as those across the primary. But if the transformer is resistance-fed, through a large fixed condenser (parallel feed), the voltage step-up applied to the next valve will depend on how the transformer terminals are connected, and the ratio will not necessarily be 1 : 3.

"Please explain how different ratios can be obtained in this way."

The reason that different ratios can be obtained is that, by varying the connections, the effect of altering the electrical alignment of one winding to the other can be obtained; and since this alignment has to be pre-arranged to give a 1 : 3 ratio, a rearrangement of it will give a different ratio.

The important distinction to bear in mind when comparing such parallel-fed arrangements with the normal use of an L.F. transformer is this: The parallel-feeding allows you to use *both* windings in the grid circuit, where they may be combined to act as one winding, or separated to act as two windings either (*a*) assisting one another; or (*b*) opposing one another.

For a 1 : 3 transformer, the respective parallel-feed arrangements would give the following ratios. Windings combined to act as one winding gives no step-up effect, so is equivalent to a ratio 1 : 1. Windings separated, in opposition, ratio 1 : 2. Windings separated, and assisting one another, ratio 1 : 4. In regard to this the article on page 123 will interest you.

REPLACEMENT OF APPARATUS WHEN CHANGING FROM D.C. TO A.C. MAINS.

W. B. (Scotland).—"I have been notified by the chief engineer that the system of supply in this district will shortly be changed over from D.C. to A.C. He suggests I accept an eliminator combined with trickle charger valued at £2 2s. 6d. at the reduced price of £1 6s. 0d., at the same time he taking possession of my present eliminator which cost me £2 12s. 6d. three years ago, and has given me every satisfaction. Before considering his suggestion further I should like your advice.

"Am I in order to refuse paying this sum as I am led to believe he should replace same?"

As the subject of the liability of authorised electricity undertakers for the alteration or replacement of consumers' apparatus affected by an alteration in the system and pressure of the supply is one of general interest, we took up the matter with the Electricity Commissioners.

In his reply the secretary of the Electricity Commissioners stated: "I am directed by the Electricity Commissioners to state that under the Regulations made under the Electricity (Supply) Acts, 1882 to 1935, for securing the safety of the public and for ensuring a proper and sufficient supply of electrical energy, it is necessary for authorised undertakers to obtain consent to any alteration of the system and pressure of the supply declared to consumers. Generally the Commissioners are the consenting authority, but in most cases of company undertakings operating under powers granted prior to 1920, the local authority is the consenting authority, and in the case of undertakings in the Administrative County of London, the London County Council is the consenting authority. Under the Electricity Supply Regulations 1934, however, which now apply to all supplies given on or after 15th January, 1934, and in due course will apply generally to all supplies, the Commissioners will become the sole consenting authority.

"In those cases where the Commissioners are the consenting authority they attach to their consent certain conditions, a copy of which is enclosed herewith. It will be observed that these conditions provide for reference to arbitration in certain cases of dispute between consumers and the undertaker in connection with the alteration or replacement of apparatus.

"I am to point out that in those cases where the local authority are the consenting authority the local authority may attach to their consent such conditions, if any, as they consider necessary."

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 consumers' existing apparatus to suit the altered system and pressure of the supply, or pay to each consumer injuriously affected by the alteration of system and pressure such sum as may be agreed upon, or, in default of agreement, as may be determined by an Arbitrator to be appointed on the application of either party by the Minister of Transport as the reasonable cost of and incidental to the change of system and pressure (including compensation for any loss or damage incurred in consequence of the alteration), and upon such appointment being made, the reference to the Arbitrator shall be deemed to be a reference to a single Arbitrator under the provisions of the Arbitration Act, 1889.

Provided that in any case where notice of their intention to carry out the aforesaid necessary alterations is served by the Undertakers on a consumer not less than one month and not more than six months prior to the date fixed by the Undertakers for carrying out the said alterations, no liability shall attach to the Undertakers, in respect of apparatus installed by the consumer after the service of such notice unless otherwise agreed between the Undertakers and the consumer, and a condition to this effect shall be clearly stated in any such notice as aforesaid.

AN UNUSUAL TRIMMING FAULT.

F. E. B. (St. Leonards-on-Sea).—"Can you explain the following very puzzling trimming fault? I can see no reason why the set should have been thrown right off its stroke in the manner described below.

"The trouble started when, with the coming of September, I decided to give the set a pre-winter overhaul. There was nothing wrong with it, but to satisfy myself that the trimming was perfect I loosened each trimmer in turn and threw it out of adjustment, proving to myself that any alteration, in or out, would impair reception strength.

"One trimmer was very stiff, and in order to unloosen the screw I had to put on a tiny

(*Continued on next page.*)

RADIOTORIAL QUESTIONS & ANSWERS

(Continued from previous page.)

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.P.P. and Class 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 magnetostrictive rod R is used 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 magnetostrictive 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 rod oscillator lies in the fact that it is more robust than the crystal.

It is thought that the actual expansion and contraction are due to a 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 up 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 magnetostrictive 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 extemely television-minded, and having no transmissions whatever on which to exercise our powers, and it seems that the 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 superhets working on them.

In the U.S.A., even for short-distance amateur-band 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 able to 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 of the order of 50 to 33 megacycles (6 to 9 metres)—has obviously got to be internationally reserved as a television band.

As for the rest—well, I have always maintained that the great wide open spaces *below* 3 metres or so would find some uses, 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 2½ and 1¼ 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 transitional, it's true, but 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 in London—though 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 I T.

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 apparently also having a good time.

BARRY KENT CALLING

News and Views from the "Big House."

Second Thoughts.

BEFORE Colonel Alan Dawnay left the B.B.C. he induced Sir John Reith to agree to 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 desirable."

* * *

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 arrangements 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 and "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 Montagu-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 "brain-waves" 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.

ON THE AIR

Our broadcasting critic gives his views on some recent programmes.

"BAFFLES—The Amateur Batsman" was an amusing cricket-cum-crook story of misunderstanding between an accomplished burglar and a simpleton of an accomplice. The latter was played by Claude Dampier. Bobby Comber was the crook. A promising partnership. "Baffles" has designs on Lord Ambergreases's plate. To the fathead Lord Ambergreases's plate couldn't be anything other than his lordship's *dental* plate. The dialogue was very amusing, cleverly using words that 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. Probably this was because it was called an operetta. But the cast attracted me. It was evident early in the performance that here was something uncommonly fine in the way of operettas. Every phase of the show was exquisitely 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 Wattawamat he sang with his usual clarity, even if the rhythms were less usual. His Indian aide-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 story which was told in a peculiar 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 tuneless. As, for instance, in Miles Standish's opening "letter" song.

* * *

The Indian music (solos and choruses) were well conceived and executed. Humour wasn't absent either. I chuckled over the "Give 'Em Merry Hell, Blast 'Em!" Mary Hinton and Peter Penrose showed the same polish in the parts they played in the production.

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 Sunset," "Lovely To Look At," "Stay Awhile," etc. Scores of vocalists are crooning 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 15 of the very best. James Dyrenforth announced each song in some well-chosen words relevant to the profession of the street singer, and reminiscent, too, 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 week was undoubtedly the sound pictures of the Hungarian capital, called "Night Falls In Budapest." Those responsible for these broadcasts 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.

* * *

Cloudesley Brereton's second talk on the "Genius of France" was just as good as his first. How he crowded ten centuries of French literature into such a comparatively short talk was a marvellous example of compression. I liked his parallels of French and English authors, 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 listening more into tune with Saturday night moods.

C. B.

SENDING SOLIDS BY RADIO

(*Continued from page* 116.)

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 salt. Also suspended in the same bath is a plate of metallic copper. The copper-plate and the article to be plated are connected to opposite poles of an accumulator or battery. 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-plate, and deposits them on the surface of the article to be copper-plated. Usually the distance between the copper-plate 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 analagous 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 sent rapidly 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. When, and 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 reconversion at the receiving station of the received "de-materialised matter" into its original material condition.

The problem is an enormous one. Yet it is fascinating in its implications. What 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.

THE B.B.C. TELEVISION SERVICE

(*Continued from page* 108.)

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

(8) *Vision Modulation.*

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

(9) *Synchronising Modulation.*

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

(10) *Line Synchronising Signals.*

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

(11) *Frame Synchronising Signals.*

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

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

(12) *Variations in Transmitted Waveform.*

The 15 per cent. interval between vision signals of successive lines, and the 10 lines interval between successive frames, are minimum intervals used at the transmitter. During the initial development of the transmitter certain transmissions may have longer intervals between lines and between frames, which lengthened intervals correspond to the transmission of a black border round the picture.

The 30 per cent. carrier is the "black level" below which no vision signals exist and above which no synchronising signals extend. The mean black level of any transmission will be 30 per cent. + or − of peak carrier. The black level during any one transmission will not vary by more than 3 per cent. of peak carrier from the mean value of that transmission.

The residual carrier during the transmission of a synchronising pulse will be less than 5 per cent. of the peak carrier.

The line frequency and the frame frequency will be locked to the 50-cycle supply mains, and therefore will be subject to the frequency variations of the mains.

EXPLANATION OF METHOD OF INTERLACING.

The method of interlacing is demonstrated on Fig. 3, which represents the top and bottom portions on the scanned area with the distance between the lines very much enlarged. The lines show the track of the scanning spot, which moves under the influence of a regular downward motion (frame scan) with quick return and a regular left to right motion (line scan) with very quick return (not shown on drawing). The combination of these motions produce the slightly sloping scanning lines. Starting at A, not necessarily at the beginning of a line, the spot completes the line A B, returns to the left and traverses line C D, then E F, and so on down the "dotted" lines on the drawing. At the bottom of the frame the spot travels along line G H and then starts at J and travels to K. At this point the return stroke of the frame motion begins and returns the spot to L at the top of the frame. A complete frame scan has now been made since leaving A, so that 202½ lines have been completed, and the point L is half a line away from A. The downward frame motion now starts again, causing the spot to travel along L M, completing a single line motion J K L M. The spot then returns to the left and traces out line N O which, due to L being half a line ahead of A, will lie between lines A B and C D. Similarly, the next line P Q will lie half-way between C D and E F. The spot now traces down the chain-dotted lines to R S, and finally traces out T U, at which latter point the frame return causes the spot to rise again to the top. When the spot reaches the top it will have completed 2 frames since leaving A and, as 2 frames occupy the time of exactly 405 complete lines, the spot will return exactly to A, after which the cycle begins again.

From the foregoing it will be seen that the complete picture is scanned in 2 frames, but as each frame contains an integer number of lines, plus a half, the 2 frames will interlace. The system does not require the short return times shown for the line and frame scans, nor need the lines begin in the positions shown. Provided the line and frame traversals are regularly recurrent and have the correct frequency ratio (2 frames = odd number of lines), an interlaced picture will be obtained.

From the foregoing it will be understood exactly what interlacing is and how it is obtained. It will also be noticed that the Marconi-E.M.I. system differs from the Baird not only in the interlacing but in picture proportions and the definition, and also in the percentage of synchronising to maximum strength. A greater percentage is reserved for the picture modulation than in the Baird system.

You have probably noticed that the synchronising impulses are rectangular, and not sinusoidal. This is a deliberate arrangement and it allows the time-base to be tripped by "one side" of the impulse and then re-set for scanning by the "other side" with a definite pause of time between the two sudden actions.

This is invaluable and makes the action of the synchronising on the time-base very definite.

The Present Position.

At the moment little is happening at Alexandra Palace. Preparations are slow, but I understand that the transmitters supplied by Baird and Marconi-E.M.I. to the B.B.C. must be delivered by January and then things will move rapidly. Probably test transmissions will be on the air in March, and regular programmes of a somewhat experimental nature by Easter or soon after.

So far certain structural alterations have been made in the Alexandra Palace, as can be seen in the photograph. One of the towers has been decapitated for the erection of a special mast and aerial. But much remains to be done in the way of preparation for the housing of the transmitters, etc.

FROM OUR READERS

(*Continued from page* 109.)

not get it to stop. In charged the whole family. "What's up!" they yelled. Lucky for me I had just switched off, otherwise all 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 idea in my mind to chuck it.

Another Circuit Tried.

But next morning being Saturday, I tried again by taking it to pieces and building another 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 baseboard with a cork screwed on to the base). The wire was wound continuously in five sections of 30 turns, with a ¼-in. space in between. This time the stations rolled in, and did I dance! That night I listened to America. Well, now I want to listen-in again for ever, so now I must close.

Yours truly,

Master Robert Dawson.

72, *Fordmill Road, Catford, S.E.6.*

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 from my holidays, and one of my first jobs has been to make some further inquiries in authoritative quarters as to the prospects of lower prices in the future. I might have saved myself the trouble, for everywhere my inquiries have been met with the same reply, "Not a chance in a million."

An executive of one of the leading firms of set makers told me that he was firmly of the opinion that rock-bottom had most certainly been reached in the models that are now available, and that far from the possibility of even lower prices, the chances are that next season may bring an upward tendency.

That is merely confirmation of the view which I have held for some time and which I have not hesitated to express in these notes. Moreover, it strengthens the pleas which I put forward last week. If you are still hanging on to one of the old-timers, dump it without delay and get one of the latest models.

On the score of technical excellence, you need have no fear that the 1935 Olympia models will be superseded for some long time to come, and since prices are never likely to be lower, there is nothing to wait for. Take my tip and act without delay. Incidentally, may I remind you that the catalogues which I mentioned last week are available for one month from the date of publication of that issue.

A Magnificent Production.

A set catalogue which has just come into my hands and which, I believe, has only just been released, is one of the most excellently produced radio catalogues that I have ever seen. It is a superb piece of work, doing justice in every way not only to the magnificent range of sets that is described in it but to the world-wide reputation of the firm that is behind it.

"A Camera Commentary on Radio in the Home," as it is called, is H.M.V. at their very best, and what more than that need I say? The catalogue is beautifully printed throughout in photogravure, and the photographic illustrations are worthy of exhibition on sheer photographic merit.

The catalogue covers the whole of H.M.V.'s existing range, and to quote from their own introduction: "The unequalled manufacturing facilities enjoyed by 'His Master's Voice' now make it possible for any listener, whatever his or her income may be, to become the possessor of a 'His Master's Voice' radio instrument." In other words, you can now obtain an H.M.V. instrument from as little as £7 19s. 6d. up to as much as £115 10s.

Readers will be glad to know that I have been able to make arrangements for this catalogue to be forwarded to them free of charge through the medium of 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.)

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 next May, and if that isn't a clever way of keeping the name of "Full O'Power" prominently to the front, I should like to know what 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.

For 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 excuse for the employment of the "hit-and-miss" method of fault detection, but nowadays reliable meters can be obtained so very reasonably that there is no object in wasting time unnecessarily.

I have just been glancing through the brochure in which is described the "Avo" series of meters and testing instruments, and that constitutes a striking argument in support of my contention. There are "Avo" meters at prices to suit all pockets, and the extreme reliability of these instruments is well known.

I propose to include this brochure in our post card service, because I am of the opinion that it is likely to be of interest to a large number of "P.W.'s" constructing readers. (375.)

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 39·3 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 16 metres during the late afternoon and early evening.

No propaganda has been heard, but news 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 on 16·87 and tuning slowly downwards. It has usually faded out by 5 p.m.

The 39·3-metre transmission is much weaker, and is badly interfered with by a very 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 7620 kc. are Zeesen, D I Y, on 7537, Ongar, G O Q, on 7590, and Pontoise, F Y A, 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 specialising 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 excellent description of the nature and sources of interference 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. It is usually most severe when sparking occurs as, for example, at commutators of motors or contacts of flashing signs.

How Interference is Radiated.

The sparks cause ether 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. This will be appreciated 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.

Atmospherics are Different.

Those of you who are troubled with interference from artificial sources (not to be confused with *atmospherics*, 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.*)

TECHNICAL JOTTINGS

(*Continued from previous page.*)

from the Telegraph Condenser Company, Limited, North Action, W.3, or from most radio dealers.

H.F. Distortion.

When using a screen-grid or H.F. pentode valve you will often find that if strong signals are applied a certain amount of rectification and distortion are produced. This is due to the fact that the characteristic curve of the valve is not straight, and this produces the cross modulation effect just mentioned. An interfering signal may be received on a wavelength not far removed from that to which the set is tuned, and this unwanted signal becomes rectified, owing to the curvature of the characteristic of the valve, and the rectified part then "cross-modulates" the high-frequency impulses on the "wanted" wavelength.

Use a Variable-Mu.

This can all be got over quite easily by using more selective circuits or by means of a variable-mu valve. The latter valve as a rule has a very long, straight portion and can handle fairly powerful signals without rectifying. Another modulation effect which causes trouble is known as "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 valve—that is to say, there must be the proper relationship between the impedance of the speaker and the impedance of the 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 input. 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.

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INDEX TO ADVERTISERS

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POPULAR WIRELESS, October 19th, 1935. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

GET READY FOR THE S.T.700! (SEE PAGE 144)

Popular Wireless & Television Times

CONCERNING MODERN "MIXERS"
+ +
HIRE-PURCHASE POINTERS
+ +
ON THE SHORT WAVES

EVERY WEDNESDAY PRICE 3D

No. 698.
Vol. XXVIII.
Oct. 19th, 1935.

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.

POPULAR WIRELESS AND TELEVISION TIMES

MANAGING EDITOR : N. F. EDWARDS. TECHNICAL EDITOR : G. V. DOWDING, Associate I.E.E.

NOT SO EASY!
THE BIG THREE
AMATEUR "POLICE"
THE "TWO PEN"

RADIO NOTES & NEWS

WRONG RECORDS
A "LIVE WIRE"
WITH WHEELS
WELCOME STATIC

More Mast Pruning.

A CROYDON reader 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 cuddled 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 be 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.

ARMY WIRELESS IN ACTION

One of the Artillery wireless sets in action during the recent Army manœuvres. Note the hand microphone.

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 to prove that the commercials could very well spare some of theirs for amateur use.

In 1938, when the next international telecommunications conference is to be held, 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 station? 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 set 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!*" Blushing prettily, "I retire into my attic, With a pleasure that's emphatic, And the gratifying feeling, That my duty has been done."

The Tragic Exception.

ALL ships of more than 1,600 tons gross are required by 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 Medhill, 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.*

(*Continued on next page.*)

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 deceivers. There was a case at a Chinese station where a Z-class singer was to end his song supported by the A1 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!" "Booooooo!" and so forth—the clearly-recorded outpourings of a disappointed audience at a boxing match!

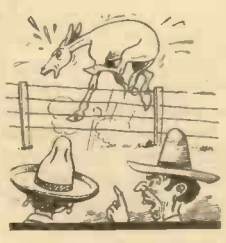
In Camera.

IT was radio amplification technique that turned the silent films into talkies; and now there has been another development, involving cine-cameras, which can be obtained with mouthpieces, in the U.S.A. The idea is that when taking the picture the camera-owner can talk into the mouthpiece, which records on the edge of the moving film, by means of a vibrating mirror actuated by a tiny diaphragm.

Alternatively a separate amplifier with microphone can be attached for picking up external noise effects, such as the onrush of a train which is being snapped. There are many ways in which such apparatus could be applied, linked with photography, and we are likely to hear more of this novel form of recording what's going on by simultaneous sight and sound apparatus.

Induced Currents.

IN every country where a wireless station is erected, the local chaw-bacons blame it for bad weather, poor crops, and similar misfortunes. One Mexican farmer even swore that it was radio that was driving his prize mule ga-ga, and just to pacify him the local engineers promised to go across to his farm and investigate.



The mule, looking peacefully over a wire fence, seemed as right as ninepence, *until the station started broadcasting*—after which time it behaved outrageously, sudden leaps, kicks, gallops, and heels-in-the-air testifying that something was certainly wrong somewhere.

The engineers were doing some hard thinking, while the farmer kept repeating the Mexican for "I told you so," when suddenly the farmer himself kicked skywards, and outdid the mule's gymnastics, with an accompaniment of yowls. But the mystery was solved at last—the wire fence was "alive" from currents induced by the neighbouring high-powered transmitter, and the mule had been licking the wire!

Airport Radio.

BRISTOL, I hear, has officially opened the new radio communication and direction-finding station at the airport—"How do y'do, Bristol?"

It was a bit of a blow—in more senses than one—when the wind horizontalised the new tubular steel mast! But a direction finding service is now dispensed daily from 8 a.m. to 9 p.m., and powerful night-landing lights have been installed at Whitchurch.

The call-sign for telegraphy is GJB, and the wavelength 862 metres.

RADIO TOPICALITIES

Opium! The very word produces a sinister reaction in the mind of the rational human. Opium—the scourge of the East! It is this evil power which Felix Felton, the producer, and Paul Denn, the writer, have been working on for the Drama Director.

This year marks the 150th anniversary of De Quincey's birth. In his "Confessions of an English Opium Eater," De Quincey tells of his gradual enslavement to the drug, his torture during its domination of his body, and finally his gradual recovery from its power.

This human epic is being used for the basis of a radio drama called "Opium Eater," which will be broadcast in the National Programme on October 23rd.

* * *

The Midland "Microphone at Large" series is to be resumed on October 25th with Ashbourne, the Derbyshire market town, which anglers and walkers know well as the gateway to Dovedale. James Gretton and James Ludovici arrange and produce the programme, which will represent the history of the town and its life to-day.

* * *

Variety will be relayed to Northern listeners for the first time from the Alhambra Theatre, Bradford, on October 23rd. Built in 1914, the theatre was the birthplace of the British National Opera Company, and is still used as an opera house.

* * *

"Sports Edition, or Both Sides of the Barrier," is the title of a new Western series which will begin on October 26th. It will be a miscellany of indoor and outdoor sports, including opinions, impressions and reminiscences from player and public, expert and enthusiast.

Listeners may expect to hear something of winter bathing, golf, the Rugby match between Gloucestershire and Devonshire at Torquay, and other sporting items.

Those Gale Warnings.

THE B.B.C. gets about 150,000 letters from listeners in a year. Reviewing this little lot, one of their officials recently stated that one letter was from a yachtsman who owed his life to receiving a radio gale warning.

It doesn't always work out that way, however. A friend of mine—Fleet Street chap named Howard—was telling me the other night how a Daventry weather report lulled him into a false sense of security, and nearly cost him his little yacht Pacific Moon, when the gallant midget was setting out for the South Seas. Incidentally, if you want to read a real-life adventure, get the girlie in the library to save you "From Thames to Tahiti"—just a plain tale of how two fellows took a chip (only a chip, not a ship) right across the world. Put a knob on the fire before you start reading it, for it sends the shivers up and down your back like heterodynes!

Strangers to Radio.

EVEN in these enlightened days, wireless has hardly penetrated to some remote country houses; so when a kind nephew heard that his aunt's house had been put "on the grid," he ordered an all-mains set for the old lady as a surprise, and a few days later called to fix it up for her.

How was he to know that the old dear, trying to move with the times, had herself ordered a vacuum cleaner? So when the wireless set arrived, apparently in reply to her order, she had sent it back to the suppliers, explaining that she wanted a lighter model—one with wheels, and a handle to push it with!

The French Television Experiments.

I HEAR that the preliminary work on the Eiffel Tower, for equipping it with high-power television apparatus, has already begun. The project is to provide our lofty old Parisian pal with a seven-metre transmitter, under the critical eye of M. Barthelemy—France's pioneer television worker, and a mighty slick scanner.

They have got a *pro tem* transmitter up the tower already, and it ought to be looking out over Paris in the next few weeks. The other transmitter will be ready by March.

Fire and Air.

MANY people were injured and five were killed when a wireless factory, near the Eiffel Tower, Paris, caught fire recently. There was a panic rush for the external fire escape, which collapsed.

* * *

A radio-equipped autogyro, accompanied by two tenders, recently left Kalgoorlie, Australia, to cover a large area of the desert in search of new goldfields.

One Man's Meat.

THE radio trade is notoriously full of pitfalls. What worried one East African wireless dealer was that, though he did a good business in selling sets to up-country darkies, they insisted on having *long-wave* sets, though there were no long-wave stations within two thousand miles!

No complaint came from customers, but the conscientious trader finally decided to trek up-country and visit a woolly-headed chief to find out how he liked his purchase. Arriving at the chief's kraal late one evening, the trader found the whole village assembled, watching with bated breath while the delighted chief tuned-in. *They were listening, enraptured, to Africa's rip-snorting X's*, which come through best of all on the long waves!

ARIEL.

"SOAP BOX" Days

By L. STANTON-JEFFERIES

OUR first Christmas at Marconi House was a very pleasant one. Broadcasting was 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 of a well-set-out grocer's store.

I remember that Burrows and I 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 was the first "parson" to broadcast. His happy personality has helped many an artist to put over a good show as, during his visits as a spectator, he would always have an encouraging word for all and sundry.

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 conclusions—though reception must have been poor that evening as I didn't hear that anything untoward had happened.

The first "tuning note" was a thing of beauty and a joy for ever. It consisted of an organ pipe sitting in one of the holes of a voicing box. There were bellows underneath this contraption which, on being raised and assuming that everything was equal, one heard the tuning note for a space of one minute —the note was generally surrounded by an aura of escaping air from the other vent holes which would not shut properly.

The "Dying Pig."

The whole outfit was placed in front of the microphone, and as the duration of the note to the general public was to be two minutes, it needed a real snappy piece of work to raise the bellows and restart without making a break.

Sometimes the end of the first minute would be forgotten, and the tuning note would end in a wail of despair like a dying pig. It is amusing to compare the modern time signal and tuning note with my rough-and-ready weapons.

It was also at Marconi House that a certain vocalist—who shall be nameless—gave me so much trouble. She had three groups of songs to sing. The first group was sung in a very hearty fashion, not at all suited to the antiquated microphone of those days. I suggested that it would be more effective if she sang with a little less enthusiasm. The second group was even louder and, on further remonstration with the lady, the third group was louder still. After the storm I ascertained the cause—she informed me that she sang "out" as she wanted her friends in Aberdeen to hear well.

I remember Saturday afternoons at Marconi House with a certain amount of pain. If one was a little late it meant getting to the studio at the top of the building in record time, via the broad stairway rather than the lift, which was not working during the week-end. To announce after such an athletic effort was no mean feat.

Reverting again to the Children's Hour, I shall not forget the anguish I went through, being the only Uncle deigning to roll up for this event on one occasion. Lewis, avuncularly known as "Caractacus," and I, for want of time to get material or put any new ideas on paper, used to extemporise—he telling some fantastic story and I illustrating the aforesaid epic at the piano.

We were getting quite used to working with each other in this way, but matters reached a climax when the hero of a particular story, the white prince, finished up in the stomach of an elephant. This put paid to the prince and ourselves, as we both burst out laughing, but it taught Caractacus a lesson, as we never reached such heights—or rather I should say depths —again.

This is the final article of the Special Short Series by "Uncle Jeff" on the early days of broadcasting.

An Early Radio "Stunt."

I created Aunt Priscilla about this time. She was inspired by a dear little girl who gave the children a talk on how to cut paper into pretty shapes. If anyone remembers "Priscilla," she was a naughty old lady, whose theme song was "I want to be loved by someone"—music by Uncle Jeff, and I think that the present director of the Children's Hour, Uncle Mac, was responsible for the lyric. "Priscilla" was always doing the wrong thing, and altogether a nuisance to Uncle Jeff on whom I think she had designs.

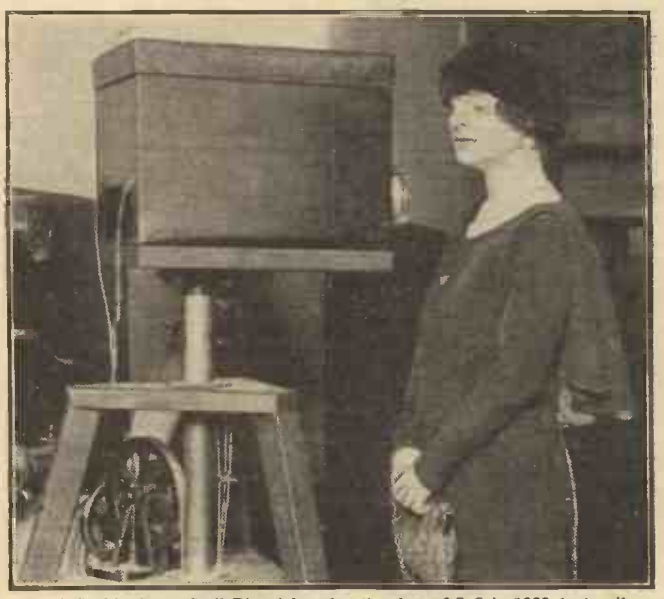
It was from this small studio that Madam Lily Payling sang by wireless to loudspeakers in the Albert Hall, and I accompanied her on the piano. I don't think I shall ever forget this occasion. In these days of "round the world" wireless such an event means little, but to us then with our meagre resources it was epoch making.

Landline Troubles.

Madam Payling was actually giving a recital at the Albert Hall, which necessitated her going from the hall to Marconi House for the wireless stunt (as indeed it was) after her first group of songs. She took with her my old friend Herbert Dawson, who was accompanying her. The idea was that he should play two bars of the opening quietly over the "land line" to show me the tempo, and I, listening on earphones sitting at the piano, should start

(*Continued on next page.*)

TWELVE YEARS AGO



Aunt Sophie (Miss Cecil Dixon) broadcasting from 2 L O in 1923 during the Children's Hour.

"SOAP BOX" DAYS

(Continued from previous page.)

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 in the afternoon, the noises having been traced to a printing press in the Albert Hall.

Such was the uncertainty in which we embarked on this experiment, but luckily it came off, and was perhaps the first wireless "stunt" to take place.

When the Studio caught Fire.

I, or rather a photographer, nearly burned the little studio down. The day before the fireman had presented me with one of those large, conical-shaped red fire extinguishers—"In case, sir."

The photographer took a very large "flash" and, when the smoke was subsiding, I saw to my horror that the roof of butter muslin was alight.

Remembering my friendly fireman's gift, I rushed for the extinguisher and hit its nose on the floor—it exuded a nasty viscous liquid which sprayed the suit of the eminent baritone having his photograph taken, eventually reaching the roof and sides, putting out the fire.

The wretched thing still continued to operate so I stuck it out of the window, its nose resting in a gutter. It was, however, full of further evil intentions, as it still continued to pour its contents on the passers-by below, and I think it cost Marconi's quite a pretty sum in compensation for my enthusiasm in fire extinguishing.

A friendly little studio, and it was with much sorrow that all who had worked in it journeyed across the road to Savoy Hill. The first studio built (No. 3) revelled in the fact that it was surrounded by three—or was it five?—tons of draperies to make it as "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 announcer 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 PRIME MINISTER'S FIRST BROADCAST

This historic photograph was taken on the occasion of Mr. and Mrs. Stanley Baldwin's broadcast from 2 L O.

THE ORIGINAL TRANSMITTER AT 2 L O

Courtesy of Marconi's Wireless Telegraph Co., Ltd.

Here is a view of the original 2 L O transmitter installed at Marconi House. Although perhaps somewhat crude when judged by present-day standards, it was nevertheless highly effective, as many thousands of listeners can testify.

SOME QUEER RADIO WORDS

A SURVEY of contemporary radio literature of America leaves us with a feeling of admiration for the ingenuity of their writers in coining words to meet with changing conditions in the world of wireless.

We are all familiar of course with most of the American words which form the equivalent of our own technical expressions. They have invented, however, many other words of a non-technical nature, chiefly connected with broadcast listening.

Instead of using the words "broadcast studio" they have coined the word "radiome," and a more recent development of this is to refer to a television studio as a "teliome." One wonders if such terms, apt though they may be, will ever find favour amongst British listeners and televiewers or amongst official circles in this country.

Difficulties of Pronunciation.

The science and practice of radio itself are referred to as "radioart," whilst there have been attempts to refer to a person engaged on the technical side of broadcast work as a "radioeer." It does not require much thought to see that this is rather an abrupt contraction of the term "radio engineer," and if they attempt to contract "television engineer" in the same manner, they will find themselves in difficulties of pronunciation.

A large gathering of radio interests, such as the famous Radio City in New York, is referred to as a "radiopolis," and the adjective which means "pertaining to a radio city" is "radiopolitan." Any street or highway in which radio is exhibited to a large extent is termed "radiovia" with its associated adjective "radiovian."

A "radiodonna" is perhaps more understandable, as it merely refers to a singer of grand opera who is in the habit of broadcasting. American literature, however, is silent regarding any special radio name for a crooner or a croonette. A.T.F.

Concerning MODERN "MIXERS"

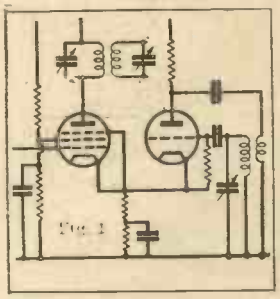
An Article of Special Interest to all Set Constructors

THE frequency-changer stage of a super-het 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 combined with a local 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 changing with the least complication of circuit. So let us look at the various modern arrangements available, omitting the older forms of autodyne, bigrid, etc.

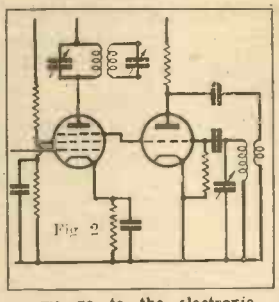
FIVE STEPS—

First we have the use of two separate valves, such as an H.F. pentode and a separate triode oscillator, coupled by means of a common cathode impedance (Fig. 1). A modification is the use of electronic coupling through the suppressor grid (Fig. 2).



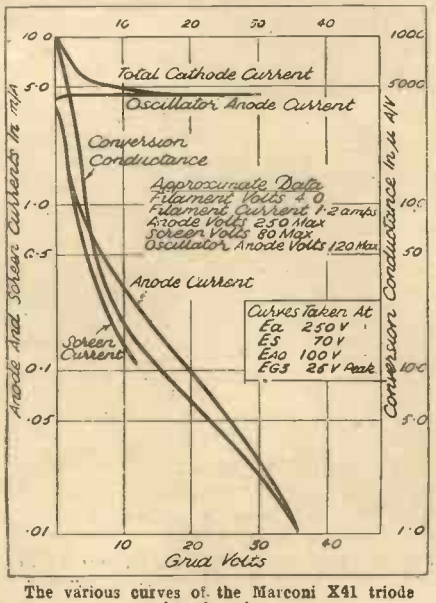
From the cathode-coupled triode and screen pentode—

—IN THE—



—we go to the electronic mixer using two valves—

THE CHARACTERISTICS



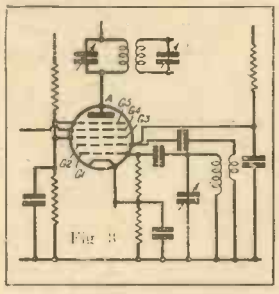
The various curves of the Marconi X41 triode hexode valve.

Second, we have the multiple valve, the triode-pentode, which is in effect the above two valves combined in one bulb. The 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 oscillator and detector function on a single cathode (Fig. 3). We need not go into a full explanation here, beyond saying that the electron stream from the cathode is first modulated by the oscillator (G1) and (G2), then passes on through a screen (G3) to the input signal grid (G4). Here it is again modulated, this time by the incoming signal voltage and the combined modulations are then carried on through G5, another screen, to the anode and intermediate frequency circuits.

—EVOLUTION OF—



—then comes the famous heptode oscillator and mixer—

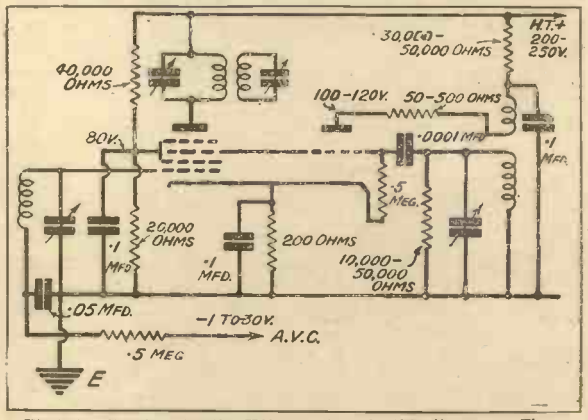
Fourth, there is the octode (Fig. 4) which is similar to the heptode, but has an additional (suppressor) grid inserted between G5 and the anode. It is clear that whereas G4 and G5 of the heptode correspond to the grids of a screen grid valve, G1, G5 and G6 of the octode are equivalent to the three grids of an H.F. pentode. Otherwise the action of the two valves is identical.

Short-Wave Working.

Now, all these frequency-changers have certain advantages and certain drawbacks. They are all reasonably satisfactory on the broadcast bands, but as the wavelength decreases we find that weaknesses become more apparent, and on the "short waves" of 10 metres upward, these troubles are serious.

The first snag is that cathode coupling becomes impracticable without complications, and electronic mixing is practically essential. This places the triode-pentode at a disadvantage, because the radio-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.

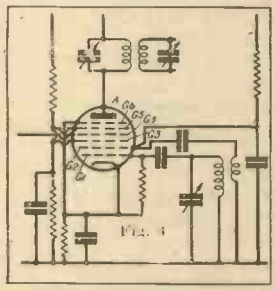
PRACTICAL CONSIDERATIONS



Vital circuit values for the X41 are given in this diagram. These should be used by anyone building a "super" with this valve as a "mixer."

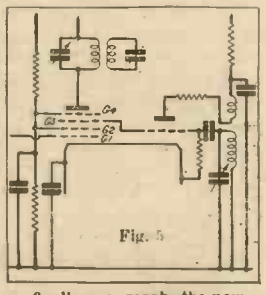
But these two valves run into trouble because of the capacity between the oscillator anode (G2) and the input grid (G4), in spite of the screen (G3). This capacity is sufficient to give rise to coupling between the relative circuits, with the result that the input tuned circuit "pulls" the oscillator off its correct frequency, upsetting the tuning and lowering the sensitivity of the set.

—THE MODERN—



—followed by the octode with one more electrode—

—SUPERHET



—finally we reach the new X41, a triode hexode valve.

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 46·5 per cent. But a signal at 10,000 kc. (30 metres) combining with an oscillator at 10,465 kc., also gives an

(*Continued on next page.*)

AN IMPROVISED LOUDSPEAKER

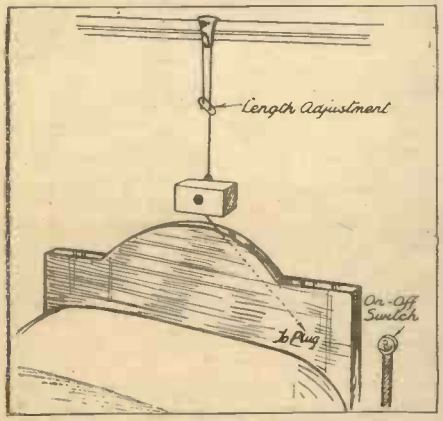
By A. T. Mighall

NOWADAYS most wireless listeners have several or all of their rooms (including bedrooms) wired for "extension" speakers. An "on-off" switch in the bedroom most used is easily and neatly arranged with a few yards of lead-covered twin wire, covered with moulding, if desired.

I wired up my own house a few years ago in order that I could, while lying in bed, switch on and listen to early morning broadcasts from foreign stations.

This arrangement makes it possible to listen to any desired programme when one retires for the night, but ordinarily there are two main disadvantages—the trouble of

OVER THE BED



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

carrying the speaker up and down and the risk of disturbing neighbours.

The scheme outlined below, which, is surprisingly successful, eliminates both. All that is required is the pair of headphones which was relegated to the junk box about ten years ago. (Of course, the "fan" who still uses phones for short-wave work is sure to have several pairs, so one will not be missed; but, in any case, since he goes to bed presumably only once a year or so, he doesn't need to have bedside wireless.)

The phones are first removed from the holder and wires disconnected. Each earpiece is used in a speaker.

The cover is removed and the diaphragm taken out. From a piece of postcard or similar material a circle is cut, the same size as the diaphragm, and a circle of about one-eighth of an inch smaller radius is cut from this. The resulting ring is placed below the diaphragm and the cover replaced. This ring holds the diaphragm a little away from the poles and allows the phone to work loudly without rattle and distortion.

A small cardboard box, about five inches square by one and a half inches deep, must next be procured or made, and the earpiece, which has previously been wired with about two yards of twin flex of any desired colour, is loosely packed into the middle with cottonwool or "paper shavings," so that the front is slightly below the top of the box.

A piece of muslin is placed over the phone, and a very light layer of packing is spread on this, another square of muslin covering the lot. The wire goes through a hole previously made in the middle of one bottom edge, 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 pasted on 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.

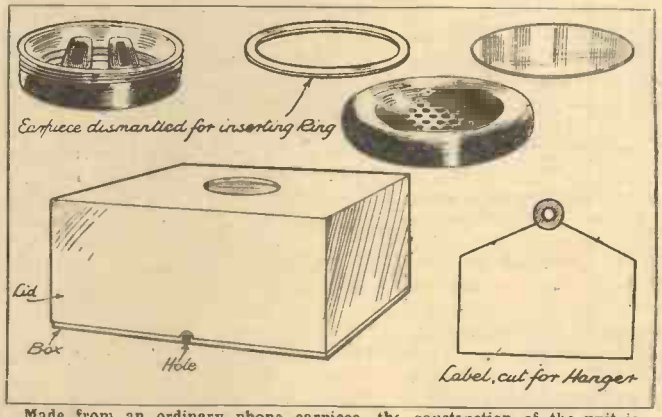
A length of coloured twine or silk or ribbon, with a "tent-rope tightener" for adjusting its length (for which purpose a celluloid tag, as used on battery-set wires, is admirable) is fastened to the ring, and is used to suspend the speaker from a picture-hook, the plug, of course, being connected to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



Made from an ordinary phone earpiece, the construction of the unit is a very easy affair.

Concerning MODERN "MIXERS"

(Continued from previous page.)

I.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 oscillator anode 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 sideband distortion.

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

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

It is clear that G1 is now the input grid, G2 is a screen, 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.

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 hexode by varying the voltage on G2 and G4, without affecting the oscillator. The normal value is some 2-megohms, giving high effective conversion gain and low damping on the I.F. transformer.

So you see we have something here which represents a useful advance.

LESSONS OF LOW-DEFINITION TELEVISION

What the B.B.C. 30-line transmissions have taught us

By L. MARSLAND GANDER,

"Daily Telegraph" Radio and Television Correspondent.

AFTER three years the B.B.C.'s 30-line television transmissions have been abruptly discontinued and, so 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, starvation 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 am in deadly 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 counsels 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 re-stated 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 variety turns of the seaside concert party standard, and with the eternal sameness of the programmes. To be fair to Mr. Eustace Robb, the producer, he could do no more. He exercised his ingenuity to the utmost within the boundaries of B.B.C. purse and personnel.

But making due allowance for the defects of the 30-line system I am not at all sure whether vaudeville should be the staple diet of television. It may play a much less important part than in broadcasting. Do not ask me to explain exactly why. I can only say that my experience tells me this is so.

I do not mean to suggest that we shall not want to see the great comic artists—the George Robeys, the Harry Tates, and the Jack Hulberts—on the television screen. But because a greater effort is demanded of the televiewer than of the listener 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.

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 there will undoubtedly be a place for the classical *pas seul* and the acrobatic dancer. As the screen will at the outset be small, however, it will be a mistake 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 talks as if he will want a screen in his home as big as the one in the local cinema, made to be watched by 2,000 people 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 and showing some of his works, museum treasures, 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 relays of sporting events of many kinds (not, I think, football). In the main it must be semi-topical; in fact, a sort of visual magazine, with its fashion parade, its glimpses of other countries, its instruction in games and its guidance in matters great and small. Television is, in my opinion, a great and powerful medium.

PLAYS EIGHT RECORDS

Loading up one of the H.M.V. 33-guinea Autoradiograms with records in anticipation of a pleasant half-hour's music. This fine receiver will automatically play eight ten- or twelve-inch records at one loading.

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 these advantages cannot be disputed, 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 is 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 titled 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 those 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 and due notice of the intention to terminate the hire must be delivered 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 he 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 guarantees 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."

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 Geographical Exploration of America. Dr. Stetson, 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.

USING A PENTODE

THE pentode valve is generally used in the output stage for its important property of giving a large output for a relatively small input, or rather of giving an output equal to some kind of a power valve with a smaller input than the power valve would require.

The pentode, however, has the slight disadvantage that it is apt 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 point of fact, what it does is to cut down the high 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.

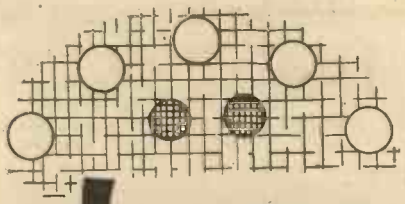
If the capacity of the condenser is increased, this will reduce the strength of the high notes still further. A similar effect can be obtained by diminishing the value of the resistance. If you reduce the resistance to zero, leaving only the condenser operative, this will cut down the high notes almost completely.

If you are in doubt as to the proper values to use, you can make a start with 0·01 mfd. for the condenser and 15,000 ohms for the resistance. Quite wide variations can be made in these values, and by juggling about with them you will be able to get values which give the best results.

Of course, with regard to quality, the matching of the speaker impedance to that of the valve, is every bit as important as with a triode power valve. But a larger step-down ratio will be required.

J. H. T.

The Positive Electron



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 the electrons which properly belong to it.

Although the electron has attained an almost unassailable position as the explainant of all electrical phenomena, the recent discovery of a positive electron bids well to upset present theories. The newcomer is fully described.

By CARDEN SHEILS.

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 leads 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 disintegrated 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.

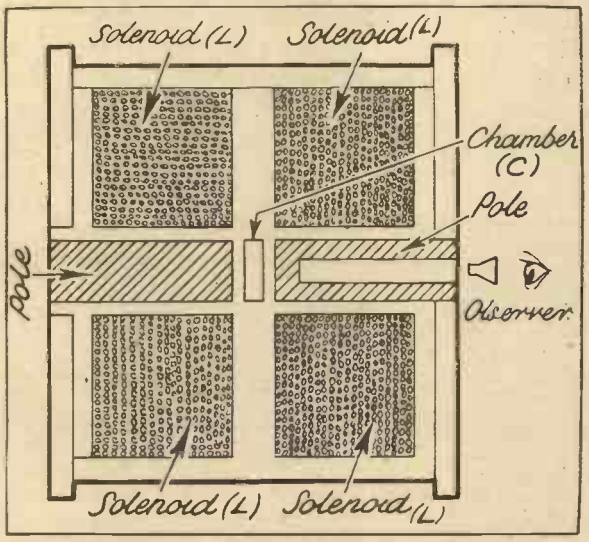
In the apparatus shown in the sketch, no fewer than 2,000 amperes of current are passed through the windings (L) enclosing an observation chamber (C) which is only seven inches square and two inches thick.

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,

(*Continued on page* 151.)

HOW IT WAS DISCOVERED



With this apparatus, in which atoms are disintegrated, the path of the new positive electrons can be followed by the eye.

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 (in the 2 v. 3·5 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 itself, but also further separated in the power-pack. The result is that I have never heard the slightest tendency to motor-boating or L.F. feed-back, no matter how loud the volume or great the field strength of the station being tuned-in.

Handling the Set.

Such immunity from L.F. instability means that the quality is always clean. Bass notes do not hang on or become smudged. Nor do they peak or sound "woompy."

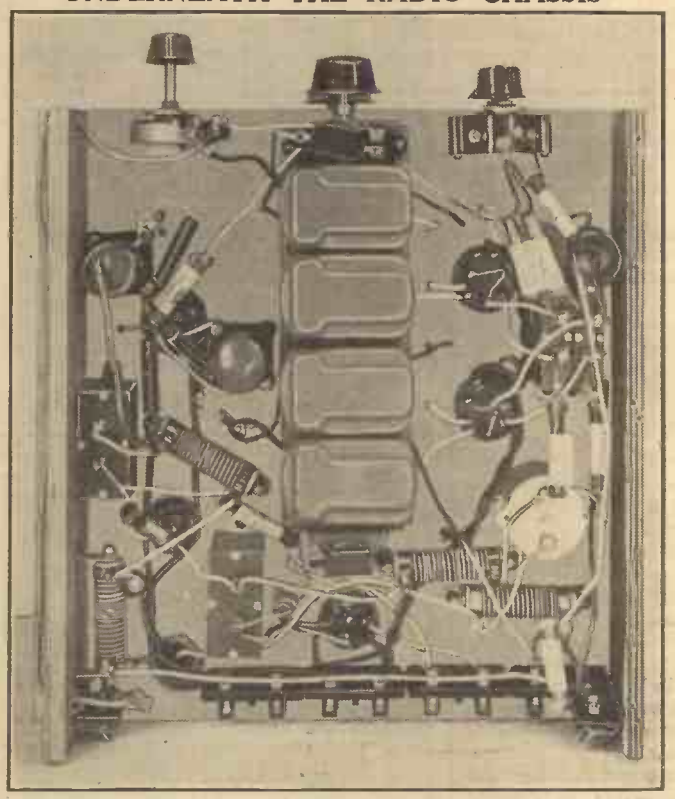
As regards the handling of the set, that is too simple to need explanation. First of all the wavechange knob must be removed and replaced after turning round 180 degrees. This is because the coil unit is mounted upside down. The volume controls are obvious in their use; the wavechange and pick-up switching needs no discussion.

All I need mention are the trimming and wavelength setting and the adjustment of output valve bias and the 50-ohm potentiometer on the baseboard.

Take the output bias first. It should be done before anything else. Connect a milliammeter capable of going up to 60 or more milliamps (borrow one, if necessary) in series with the loudspeaker, with its positive pole towards the H.T. (negative to V5 anode). Place potentiometer (1,000 ohms) in "full in" position. That is with slider at end of resistance bobbin farther from the earthed end.

Switch on. Watch the milliammeter needle. After about two minutes move the 1,000-ohm resistance control slowly until the milliammeter reads 60–63 milliamps. Switch off. Remove the milliameter, re-connect properly the loudspeaker, and that job is done.

UNDERNEATH THE RADIO CHASSIS



The underside of the radio chassis of the 1936 "Ferro-Power." Note that the shielded lead from the pick-up terminal on the gramophone volume control is taken along the outside of the runner to obviate it coming into contact with any of the components, and thus producing an H.T. short.

Now with aerial and earth connected (it need not have been on before), switch on again. Screw up all trimmers on the condenser and then unscrew half a turn. Tune in a B.B.C. station and adjust trimmers roughly so that the correct wavelength reading is achieved when the station is tuned-in.

If this is found to be impossible slack off the pointer drive from the condenser spindle and rotate it so that correct reading is obtained. This will not affect station getting to any serious extent—the set has plenty of margin. You will find you still get up to 550 metres and below 200 in the worst cases of "requiring adjustment." If you do not there is something radically wrong.

Now proceed to trim in the usual way—leaving the foremost trimmer (detector grid) set. Trim to a station below 250 metres if possible.

Setting the Potentiometer.

With the set trimmed have a quick run round to see that all is O.K. and then turn your attention to the 50-ohm potentiometer near V5. Turn this slowly till the "residual hum"—this should not be much—vanishes. This will be near a mid-point setting of the potentiometer. The test should be done with a station tuned-in, of course.

With these adjustments carried out nothing more remains but to place the receiver in service and sit back and enjoy it.

There is one point, however, I have forgotten to cover. That is the dial light. It is not shown wired up in the wiring diagram, but should be connected by a length of twin flex to the two outside terminals of the 50-ohm potentiometer on the upper side of the baseboard. Two six-volt pea-lamps should be inserted in the dial-light holder.

A further point that should be mentioned concerns the Erie volume control. As will be seen in the photograph on this page, the spindle of the pick-up control is longer than that on the H.F. volume control. The photograph was taken before the spindle was cut down in length.

I preferred to cut the spindle down in the case of the original set to keep the volume control well away from the grid of the detector valve and the H.F. wiring to it. The alternative to cutting is to set the bracket back on the chassis, but, as I explained, I recommend that the cutting be done in preference to the setting back.

The Valves.

Someone is sure to want to use all sorts of valves other than those I have specified in this set. Let me say here that *such a change is most inadvisable*, and in some cases impossible without ruining the operation of the receiver.

The Mazda P.P.4/500 could be used instead of the P.X.25 with success, but the Cossor 41M.P. is not interchangeable with any make. The detector should be left alone unless a similar steep-slope valve is used, and I certainly do not recommend the changing of the H.F. valves at all.

It must not be forgotten that if valves are changed the various bias resistances and the anode feeds will have to be changed to provide the correct voltages, and especially is this so with the screen-grid pentodes. The set has not been tested with valves other than those specified, and I certainly do not recommend any change from the listed types.

On Sale October 30th!

The Event of the Year!

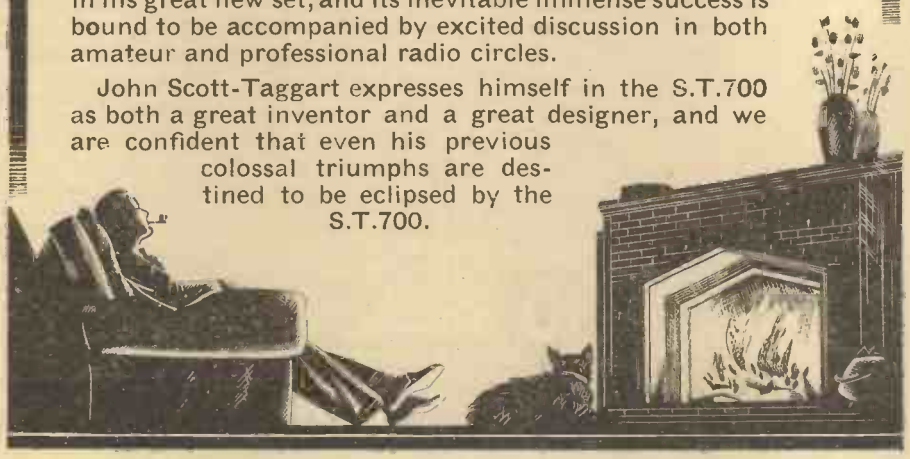
ONLY TWO MORE WEEKS!

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.



Place Your Order Now!

Remember the Date!

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-valve receiver. Quite a few, I know, use 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 these two-valve folk, satisfied though they may be with results, decide that they want something a little better. We all know that the most obvious way of "improving the two-valver" is to add another valve to it, but our opinions vary as to how it should be done.

Use H.F., Not L.F.

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, and that has put me on to this line of thought. I am all in favour of making your third valve amplify at radio frequency.

I have *no* use for three-valvers of "the detector-and-two-L.F." type for short-wave work. The third valve should be an H.F. stage. Then if you want a fourth perhaps you might be allowed to add another L.F., just to make it into a really beefy loud-speaker set.

Here, on this page, is a very simple little unit for adding to a two-valver like the "Simplex." In the case of that particular set all you have to do is to remove the aerial from it and place it on the new aerial terminal; connect up the terminal at the right-hand end of the strip on this unit to the one that the aerial came from; and then, when your batteries are connected to the unit, off you go.

A Special "Simplex" Design.

For those who, like myself, can never see a thing straight until they have looked at the circuit diagram, I have shown this on the next page. You will see that it is a perfectly straight tuned stage, the screen voltage being instantly adjustable by means of a potentiometer in series with a fixed resistance. The aerial is coupled to the grid coil through a neutralising condenser, and the output goes straight from the plate of the valve to the neutralising condenser, which is already installed for aerial coupling in the "Simplex" Two.

It is important to note that if you use this unit in front of any other receiver than the "Simplex" you must make quite certain that the aerial coupling on the said receiver is, or was, of the capacity type. If you have a three-winding coil and inductive aerial 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.

Note, therefore, that this unit, as shown, is specifically intended for the "Simplex" Two users who have asked me for one.

The scheme of using a potentiometer and resistance for getting the correct screen voltage dispenses with the need for an extra H.T. terminal, but, of course, makes it essential to remove the H.T. wander-plugs or to install an H.T. switch. Otherwise the steady drain across the 100,000 ohms, although not very high in value, will certainly shorten the life of batteries.

Similarly, no L.T. switch has been shown on the S.G. unit. The plan I recommend is for you to connect your L.T. leads from the terminals at the back to the terminals on one of the valve holders in the "Simplex" Two. The switch on the receiver proper will then control the filaments of all three valves.

Constructional difficulties? There should not be any, and I'm certainly not going to anticipate them for you. So we will assume that you have built the thing with one hand, while you've been reading with this article in the other, and that you're now all ready to switch on and act 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.

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.

If the latter happens (and I hope it won't), 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.

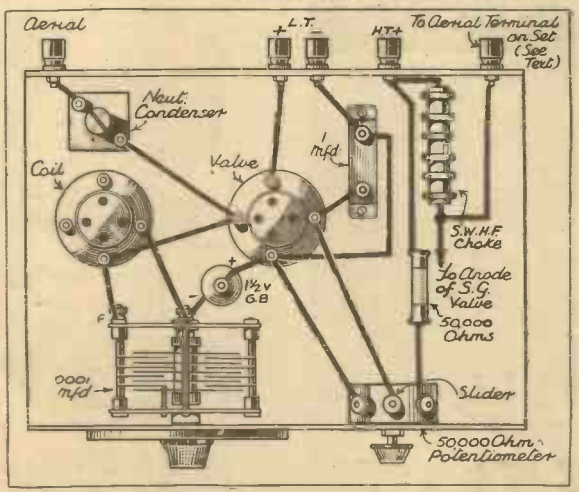
Preventing Interlocking.

If there's any interlocking between your two tuning controls, the set will be a bit of a job to handle. But it *can* always be got rid of by adjusting those two "neuts." carefully.

If there is 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 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"

AN H.F. "ADD-ON" STAGE



This is the wiring of the H.F. unit described on this page. The circuit diagram is shown on the next page.

ON THE SHORT WAVES.—Page 2.

WHAT READERS ARE SAYING

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 ·00025 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."

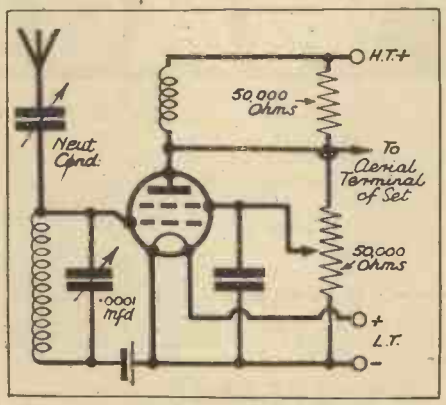
Also, the minimum of the large one is so high that it starts, more or less, where the small one leaves off. One coil will give him a range of 16–23 metres, or 23–52 metres, according to which condenser is in use.

He also has a grumble about "dead spots" on about 16·5, 22 and 37 metres, which persist even with the aerial removed. Yes, but do they with the aerial *earthed?* If they do, it's probably the reaction coil or choke-resonance.

G. M. M., the gentleman who has travelled 125,000 miles with the "W. L. S. Short-Wave" One, tells me that he's taking a kit of parts for the "Simplex" Two on his next voyage. He also wants me to design a "three" for "men who go down to the sea in ships." He is disappointed at the non-existence of British radio gear at all the places at which he calls on his travels. Finally, he registers a distinct preference for "megacycles" and "frequency" rather than "metres" and "wavelength."

L. J. (Farnham) having read that some people have had hand- and foot- capacity

A SIMPLE CIRCUIT



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. 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-valvers*, 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-valver, 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 "hay-wire." 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, 5. Sorry, H. H., but I don't know the wave ranges with the coil you mention. But obviously the 6-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, and also lives 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 athirst 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. of the "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." 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 the secretary, Mr. L. Woodhouse, of 57, Pembury Road, Bruce Grove, asks me to say that the main object of the club is to give all possible help to newcomers in the short-wave game. Any such persons are welcome at the meetings; full particulars of which are available from the above address.

Mr. Oliver M. Derrick, of Gowanhill, Drip Road, Stirling, tells me that he and Mr. Oscar Bylundle of Sweden (who recently wrote to me) have formed an ultra-short-wave club. The main object of this is to enable readers who are interested in the ultra-short waves to meet kindred spirits in their own districts—in other words to assist in the formation of small local clubs.

If any readers are really keenly interested in the ultra-shorts, they should write at once to Mr. Derrick. Mr. Bylundle is the representative for Sweden, Germany and America, and it is hoped, eventually, to make this a really international affair.

Mr. P. Tyndall (West Park Drive, Roman Avenue, Leeds), of the Institute of Scientific Research, asks me to mention that the I S R has now formed a Q S L forwarding bureau. Only reports to and from amateur transmitters will be dealt with—not "veri's" from broadcast stations. Full particulars will be forwarded on receipt of a stamped, addressed envelope.

On October 30th the West Middlesex and East Bucks Branch of the Anglo-American Radio and Television Society commences activities again. Readers of these notes will be welcomed, but they should apply first to Mr. Leslie W. Orton, "Kingsthorpe," Willowbank, Uxbridge. A modern all-wave receiver is to be demonstrated by one of the members, who is confident that practically everything going will be tuned-in during the course of the evening.

A Healthy Sign.

All the above news seems to have been concerned with societies and clubs, which I regard as a pretty healthy sign. I am looking forward to the day when there is no decent-sized town in the country without its short-wave club.

Will all organisers, secretaries, would-be secretaries and treasurers please notify me of their activities? I shall be glad to give publicity to any of their doings; I receive hundreds of letters from readers who *want* to join a club but can't find one to join.

W. L. S.

"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 superhets 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 metres.

The design of a "radio" superhet, as distinct from a television receiver, is simple. The whole problem when one comes to television is tied up with the intermediate-frequency stages, and the means that one must adopt to secure 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 1½ 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 putting 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") and does not give anything like the band-width of the resistance-coupled job, but naturally the stage-gain is a lot higher.

If any form of tuned circuit is used for the coupling device, it is necessary to damp it down so tremendously that it need hardly be there at all by the time one has finished. In any case, the amplification will be very seriously reduced.

Those Stray Capacities.

The factor that one comes up against all along the line is stray capacity. By this we must include unwanted capacity across the tuned circuit (or the anode resistance), and the various inter-electrode capacities of the valves used. The H.F. pentode is by far the most suitable valve for the job, and if something on the lines of the American "Acorn pentode" is ultimately available, things will become much easier for all of us.

When using resistance-coupled amplifiers, the values of coupling condensers are naturally very low—nothing larger than ·0001 has yet been found successful. The top end of the response curve can be tilted still farther by judicious "cooking," the easiest method being the use of a small amount of inductance in series with the anode resistance.

The L.F. Side.

If we are to use any L.F. amplification in the television receiver, precisely the same problem arises, and we still have to use H.F. pentodes and resistance-coupling, but now we have got to look after the bass response as well. Lack of low frequencies in a television set will have just as serious an effect upon the picture as lack of "top."

Fortunately, it seems that the output required to operate most cathode-ray tubes can be derived directly from the second detector of a superhet which has a series of well-designed I.F. stages.

(*Continued on page* 153.)

SNAPPED AT ABBEY ROAD

Elsie Randolph and Jack Buchanan at the H.M.V. studios. Jack has just made a new Columbia record from his film "Brewster's Millions."

ROUND THE RECORDS

News of the latest gramophone recordings.

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.

They decided that competition must be bitter, that as many as possible new voices, new names, and new methods of playing or singing should be found and added to each list of records issued. And what has been the result?

We are flooded with unknowns who sing popular song hits badly, or introduce us to little known and less wanted numbers that do not deserve the honour of being placed on the wax.

A Wrong Policy.

Apparently the idea nowadays is to issue as large a list of records with as many new names as possible, and hope that the public will fall for a reasonable percentage. A wrong policy, in my opinion, as I have said before.

Take a record I have just been playing. It is of the latest hit—"Red Sails in the Sunset." This has been played and sung on the radio almost *ad nauseam*. 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 will 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 "extras" thrown into the lists—names we have not previously heard, some we shall never want to hear again. A few of the new arrivals will be appraised, the rest—well, need I add more?

I have mentioned "Red Sails" as an example. Another is "When I Grow Too Old to Dream." The Street Singer has sung this, bands have played it, and several famous dance band vocalists have added their records. The other day I came across another record of this song by a foreigner I had never heard of before. I hope I am not criticising him too harshly, but candidly I did not like the way he sang. I had too keen a recollection of the Street Singer and others who have tackled the same number.

Latest "Hutch" Recording.

I shall probably be taken to task for it, but I must give another word of advice to those who are tracing the wax for the first time, or bursting into a new sphere of music. Do not come along with an old favourite that has perhaps a score of records to its credit already. Try something new. "Comparisons are odious," they say, but when a popular number is sung comparisons are inevitable.

"Hutch" (Leslie Hutchinson) has made a typical recording of *Red Sails* (Parlophone F 233) and *Murder in the Moonlight*. There is a character and personality about "Hutch" that ensures a big fan following.

* * *

From America Ray Noble gives us two recordings, one *I Wished on the Moon*, with Al Bowlly singing, 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 in England again, and that he will get down to some of his straighter but neater orchestrations that made his records so popular eighteen months ago. (H.M.V. BD 211.)

* * *

Richard Tauber has again recorded *You Are My Heart's Delight*, this time in English. It is on Parlophone RO20284, and is coupled with *When Moonbeams Softly Fall*. A delightful record by a delightful artist.

Songs in German and Italian.

Another excellent tenor recording is that by Joseph Schmidt (Parlophone R 2111). It contains *A Star Falls From Heaven*, from the film of that title, and the Italian folk song *Mandulinata 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.

* * *

Perhaps your taste runs in the direction of string music of the mellifluous type. If so, let me recommend Grieg's famous *Ich Liebe Dich* (I Love You), played by the Carpi Trio. On the other side is the same composer's *Erotik* from his lyric pieces *Opus* 43, No. 5. The record is Parlophone R 2114.

* * *

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*" *Sonata* (F minor, *op.* 57). The pianist is Edwin Fischer, and the execution and recording are both superb. The recording is clean and crisp, and the natural timbre of the piano has been captured in an unusually accurate manner. It is a record I can recommend to all, especially those who have radio-gramophones capable of the very finest quality. The numbers of the records are DB 2517, 2518, and 2519.

K. D. R.

RADIOTORIAL QUESTIONS AND ANSWERS

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

MATCHING THE LOUDSPEAKER.

R. W. (Melton Mowbray).—"Can you tell me the method of selecting the correct ratio of transformer to use, 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 valvemaker's figure for optimum load?"

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

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

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

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. Be sure to get these figures *correctly* from the respective makers' literature, as other figures of impedance 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!

The ratio is arrived at from the formula

$$\text{Ratio} = \sqrt{\frac{\text{optimum load impedance}}{\text{working impedance of loudspeaker}}}$$

To take a practical example: Suppose, as you say, the answer to your inquiry about the output valve is that its optimum load is 6,500 ohms.

The first step is to divide this by the working impedance of the loudspeaker. Assuming this to be 6 ohms, the working will be

$$\frac{6{,}500}{6} = 1{,}083 \text{ (approximately).}$$

The next step is to find the square root of this answer. (There is no need 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 square root gives you the ratio to employ in the particular case quoted—33 : 1. Other examples will, of course, give different answers, but the principle is the same for all ordinary cases.

2 H.F.'S AND CAN'T GET LUXEMBOURG.

T. E. R. (Hove, Sussex).—"Here's the problem: Two beautifully looking H.F. stages (followed by detector and R.C. coupling) with an air-core pack, screened like a battleship, fore and aft, below and aloft. With its beautifully fitting cans, metal deck, and general air of efficiency it seems *impossible* that there can be anything wrong with that. The valves are screened, and the detector (which is an M.H.4) is connected to a screened H.F. choke. All the wiring is perfectly spaced (though I say it myself!) and sound in wind and limb.

"On the medium waves the set justifies its looks—goes like a peach, in fact. On the long waves it is grand at the top of the tuning, and quite O.K. half-way down, but below that *H.F. instability.*

"It is so bad that I cannot hear what Luxembourg is saying. Whereas, at the top of the tuning, Kootwijk, even on his low power during daylight, needs a touch on the volume control to keep him at bearable strength.

"Another thing is that the volume control acts perfectly on medium waves, and on the top part of the long waveband. But as I tune down to Luxembourg, the adjustment of the volume control makes the set let out a double squeal—'WHILP! WHILP!'—which is exactly the same symptom as I had last time with H.F. instability.

"I feel certain that the tuning-pack is not to blame, because I have had a couple of loose screens placed at all angles round it, without making any difference. Then I turned my attention to the H.F. choke (screened) in the detector plate circuit. (A good one—250,000 microhenrys.)

"I have the plate-end of the choke connected to earth (cathode) via a ·0005 mfd. And the other end of the choke by-passed to earth via a ·0002 mfd. All components, including the following coupling condenser and coupling resistance, are of right values, and in good condition. Can you suggest anything else?"

(*Continued on next page.*)

RADIOTORIAL 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. But we understand that the screening there is unusually good, and the workmanship (connections and so forth) perfect. So what is left?

Obviously, you would not forget such an elementary precaution as to see that the aerial lead, etc., was clear of loudspeaker wires, or the similar traps which lie in wait for the haphazard constructor.

So it seems to us that the probability is that it is not the H.F. valve circuits that are to blame, but rather the H.F. which is associated with the detector stage. With two efficient H.F. stages in front, you cannot be too careful to make a clean separation of H.F. from the L.F. amplifying stages.

You have already tested the choke and it is properly by-passed. But you can enhance its effect by providing more choking and more by-passing.

We suggest, therefore, that you get another choke and another by-passing condenser and use them *in addition* to the existing arrangement.

Use another 250,000-microhenrys choke if you can—the higher the impedance the better. And another good condenser, of ·0001 mfd.

Join the new choke between the old one and the coupling resistance and condenser; and connect the new by-pass condenser from its H.T.+ end to earth. That alteration should do the trick.

HOW TO FIT FUSES.

The large correspondence that we continue to receive on the fitting of fuses would appear to indicate that far more readers are still interested in this subject than might be supposed from its apparent simplicity. And a number of further points have been raised which are summarised below.

"If the ordinary flash-lamp bulb will burn out when excessive current is passed through it, why pay sixpence for a similar article because it is called a 'Fuse'?"

The above is a ridiculous question. A few minutes' consideration would have convinced the reader who raised it that he should beware of calling something "a similar article" merely because it *looks* similar. The only thing that matters is, how does it *act?*

A properly rated fuse can be relied upon to protect a circuit, because the fuse will "blow" (thus disconnecting the power) when the current rises beyond a certain specified figure. A sixty milliamps fuse, for example, will pass sixty milliamps with ease, and is tolerant of *little* increases in current such as will inevitably occur in practice. But it will probably blow at 100 milliamps every time, while 120 milliamps—double its rating—would certainly be the death of it.

If an ordinary flash-lamp bulb were used instead, what would happen? It would carry the sixty milliamps just as well as the proper fuse (a thick wire would do the same!), but when the current rose 100 per cent the flash-lamp bulb would *not* "blow," and the other apparatus in circuit would, therefore, *not* be protected.

Many flash-lamp bulbs will stand up to current of the order of 750 milliamps. They are excellent in flash-lamps, but no good at all as 60-milliamp fuses!

Another point raised by readers is that of the glowing fuse. Many have asked "Should a fuse glow?" or "Why does it glow?"

The fuse glows at times because of increases in the current it is passing. Fuses in mains units are specially liable to this, because the current they handle is liable to quite heavy surges. In such cases the glow shows that the fuse is acting, and nothing need be done about it.

Sometimes, however, a fuse which normally never glows is seen to be glowing. This is a useful warning that something may be wrong. Notice whether quality has fallen off, and, if so, suspect a coupling condenser breakdown, a grid-circuit break, or a grid bias fault, any of which would allow a valve to pass too much current.

If a fuse not only glows regularly, but frequently needs renewal as well, though nothing seems wrong with the set, get a "one-size-larger" fuse to replace it. It was working too near its limit before, and the breakdowns notify you that the current passing is probably heavier than you supposed.

Yet another point of interest—the protection of measuring instruments.

Fuses can be used to prevent overload and the burn out of the instrument *provided the latter does not burn out first!* It would be useless to put a 60-milliamps fuse in the lead of a sensitive voltmeter, which takes very little current indeed. But it might be well worth while to arrange a fuse in a milliammeter circuit, because the latter instrument might not be damaged in the event of the momentary excess current that is permitted by a fuse before it "blows."

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 set is nearly four years old. Can you help me to localise it, as otherwise it will mean taking the whole caboodle 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 just as loud 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 from 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 : 3 L.F. transformer primary, the secondary going to L.F. grid and to grid bias. The loudspeaker is choke-coupled, and I have tried that on a similar set. After being in use all one evening the report was 'No crackles from the loudspeaker.'

"I need hardly say I have inspected everything carefully, and done all the obvious things without getting a clue as to where the crackle comes from. It is very loud and occurs without any apparent cause—walking across the room, or even tapping the set, has no apparent effect. Sometimes it will go hours without a murmur, 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 principle can now be extended to remove other sections of the set in turn to see at what point the trouble is disconnected.

First you can detach the S.G. valve and the tuning in front of it by transferring the aerial lead to the G. terminal or to the fixed vanes of the tuned circuit connected to the detector's grid condenser. The set will now be converted into a detector and one L.F., so work it that way for an evening and watch for the crackle.

If the trouble does not recur you can be sure it lies in the H.F. valve itself, or in the parts upon which it depends for working, viz., H.F. choke and anything in its H.T.+ lead (including the battery itself); screening lead and its associated components; grid connection and coil and condenser attached to it; and grid bias battery and filament connections.

Should the crackle, however, continue when the aerial is taken to the detector's input, choose a strong station to listen on, and give it reaction to make it as loud as possible, leaving the adjustments accurately set for maximum strength; then switch off and undo the transformer primary terminals.

To these two terminals connect the loudspeaker itself—if it is one of the high resistance kind; or else the loudspeaker choke's terminals, keeping these as for the output valve, with one L.S. terminal to filament, the other to condenser, and the other side of condenser to choke and plate of the valve.

This will enable you to hear the detector working as a one-valve set; and though you may have to sit up pretty close to the loudspeaker to hear, you should be able to say definitely whether or no the crackle continues. If there is now no crackle you can restore the aerial to the correct terminal again, and operate the set as H.F. and Det., just to make sure. Absence of crackle is a definite indication that its cause lies after the detector—i.e. in the last valve itself, or in transformer, grid bias, etc.

On the other hand, should you be so unlucky as to find that even working as a one-valve there was no getting rid of the interfering noises you will have proved quite definitely that they originate in the detector valve or in one of the wires or components directly associated with that part of the circuit.

THE IDLE DIODE IN A DUO-DIODE VALVE.

"DIODE" (Worcester).—"I am thinking of getting a duo-diode pentode as the output valve for a sort of experimental set I am rigging up. But there is one question about it which I should like to ask, as I have never seen any reference to it in print.

"The question is: That if the diodes—one or both of them—are left idle, and not used for A.V.C. or for detection, etc., does the rest of the valve suffer in any way?"

(Continued on next page.)

RADIOTORIAL QUESTIONS & ANSWERS

(Continued from previous page.)

We are not quite sure what you mean by "suffer," but we can be completely reassuring about this point.

If you mean does it hurt the valve in any way, we can say no; the valve works just as well with either or both the diodes in action.

If, on the other hand, you mean does the pentode section's amplification or other electrical characteristics suffer when that section only is employed, the answer is again, no; you can consider the diodes as extras, to be used or not as desired, and quite independent of the rest of the valve, if that is hooked up as recommended by the makers.

POOR REACTION WITH ANODE-BEND DETECTOR.

S. O. (Chester).—"Can you tell me if it is usual for the reaction control obtained with a set employing anode bend detection to be inferior to the control obtainable from a grid-leak-and-condenser detector? I have noticed this repeatedly, but have never seen it stated, so don't know whether it is normal."

It is certainly usual to find that the anode bend method gives less satisfaction. This is due to the conditions under which the circuit is operating, and you will always find it inferior to the leaky-grid reaction.

A SERVICEMAN'S EXPERIENCES

AS a radio serviceman I come into contact with a large number of listeners, and many are the stories I could tell: some of which would make you laugh, and others make you cry.

We servicemen get to know the "other side of the microphone" better than anyone else. We go into the homes of the rich and into the homes of the poor. We more often than not get a lecture on the B.B.C., or on the superiority of Mrs. Smith's such-and-such-a-set that she bought six years ago and has never given a bit of trouble.

Everyone has a different tale to tell, and everyone knows of a better set than the one which he possesses.

I once had a job to attend to which afterwards became quite a joke around the workshop. The people had stated that the set, an all-electric superhet of the latest design, had started to smoke. Well, this was not a very uncommon fault, and I went out to the job fully expecting to correct the fault on the spot. However, I was to have a surprise. On entering the house I noticed the most horrible smell which I did not usually associate with a burnt-out transformer! The set was nowhere to be seen. "It's in the backyard," said the woman of the house. "We don't want it in here no more. Nearly smoked us out. It did that."

Salt and Soapy Water.

Well, it was in the backyard, and you should have seen it! Whatever they had poured over it certainly made it look pretty. The chassis was turning all colours of the rainbow, and was covered with a thick solution of something. I afterwards learnt that about ten minutes after the set went off they noticed thick clouds of smoke issuing from the set, and their first thought was to throw a solution of salt and soapy water into the "works," and then place the set in the backyard to cool off! Had they switched off as soon as the set went dead, a great deal of time and expense would have been saved.

Another funny instance is of a woman who had a small battery set. It was located in an upstairs room, some distance from the water pipes, and, being somewhat technically minded and knowing that a good short earth was required with such a small set, she had done the only thing possible. Or so she thought. If the mountain won't come to Mohammed, Mohammed must go to the mountain.

Anyway, she had placed a well-filled flower pot under the dresser and put the earth wire into it. She had been in the habit of watering this once a week! However, she was no exception. I have come across a number of cases where earths have been placed in flower pots, buckets of earth and window boxes.

V. E.

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 4¾ in. by 7½ 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 7d. post free.

Everyone should possess one of these informative maps as a guide to operations in the war-zone.

RADIO SET DECORATION

By CHARLES J. ELLIOTT.

WIRELESS cabinets are not complete without certain metal ornaments 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 is 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 may be 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 butt hinge 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 often 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.

Knobs 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 appearance of simplicity of all operations; the fewer knobs or other "gadgets" on view, the more readily does the public visualise the simplicity of wireless: absolutely nothing for them to do—the set works itself—simply switch on. If 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.

This 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's," "L's," etc.—in an effort to connect up the loudspeaker fret with the control knobs; and 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 keenness 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.

A POPULAR OPERA

Candid comments on recent programmes by our broadcasting critic.

I HAD been looking forward to "Véronique," owing to past successes of broadcasts of the same type. "Véronique" did not disappoint me. I can easily understand why this opera is popular with amateur dramatic societies. Its several tuneful numbers, and particularly the number "Swing High, Swing Low," are tremendous box-office draws . . . . George Graves played his original part of Coquenade, and so a cast had to be engaged of similar strength and calibre.

Miss Betty Huntley-Wright, as Hélène de Sonlauges, was a very wise choice. She sang and acted with the vivacity one always associates with *la petite parisienne*. Michael Cole, as Florestan the philanderer, played opposite Miss Huntley-Wright. His performance was in the approved style, just as this role is always played in operas like "Véronique."

George Graves used his old "explosive kind of utterance," as Willson Disher aptly describes it. This isn't often heard on the air, hence its appeal. Janet Lind (Agatha) scored a great success, as did John Rorke, the groom. I liked John Rorke's singing better than his speaking. I think there's a tendency with B.B.C. producers always to exaggerate the imperfections in speech and accent of the lower orders, and I must say the accent jars in an opera of the "Véronique" order.

Once again the B.B.C. Theatre Orchestra and Chorus were first-rate.

* * *

We have had better extracts from Napoleon's life than that taken for the subject-matter of "Brumaire." Anthony Ellis writes with vigour, but owing to an almost complete absence of dramatic incident in the play, his "Brumaire" was not a very valuable contribution to the B.B.C.'s series of Napoleonic plays, small as that series may be

A Popular Item.

"Tunes of the Town" ought to be a popular item this session. It isn't surprising that the first of the batch should have come from the Vaudeville Theatre, where André Charlot's revue, "Stop-Go," is being staged. With André's kind permission a good array of well-known artists sang a selection of numbers from the show. The best of the selection was, I thought, "The Hunt-Ball Sketch."

John Watt disputed very playfully with Mary Brian the privilege of compering the broadcast. They exchanged pretty compliments. I could have done with a little less of this amiable chatter. None of it was particularly bright, and it does hold the show up a bit.

(*Continued on next page.*)

A POPULAR OPERA

(*Continued from previous page.*)

There is a danger, it seems to me, with these theatre music items. As a friend of mine said of the "Stop-Go" excerpts: "This was no advertisement for the show. I have seen it at the Vaudeville. It is good. But the selection of the tunes that were broadcast was poor, and not at all typical of the show as a whole."

* * *

Don't be put off by high art titles and sub-titles, for these aren't always what they seem. Dr. Inge introduced a series of talks whose sub-title is: "A Psycho-analytical Approach to Social Problems." Very frightening, you say. But in his talk Dr. Inge 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. And the post-war English girl tries to obliterate all the curves in which female beauty consists."

The simple truth of these observations could be grasped by everyone.

* * *

The inclusion at long last of old ballads in the session's programmes will meet with the warm approval of countless listeners, I should say. And who can sing them better than Isobel Baillie, Norman Allin, and the Gresham Singers? Thank you, B.B.C.!

An Unusually Good Programme.

"The Variety of Music" programme was unusually good. Almost every type of song was represented. Lily Morris was outstanding, especially in her last song "Muffle Up Those Merry Wedding Bells." Ernest Butcher sang an old song, "Nothing at All," with remarkably clear enunciation, while the serious singing was entrusted to John Dudley. He sang some Mozart. These three appealed to me perhaps more than the rest. Brian Michie compèred the show. And I think that Brian Michie hasn't a rival at present in this compèring business.

* * *

The season's talks, judging from the quality of the No. 1's that I have already listened to, are of a high standard. Geoffrey Crowther speaks well, and obviously is a master of his subject. The finest talk of the week (will it be of the session, too?) was H. G. Wells' on Huxley. Intensely interesting was this portray of the great scientist. What a master of English prose Wells is! Alas! he had only twenty minutes allotted him. Music will not let go its hold on broadcasting, it seems, not even in favour of Wells.

* * *

The "Proms" are over. I have no great regrets. They bag the front seats of broadcasting for mu h too long a period. Nothing else gets much of a look-in—at least at the ideal time of day.

C. B.

THE LINK BETWEEN

By G. T. KELSEY.

MY recent reference in these notes to the loud loudspeaker menace has brought forth more correspondence than any topic I have dealt with for some long time past. Letters have been pouring in, and even if I may previously have had doubts as to the extent of the nuisance, I am certainly left now with the impression that the trouble must be very widespread.

As to what can be done about it, other than by some form of country-wide legislation, I am afraid I am at a loss to suggest. But I must confess that it appears to be a matter calling for urgent attention.

I am afraid I still hold the view that a possible solution lies in the introduction of a limiting device in the set itself, but several of my correspondents have drawn swords with me over this point, although they are agreed that something should be done about it. "Why," they ask, "should we be made to suffer for the misdemeanours of the thoughtless minority?"

That Reserve of Volume.

Well, there is something in what they say, but I am afraid that I still do not see in what way they would suffer. After all, if a set is to be used for purely domestic purposes, I cannot see the point of providing it with an output far in excess of what is required. As I view the matter, if the reserve of volume is there and is used, then surely the listener will be committing the nuisance which he is so anxious for everyone else to avoid, and if the reserve of volume is there and is *not* used, well, why have it?

I have dragged this matter up again because I do honestly feel that repeated references to it in print may help the cause along. In any case, the ventilation of views in the letters which I have received is 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 "cure" 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, noise, and then more noise until three o'clock in the morning! So he rigged up a powerful Hartly oscillator that could be tuned from his bedside, and he just "chased" his neighbours up and down the dial as they searched for stations without what to them must have been a "mysterious" ear-splitting roar. He won the battle in two days! Ingenious, but hardly practicable in this country!

The "All-Metal Way."

In general I make a point of dealing only with free literature under our post card scheme, because if stamps have to be sent it is no longer a post card service. All the same, I feel that I should be lacking in my duty to readers if I failed to make some reference to the excellence this season of that very popular Westinghouse publication, the "All-Metal Way."

It has always been a highlight in radio literature, and this year it is better than ever. It comprises 48 pages of the most useful information imaginable, and as a reference work for all matters connected with metal rectification and smoothing it is unequalled. It includes numerous circuits and a wiring diagram for a mains eliminator, and it is just the book for all who desire to learn something of "what happens."

But naturally a book of this type is an expensive one to produce, and Westinghouse, in my opinion, are being very generous in asking that only threepence 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 threepence in stamps with your application, which should be sent to me in the usual way. I am reluctantly compelled to have to say that on account of the large number of "P.W." readers who are making use of our literature service these days (not that we mind, for "the more the merrier" is our motto!), we shall have to ignore in this case all those who omit to enclose the necessary stamps. Our reference number in this case is (376).

WIDE-BAND SUPERS

(*Continued from page* 148.)

A friend who is working on a set tells me that he estimates 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 superhets for broadcast reception.

All this brings the problem farther forward in the receiver, and shows us that we must not risk the slightest loss of efficiency in the frequency-changer, or, for that matter, 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 Elettra off 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.

From almost every European country there have been rumours of "a revolutionary invention which will make cheap television possible," or words to that effect. All this almost makes one wonder whether the Old Country will be *last* in the field after all! And many of us thought at one time that we should be the first to have a real high-definition service.

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.

Arising 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 radio work is so different that it is better to employ professional radio conductors for all performances over the air.

* * *

That Cinema Organ.

The battle for the cinema organ continues. Mr. Eric Maschwitz, Director of Variety, finds that he needs organ music more and more in his productions. It is a year since he asked for an up-to-date organ to be installed. The problem has been deferred repeatedly, because of accommodation difficulties. It was felt by the B.B.C. administration that it would not be wise to install an organ which would have to be moved soon afterwards. Now an organ company has offered to make a mobile organ, which can be put into St. George's Hall and then moved as and when required. I hear that this proposal is likely to go through. 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 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.

* * *

Visitors Not Wanted.

I hear there has been a change of attitude at the B.B.C. about visitors, and particularly about those wishing to be shown over the building. In the past three years there have been almost daily tours of visitors. Now this is being drastically curtailed. To go over the B.B.C. now the visitor must have some special reason or qualification.

* * *

Mr. Norman Carries On.

Mr. R. C. Norman, who has been appointed Chairman of the B.B.C. until the end of 1936, has been doing the job all the time since Mr. Whitley's death two years ago, except for the brief period in which Lord Bridgeman held the post.

The other candidate, Lord Selsdon, is understood not to desire to take it up while the Ullswater Committee is still in being. It is almost certain, however, that Lord Selsdon will be invited to succeed Mr. Norman at the beginning of the new Charter of the B.B.C on January 1st, 1937.

* * *

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 Doris 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 Louisiana 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 negatron 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 transmission will be 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 is played on a radiogram and 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 anywhere 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 nearby carrying alternating current will cause a "vibration" of the cathode beam, synchronising with the frequency of the alternating current. If you switch on an electric light on the A.C. when a cathode-ray television receiver is working, unless precautions 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 strike 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 add, however, 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 so it must be merely 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, admittedly, great improvements have been made in P.M. moving-coil speakers, especially in relation to the strength and permanency of the magnet, at the same time I still think that an energised speaker, operated in proper conditions, has the advantage.

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.

Working Below Rated Wattage.

A rather curious feature of an energised moving-coil speaker is that it often works pretty nearly as well, or seems to do so, when the watts dissipated are only about two-thirds or one-half of the rated watts. This is a point to be borne in mind, because some people are put off trying an energised speaker because they think that the mains unit they employ will not be able to give sufficient energy for the speaker and for the valves as well.

Making a Multi-Meter.

If you have a fairly accurate milliammeter, reading up to say 5 milliamps, you can use this for reading all kinds of currents 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 90 ohms, that is, through the meter, and

(*Continued on next page.*)

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 1/99th of the resistance 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 9. In such a case you can include a small resistance in series with the instrument so as to bring the total resistance 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 connected across the *whole* combination, consisting of the instrument and the series resistance. In other words, the series resistance is to be considered as being included in the internal resistance of the instrument.

Electric Supply.

Everybody who can uses the electric supply for operating his radio receiver; 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 whole 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 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 very large, and indeed the number of high-tension dry batteries sold in this country every year is in itself the best possible indication of the enormous number of such sets in use.

Dry Batteries or Accumulators?

Of those who use batteries for operating their sets, I should say that the vast majority use dry batteries for the H.T. This is probably because dry batteries are very compact and convenient, requiring no attention at all whilst they are in use, and when a battery is no longer serviceable it can be thrown away and a fresh one bought for something under a ten-shilling note.

On the other hand, there is a section of battery users who take paper and pencil and work out exactly how much their battery costs come to in the course of a year. To these the high-tension *accumulator* battery soon makes an appeal because, after the initial outlay—which, of course, is considerably higher than in the case of a single high-tension dry battery—the running costs are very low and the high-tension accumulator can always be relied upon, if of a good make, to give a steady supply of current free from crackling, failing voltage, and so on.

What Does Your "Juice" Cost?

There are a number of high-tension accumulator batteries on the market, one of the best known and 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 the 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. These 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 means 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-volt accumulator.

Alkaline Cells.

There are, as a matter of fact, other advantages of this nickel cadmium and alkaline cell. For one thing the plates are claimed to be far more durable than lead plates; they do not crumble and do not sulphate. Moreover, the alkali which is used does not corrode the nickel cadmium and steel used 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.

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 WIRELESS, Tallis House, Tallis Street, London, E.C.4.

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TRADE LIST ready. Send trade heading and stamp.
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(Continued)

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SAVED HIS LIFE
RADIO SALONIKA
AMERICAN EXPORTS
NEW STATIONS

RADIO NOTES & NEWS

JAPANESE "NEWS"
HATS OFF!
"PLANE" SAILING
WHO WAS IT ?

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 took no sugar, but instead used saccharine in tablet form. He was dropping his tablets into his teacup when the loudspeaker announced a warning: Would a man who had bought some saccharine tablets at So-and-so's, the chemists, take the phial back to the shop unopened? Tablets of *poison* had been supplied by mistake!

With a trembling hand, the listener refilled the chemist's phial and complied with the request. He owes his life to a liking for tea-time music.

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 anæmic—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 probably hear the young hopeful trying out his new lungs.

A Belfast reader tells me that the engineers have not yet had 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 has been 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 509,786 which was the total for 1933. The value of the 1933 crop of sets exported was 9,323,535 dollars: that of the 1934 exports, 15,338,143 dollars.

The "toob" 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 6,639,311.

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.

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.

* * *

The Crystal Palace firework display was recently televised experimentally by engineers of the Baird Company.

* * *

Australia 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.

IT now being the time of the year when most of the radio administrations arrange for their new season's plans to mature, I have further new stations in Europe to bring to your notice. The first is Vigra, near Aalesund, Norway, which will probably be working this month. Soon after, the new Tromso will come into action. Finland has begun work on a pair of 10-kws. at Oulu and Vaasa, and there is to be a new transmitter at Stolp (in East Pomerania).

Oh! and while I remember, there's little Linz down in Austria, expanding his chest from a mere ·5 kw. into 16 kw. A fine batch of recruits—yes? No? "I tank I go 'ome and tune 'em in."

Neglected Wavelength Commandeered.

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 Lucerne 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 1½ kw. station will be used. As soon as possible after that the *pukka* Saar transmitter will be installed—a 17-kilowatter.

France's Latest.

THE Marseillaise are delighted with the first tests of their new Regional station, which should soon be pumping programmes over into British aerials. The wave-

(*Continued on next page.*)

LINKING THE COUNTIES WITH RADIO STATIONS

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 reported to be testing its 60-kw. outfit? There are such numbers of newcomers to watch for, that even the keener sleuths are not able to bag them all with assurance.

I have had reports of Torun (304 m.), of Lyons La Doua (463 m.), of Lille (247 m.), and of the new Toulouse station which is replacing Toulouse-Pyrenees. Heilsberg 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 topcoat, dry-cleaned to carry on till funds improve.

A Big Disappointment.

TIRED of all this political palaver, and surfeited with propaganda, one of my correspondents sought out his old short-waver as a relief from European trouble and strife. He picked up Bandoeng first, but that station closed down, so he went over to a Jap who was tinkling away on a harp-cum-triangle musical instrument.

Settling himself comfortably to enjoy this Oriental interlude, the poor chap was horrified to hear the music stop, its place being taken by war news, and all the old familiar terms: "Commit-tee of Six," "Geneva," "Meesta Ballwin," and all that lot! "It's hard lines," his letter concludes, "when all the European stations talk about war, and you get the same thing back from Nagasaki, where the fellows chew tobaccy."

Disappointing, I grant you. But also a reminder of the brotherhood of man.

Signalman Smith, M.M.

REMOVE your glove for a moment and extend with me the right hand of how-do-y'do to Signalman P. C. Smith, of the Peshawar District Signals. Signalman Smith is not one of those fellows who packs up radio and throws his hand in as soon as there is a bit of interference knocking about. That is why Field-Marshal Sir Philip Chetwode has approved the immediate award of the Military Medal to Signalman Smith.

In the face of the enemy during the Mohmand operations on the N.W. Frontier, and while under heavy fire for three hours, Signalman Smith continued to operate his set single-handed and remained completely unperturbed. Under particularly heavy fire during the withdrawal of the 1/4th Bombay Grenadiers, he halted the mule, which was carrying the wireless in a spot where no adequate cover was available, to take down an important message.

The official award is "for conspicuous gallantry," and when the Army puts it like that, it is time you and I took off our hats and raised the roof.

Sympathy, Please.

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.

Circuitous 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 VK5SU, wanted to get a good television circuit from a Heathfield, Sussex, fellow fan, the owner of station G5JZ. Failing to pick up the Sussex station direct, VK5SU passed the request on to VIT3EG, Victoria. VIT3EG got into touch with VSIAG, Malaya. This station, apparently impatient of dodging about in the Southern Hemisphere, slapped the message down bang on to the aerial of G2NM, England, whence it was passed on to Heathfield.

It's just as well that poor old Great-Grandpa never knew about all this. The television part would have scared the old chap stiff, while calling up the other side of the world would have seemed to him to be sheer devilment, and right agin' Nature.

Following the Programmes.

THE Australian airman, Mr. James Melrose, has fitted to his Percival 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 stow 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 keep him on his course if he flies into the picked programmes.

Clubs are Trumps.

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, Ealing, 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," Ridge 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.L.S. that "I shall be worrying him soon," and concludes, "I use an eleven-valve short-wave super, and *I am pulling the world to pieces with it!*"

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; Lancashire 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, but when I talked to 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 I know that as soon as the station gets on the air one of my faithful bloodhounds will pick up the trail. Noses down, boys! Watch all wavelengths.

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 sang 'Just a Song at Twilight' last night, at 10.15, just above Vienna?"

Impossible to say, I fear. It might have been Athlone (a station addicted to the latest song hits!) or Budapest, or Beromunster, 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.

ARIEL.

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. It can be 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 only 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 note 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

Excellent tests for quality can be carried out by the ear if you know how to go about it. On this page John Ruston, B.Sc., explains the best way to set about the tests.

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. Hence 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.

Those 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. It makes 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 2½ octaves about middle C on the piano. This makes the reproduction shrill and, just as a bass resonance produces a boomy 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 unnaturalness 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

(*Continued on page* 179.)

RADIO FOR THE SICK

Little patients of the Royal Free Hospital, London, examining the new radio receiver presented to them by two of the life governors of the hospital.

"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.

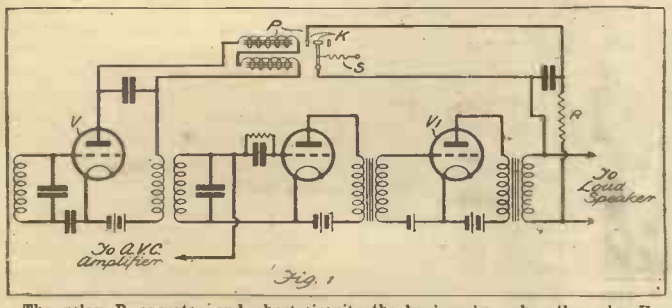
The object of automatic volume control is to get rid of the casual changes in signal strength which are caused by fading. In order to do this the sensitivity of the set is kept in check, so to speak, when the signals are coming in at full strength, and is automatically increased as they fall off. Obviously, 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 worth-while 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 creates 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 "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.

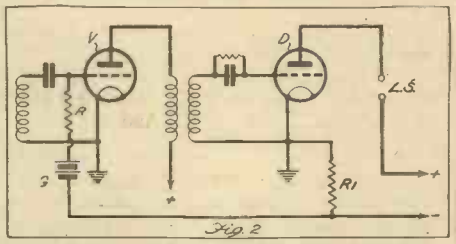
Accordingly, designers have produced a number of Q.A.V.C. circuits (Q standing for "quiet") as well as "background" or "inter-channel" noise suppressors, all of which serve to keep the loudspeaker "mute" during the operation of re-tuning and until there is some signal really worth producing.

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

POSITIVE BIAS



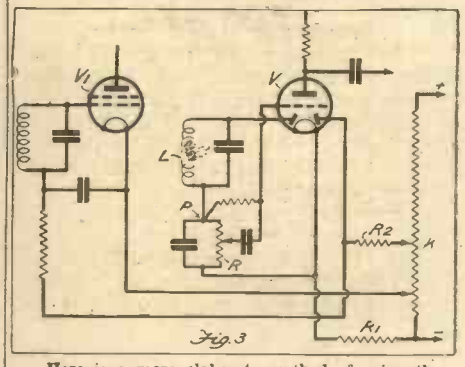
Another method of providing silent tuning is by a positive bias on pre-detector valves. This bias is nullified by an automatic negative bias provided by the anode current of the detector when a station is tuned in.

from the last L.F. amplifier V_1 through the resistance R, and so effectively prevents any "noise" from getting through into the loudspeaker.

Directly a worth-while 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 reopen the contact K so as to throw the resistance R out of circuit and restore the path to the loudspeaker.

Fig. 2 shows another and simpler scheme, which is quite effective in cutting down unnecessary background noise. Briefly, the idea is to apply an initial positive bias from G through a high resistance R to the grid of the H.F. amplifier V. Under these conditions the amplifier will work only at low efficiency, i.e. so long as the set is off-tune. As soon as a signal is picked up, however, the detector D starts to rectify it, and so develops a voltage across a resistance R_1 in its plate-cathode circuit. This throws the lower end of the resistance R_1 more negative, which in turn offsets the original "positive" grid-bias on the amplifier V, so that the latter is automatically brought back to full efficiency.

AMPLIFIED CONTROL



Here is a more elaborate method of using the Fig. 2 scheme, amplified bias being applied to V_1 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.

Fig. 3 shows a more thorough application of the same principle. Here the amplified H.F. signals are applied to a circuit L, inserted in series with a resistance R across one of the rectifying electrodes of a double-diode-triode V. Rectified voltage from R is fed back from the point P to the grid of the same valve, and reappears in amplified form across a resistance R_1 in the anode-cathode circuit.

It will be noticed that the grid-bias for the preceding amplifier V_1 is taken from a positive point K on the supply potentiometer, and so long as its grid remains positive the valve is practically out of action—so far as low-value signals are concerned.

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_1 "unlocks" the right-hand "diode," and a voltage is developed across the load resistance R_2 which reverses the original positive bias on the amplifier V_1, 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 compel 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.

Such are a few of the many ingenious systems that have been devised to make modern radio sets free from tuning snags.

TWO MINDS WITH NOT A SINGLE THOUGHT

Our Special Correspondent interviews Mr. Murgatroyd and Mr. Winterbottom.

TOMMY HANDLEY, alias "Mr. Winterbottom."

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 BA.

But only Murgatroyd (alias Frankau) was there.

"You want to see us?" queried Frankau (alias Murgatroyd). "But we're never together. Mr. Winterbottom is rehearsing in another studio upstairs."

"But how so," I expostulated, "when he's your partner?"

"We *never* meet." I was solemnly assured by this prince of ballyhoo, who thereupon told me that he went to school at Eton.

How The Act Started.

"After that," he said seriously, "I went to a business college in Germany, worked in an office, trained as a singer, went on the stage as 'Frank Ronalds'—Mamma was shocked and insisted on a pseudonym. That was in the chorus of 'The Country Girl,' in 1914. Then War. After War, lost money in theatrical ventures until 1924, when I founded the 'Cabaret Kittens' and——"

"You've never looked back!" I added.

"Only to see if a policeman is following me."

I asked how the Murgatroyd-Winterbottom partnership began. Mr. Frankau replied:

"I heard Tommy Handley on the air one night and decided he would make a good partner. I rang him up and suggested our getting an act up, as long, of course, as he was willing to accept 10 per cent. of all moneys accruing therefrom. He, being fully in sympathy with my ambitions, said he'd love to. We got together before closing time and, after we were thrown out, sat on the kerb and I wrote the act. He held the paper.

"Our first broadcast was so successful," continued Mr. Murgatroyd, "that the B.B.C. offered us a 10 per cent. drop to broadcast again. We have now done five broadcasts together on such terms, so it is quite easy for you to work out what we paid the B.B.C. for our last broadcast."

"Please, Mr. Frankau," I pleaded, "will you answer a few serious questions?"

"I begin," he prattled on, "to like Mr. Winterbottom a little more than I used to. He works better wearing my old clothes, and has copied some of my old-world charm."

Mr. Murgatroyd (alias Frankau) slapped me proudly on the back.

"We've made six double-sided records," he cried. "And we met a man the other day who had bought one. And——"

"MR. MURGATROYD"

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 Ballyhooer No. 2, "despite the fact that the first word I said 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 corn 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 liquorice 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."

"That's Murgatroyd's gag," I challenged.

"I 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 pencil and putting in several 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."

(Next Tuesday, National Programme.)

"THE RED SARAFAN" is to take the place of the cancelled broadcast of the Royal Command Performance. The last 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.

A CHAT WITH DOCTOR BOULT

ALAN HUNTER interviews the popular Conductor of the B.B.C. Symphony Orchestra.

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 high-brow—which is the last attribute I would accuse him of, knowing his intense humanity; his abiding love of real music.

I wonder how many listeners have stopped to think of the various different series of musical concerts that come during the course of a year under the unwearying baton 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 'Promsters.' 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 musical appreciation from 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 money 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—programmes arranged on the lines of, say, Francis Toye. Listeners may hear, perhaps for the first time, a Rossini overture on one of these records. Then they will see something they enjoyed featured in the programme of an important orchestral concert—and they will make a point of hearing that overture again.

"Or, to take another example, they may hear the popular Military Band playing, say, the first two movements of a Mozart Symphony. When they see it is down to be played by a really big orchestra they may be curious enough to want to hear how different it sounds—and, of course, the full orchestra will 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 my readers, 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.

Dr. ADRIAN BOULT.

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 volume range from very soft to 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 instruments.

"Some time ago I had an experience that proves my point. I was listening to a broadcast concert, and I gradually came to the conclusion that some of the performers were not worrying enough over their pianissimos and fortissimos. I could tell that just by the thinness of the tone, you understand, not by any critical judgment of the actual dynamic volume range.

"The next day I took the trouble to hear the same orchestra again, only this time I went along to the hall itself. And, do you know, I was quite right—they were not taking enough trouble! So that really answers your question. If, at the loudspeaker end, I can detect such lapses from perfection of playing, it must mean that *something* comes over when they are perfect."

This was most interesting, I thought. For the technical, as distinct from the artistic, purists are fond of telling us that we can never 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, it is 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 skimped.

"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. Boult 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.

"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, D and E for various orchestral needs. Confusing? Yes, perhaps it is. But I cannot see any other way of doing it. We cannot tie a label on each section, for the very simple reason 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 as to which section is performing."

Simple Metal-Working

Metal-working is by no means so difficult as many suppose, and is a valuable accomplishment. The best methods to adopt are outlined in this contribution.

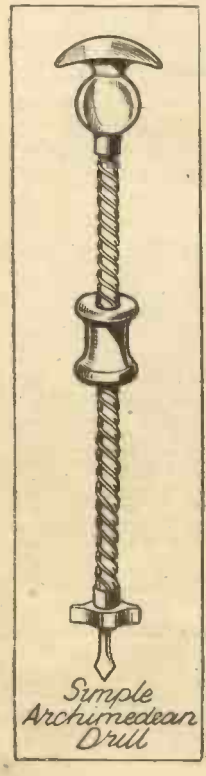
By G. V. Dowding, Associate I.E.E.

AMATEUR craftsmanship is a fascinating as well as an extremely useful diversion, and everyone who possesses a modicum of patience and can handle the simpler tools ought to be able to tackle a hundred-and-one different kinds of jobs. With the construction of radio sets as a kind of nucleus of knowledge and experience, one can branch out into innumerable directions.

There is an idea that wood-working 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.

Maybe 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 join 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 those 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 thoroughly but sparingly, and see that the iron is hot before you apply it.

Of course you can't employ small tin-snips 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.

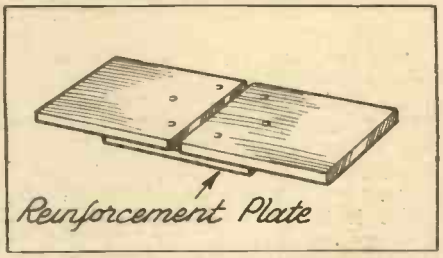
A Useful Method.

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 jobs. Soft copper rivets are no good, though, where there is any real strain on the job. For

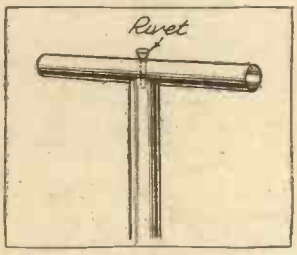
(Continued on next page.)

JOINING FLAT METAL



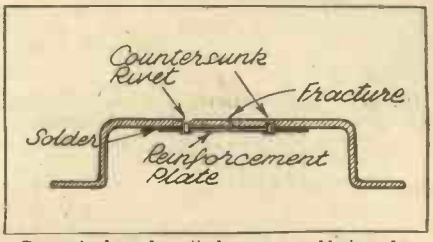
A metal plate, riveted to the pieces of metal to be joined, makes a strong job.

FOR SECURITY



This is an instance where soldering can be valuably aided by a driving-fit rivet.

A NEAT REPAIR



Do not depend entirely upon soldering for strength, but make use of rivets as well when possible.

TO START HOLES

An Archimedean drill is often better than a centre punch for metal working.

SIMPLE METAL-WORKING

(*Continued from previous 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.

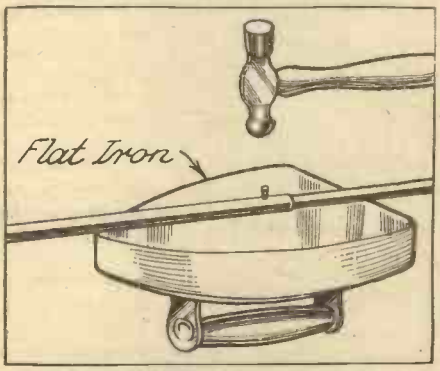
Making It Quite Secure.

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!

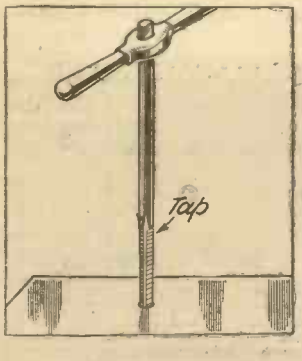
Maybe not a "professional" job, but one that is fully effective. It is worth noting that the tricycle concerned with the operation had been taken to our only local cycle shop, which had estimated the cost of the repair at one guinea. It took me about half an hour to do!

JOINING METAL TUBES



Simple rivets made from wire nails are ideal for joining telescopic tubing.

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,



GIVES GREAT STRENGTH

A threaded hole removes much of the strain from a nut.

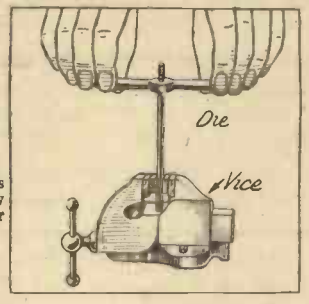
because in this event the strength of the rivet is its tensile strength, and in the case of, for example, a stout nail, that will be tremendous.

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

HOME-MADE BOLTS

A set of dies will amply repay their cost.



lying in it, the whole onus 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 thumbscrews on to a bench, table, or even chair, and I hammer things flat on it in preference to banging at them on a vice. Vices are mostly of cast metal, and fracture rather too easily if hammered. That is, the small ones do.

NEXT WEEK

Don't Miss Our Special Triple-Gift

S.T.700 NUMBER

NOTES ON TELEVISION

By L. H. THOMAS.

WITH the release of technical data by the two firms responsible for installing the B.B.C. transmitters, and the cheering news that programmes should be starting by next March, we "televisionaries" feel that we have something to work on at last.

As far as the details of the two systems are concerned, they do not affect us very much on the question of receiver design, which, I suppose, is the side of things that we are most keen on at present. Those who are going ahead with time-bases, however, will be able to make full use of the particulars of the synchronising signals, depth of modulation, and so on.

I cannot help wondering how many readers are working on their own time-base units. Very few, I should imagine, although surely everyone would be able to tackle one from a published design.

Next Year's Sets.

At the same time it seems pretty certain to me that the average home-constructor's television receiver, next year, will consist of a home-built ultra-short-wave receiver and a "bought" time-base, whether the latter is purchased complete or built up from a kit.

Talking of receivers, a friend of mine who seems to have access to an unlimited supply of "Acorn" high-frequency pentodes, has built an ultra-short-wave set with three signal-frequency H.F. stages! He is not yet completely converted from the superhet, but says that his scheme has such possibilities that he quite thinks he will use it for his proper television receiver.

In most parts of London quite a strong signal would be picked up from the Alexandra Palace, and a receiver with two H.F. stages and an anode-bend detector might easily give sufficient output to operate a C.R. tube.

A Powerful Signal.

Amateur transmissions on 5 metres can be received at very good strength without using either a superhet or super-regenerator, and the power employed, in most cases, is quite negligible.

A 10-kilowatt signal on 6 metres will be a very different proposition, and ought to be quite strong on a detector *only*.

I wonder how the problem of local interference from the Alexandra Palace will be tackled? It is in the centre of a fairly thickly populated area, in which there must be scores or hundreds of relatively unselective receivers. The Baird transmitter at the Crystal Palace called forth rude letters from broadcast listeners up to distances of over a mile, although in all cases they were found to be using sets with the aerial straight on the detector.

Tuned traps, or even H.F. chokes of suitable size in the aerial lead, cured the trouble in practically every case. After all, there isn't much enjoyment, on the broadcast bands alone, in owning a flatly-tuning receiver nowadays. A 10-kilowatt "local" will just about remove any quiet spaces that *are* left on the dial!

The ROBOT Editor

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.

SUBTLETIES 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 so on. These developments form part of a well-thought-out scheme for making the most of recording possibilities for brighter, more lively broadcasting.

Naturally, the first few months of recording work have involved a good many make-shifts—the mobile unit itself is only experimental. Now, based on working practice, the engineers have a pretty good idea of what they need. And that's why the Mixer has been designed.

An imposing affair it is. Rather like a Dramatic Control panel to look at, perhaps, but infinitely more subtle in its uses. First, I will give you a brief description of the Mixer and then try to show some of its uses.

Before we go into details you may as well know that the new gadget has been brought into service not only to make the recording of programmes—from one or more sources—easier than it has been, but also to "produce" for broadcasting records already made.

Ten Separate Channels.

The Mixer has ten channels, as they are called, each being a source of programme material. Now this material may be straight from a studio, it may be from a distant "O.B." point, or it may be a record.

The flexibility lies in the ability of the Mixer to merge any desired proportion of the various channels to make a composite programme. Each channel has its own potentiometer control for this purpose.

Six of these ten channels on the Mixer are permanent connections to the outputs of six pick-ups, associated with six turntables, arranged on what the B.B.C. calls a multigram desk—that is, a gramophone with six distinct outputs.

Each turntable can be started up separately by its own switch, the output of the pick-up being taken through a potentiometer to its main channel. It must be understood that this "pot" is merely a smooth switch for turning on the output of its pick-up.

One of the most useful features of this desk is the provision for "pre-fade" listening on headphones. A pair of phones can be plugged into any of the pick-up's outputs without in any way interfering with the work of the channel as a whole.

Well, that disposes for the moment of the first six channels. The other four—from seven to ten—are recording as distinct from reproducing channels. They can be connected to any programme source normally available—such as to a studio or outside broadcast point, or even to a commentator's microphone fitted up in the Mixer's room. "Pre-fade" listening is also provided on these channels.

So there you have the ten channels ready to provide some kind of programme material—either real life or recorded, local or distant. What then? It is up to the Producer. He can mix these sources as he pleases—passing the final output through a main control potentiometer at the very right-hand end of the Mixer. This output is then taken by the Control Room in another part of the building either for broadcasting or for recording at Maida Vale.

Incidentally, the Producer himself has an aural check on the result of his mixing, for in the Mixer room there is a monitoring loudspeaker connected to the final output.

Now I should explain that in the physical layout of the Mixer the main Producer's control panel or desk—call it what you like—is necessarily some distance from the multigram desk where the turntables are revolving. It is, therefore, essential that a foolproof system of cueing should be at the disposal of the Producer at his desk and the engineer minding the turntables.

All of which has been most ingeniously 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.

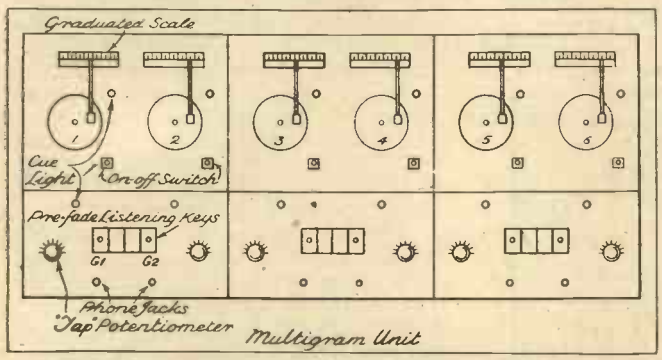
Let us watch the whole box-of-tricks at work. The Producer, we will assume, is ready to do his stuff at the main Mixer. The engineer is standing by the turntables, all of which may be revolving, with their individual pick-ups poised above, ready to be lowered when the signal is given.

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

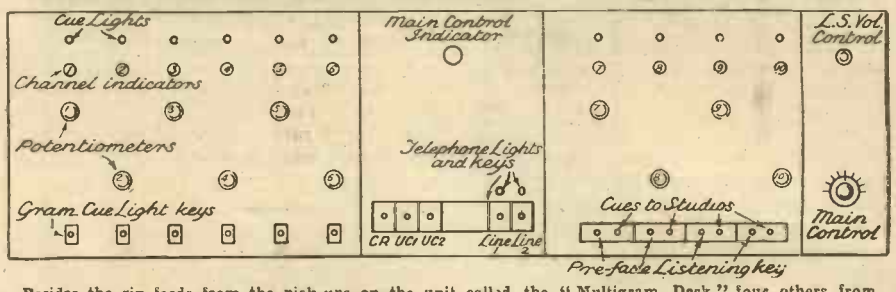
(*Continued on next page.*)

THE B.B.C.'s "MULTIGRAM DESK"



This unit, with its six turntables and pick-ups, is attended by an engineer who gets his signals from the operator at the mixer panel diagrammised below.

THIS IS CALLED THE "RECORDED-PROGRAMME MIXER"



Besides the six feeds from the pick-ups on the unit called the "Multigram Desk," four others from studios are fed to the elaborate mixing panel.

THE ROBOT EDITOR

(Continued from previous page.)

cue 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.

Cueing 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, 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 really effective indication of the actual programme content of any part of a record. One cannot, obviously, tell what a record is all about simply by looking at it—careful playing through and makeshift marking must first be done.

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 when 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 in, 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 uses of the Mixer when I watched him "playing" the controls during a rehearsal of a programme.

"Let us take the Boat Race as a classic example," he explained. "We will assume that, for subsequent broadcast, either in the home or Empire programmes, we put through the O.B. signals via this Mixer to Maida Vale, where a continuous recording will take place. Meanwhile, at the Mixer we can be noting down the 'highspots' that will be wanted. All we have to do is to keep an eye on the two indicators, showing the number of record and groove.

"For the sake of example, let us assume Cambridge goes ahead. Right. We note that happens on, say, disc two 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, but 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 Palais de Danse, who have recently joined the list of bands who broadcast.

USING AN ALUMINIUM CHASSIS

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. Any other 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 earth in this way you avoid the possibility of what are sometimes called "loop" circuits in the metal of the chassis.

It seems a very strange thing, but it has often been found that to connect different earth leads—that is, leads intended to be connected to earth—to all different points on a chassis has led to a curious kind of instability very difficult to track down.

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 some year sago in the laboratories of one of the large American electrical concerns. It had a calculated gas-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.

USED IN RADIO

The Langmuir mercury - condensation vacuum pump used for exhausting radio valves.

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 equalled 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 50 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 give 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 up 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 to the sides of a double-walled cooling jacket of the apparatus through which cold water is continually flowing. The 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 have 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.

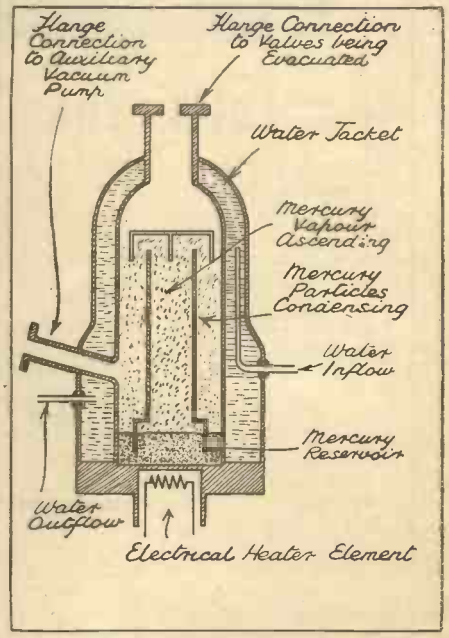
Why the Valves are Heated.

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.

INSIDE THE PUMP



This sectional sketch shows the various working parts of the mercury vacuum pump.

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 heated

(*Continued on page* 179.)

ON THE SHORT WAVES

THE "SUPER-REGEN."

In dealing with the subject of super-regenerative circuits, W. L. S. explains how an ordinary single-valve short-wave receiver may be converted to this type of set.

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 wavelengths.

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. won't 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 *without* 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, L_1 and L_2, 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 750 for the anode.

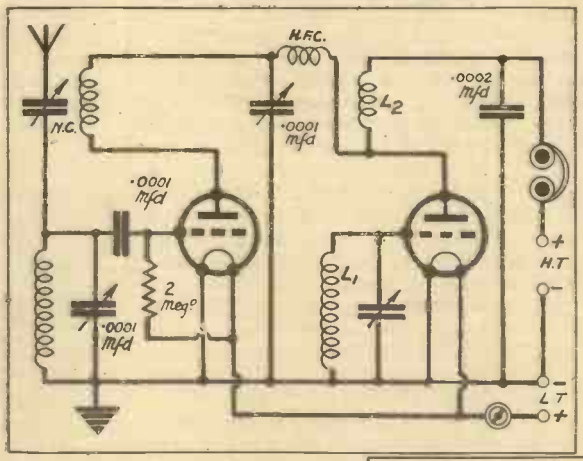
Varying the Frequency.

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 ·0002 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 long-wave, i.e. low frequency, oscillator, usually operating just above the audible frequency limit—at 15 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 that 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.

TWO METHODS OF QUENCHING



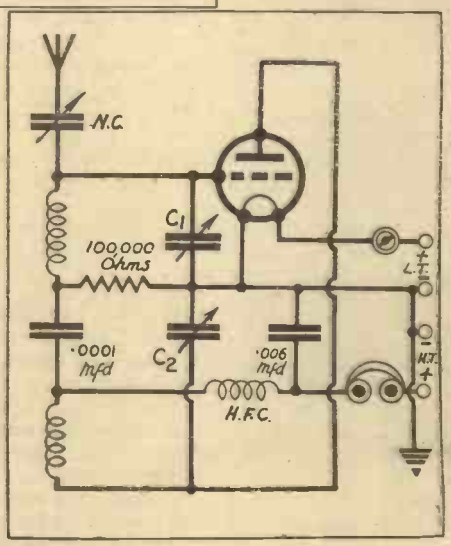


Fig. 1, above, shows a super of the type in which a separate quench valve is employed. In Fig. 2, right, quenching is achieved by grid choking.

★ ★ ★

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 squeals are heard as one tunes-in signals—just the modulation.

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.

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 waves, and is therefore ineffective at the quench frequency.

The tuning condenser (C_1 and C_2) 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 ·005 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.

ON THE SHORT WAVES—*Page 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 whatever 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

In this corner of the laboratory owned by a Calstock enthusiast, can be seen a 12-valve short-wave superhet with the speaker mounted above

saying all sorts of nice things about the " Simplex " Two, built at a cost of 7s. 6d., including headphones (6d !). The other is from a reader who doesn't seem to like my sets, somehow, and suggests that I should drop radio and start building Meccano models.

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.

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 terrific 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 dance-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, Jo'burg 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). It is put up there to save room and just serves to amuse him with the local programme while he is working. A good idea that others might copy.

Local " Fans " Required.

M. S. (Harlow), who used to be a " regular," 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.L." Two user, 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 8 p.m. on the 40-metre band, and again between 7 and 8 a.m. on both 40 and 20.

(3) Is L Y 1 A G the correct call for a Lithuanian amateur ? Yes.

SHORT-WAVE NEWS

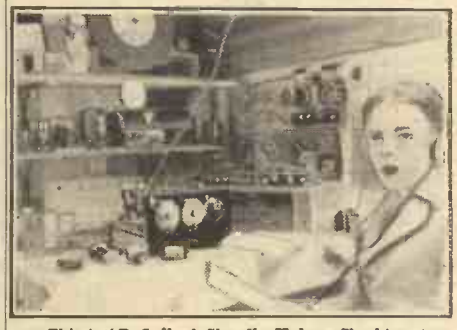
ARMISTICE WEEK-END, November 9th-11th, will be a red-letter day for Empire listeners this year. The following programmes are to be radiated from the Empire station : The Jewish Ex-Servicemen's Remembrance Parade, from the Horse Guards Parade ; Excerpts from the British Legion Festival at the Albert Hall ; 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 6th is also being broadcast in the Empire programme. The service will be relayed in its entirety, and the scenes outside Westminster Abbey before and after the ceremony will be described by Howard Marshall.

Conditions at the time of writing show

A LISTENER'S DEN



This is " P. S.." 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 49, which is usually a good sign. The 19-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 O N 4 A U 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 favourably with the broadcast station on 19 metres.

From Our Readers

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 old analogy of the well-worn pebble being dropped into the same old pond will continue to meet my requirements till more recent conjectures 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 to us 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 sound travels depends upon the density and elasticity of the medium employed, and is it not reasonable to assume that the same laws govern the propagation of light and electro-magnetic energy?

In concluding, with apologies to Mr. Einstein, I firmly decline to entertain the supposition of warped nothingness till someone can put forward a rational objection to our old ether theory.

Yours truly,
G. F. Lamb.

3, *Clumber 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. L. James raised the question of 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-townsman—a Mr. Wright—I am tempted to add my contribution to the increasing correspondence of this "ethereal" 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 consigns in the wake of several other abandoned scientific theories. Indeed, in its place he leaves us with "nothing" or "empty space." May I introduce a little relativity? Does Mr. Wright refer to the Space-Time Continuum of relativitists 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 analagous 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 of radiation that have been previously attributed to a material ether. This, I understand, is being done, in effect, in the more advanced realms of physics.

However, be that as it may, my nightly radio entertainment continues to arrive, despite all phases of scientific opinion regarding the ether's existence.

Yours truly,
Thomas Twiggs.

27, *Harris Street, Fleetwood, Lancs.*

ONE GUINEA FOR A LETTER!

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

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

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

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

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

TWO ENTHUSIASTS.

Sir,—I have been interested in S.W. reception for some time, but until January of this year I was unable to sample the joys of this branch of radio.

Since that time, however, my friend and I have built about twenty receivers, and have had only six failures.

Most of our sets would have given "W.L.S." a fit, had he seen them, but they were nearly all capable of bringing in Schenectady W2XAD, on 19·56 metres.

My own receiver, a Det.-L.F. arrangement, incorporates a commercial dual-range coil, tuned by a ·00025-mfd. condenser. (Incidentally, this combination will be scrapped as early as possible.) This set was built during the early part of last month, and, due to financial difficulties, I was unable to procure the required valves. Therefore, I "borrowed" the valves from our broadcast receiver, and tried various pairs in the two stages of my Short-waver. As a result, I am using a power-valve as detector, with an L.F. in the output stage. Yet, apart from "ploppy" reaction, the set functions perfectly.

Yours truly,
G. Rignall.

77, *Granville Street, Peterborough, Northants.*

SOLUTION WANTED.

Sir,—I am employed in a radio shop, and often try to puzzle out the little mystery which I relate below:

With about half the radio repairs brought to the shop the owner brings the receiver, and his conversation usually takes the following lines:

"Would you please repair this set? Of course there is not much the matter with it: just some simple trouble."

He then informs you that "he knows a bit about wireless," but fails to explain why he, "knowing a bit about wireless," brought the set to you.

There is another type, who will admit he "does not know much" about the game, but you could never get him, or the other type, to admit that his knowledge of radio is conspicuous by its absence.

Now why do these gentlemen adopt this pose when they probably would not dream of saying that they "knew a bit about" plumbing, carpentry, or any other trade?

Perhaps some kind reader will enlighten me, or, better still, perhaps one of the "guilty" will even read this letter.

Yours truly,
S. Davies.

11, *Wandsworth Road, Liverpool.*

A KEEN CONSTRUCTOR.

Sir,—In 1927 my parents decided that we should have a wireless set. It was purchased, and proved to be a "Marconiphone V.2. Long Distance Set." The aerial was erected by a "wireless man," who risked a broken neck climbing a tree. I was about fourteen at the time, and had just left school. My one ambition then was to possess a set of my own. A crystal set was being offered for 150 coupons by a cigarette firm, so I collected the coupons and sent for it. When it arrived, about Christmas-time, I tried it out on our aerial. Not a sound. I gained permission to erect an aerial and earth outside my bedroom window (we were in a bungalow at the time), and on one Sunday afternoon I heard faintly some speech and music. 2 L O. Oh, boy, it was good!

A wireless friend gave me a transformer (which I still have), two Marconi valves (since blown), the remains of a crystal set, and a large bundle of wire (looking like a ball of wool the kitten has finished with). Home I went, and in due course built an L.F. amplifier for my crystal set; this, together with a new crystal, was a great improvement. But I tired of it. Why not a one-valver? So I built one, having purchased some plug-in coils and a condenser or two, and (after a visit to the wireless friend) the biggest piece of ebonite I had ever seen.

(*Continued on page* 178.)

"STRAY" ELECTRONS

How They Create Interference

By J. C. JEVONS

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 "atmospherics" 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 band-pass inputs, 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."

Luckily 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 loud-speaker.

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 tiny 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. stages 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 occur here and there according to chance. As this is not a stable condition, sudden changes of distribution will occur from time to time, which naturally produce "crackles" in the loudspeaker. "Wall" charges are also very sensitive to any stray fields of disturbance outside the valve, so that the valve is likely to be "noisy" on this account.

Some of the stray electrons will come to roost upon other foreign parts of the electrode system, such as the insulators or conductors forming the supports. Here again the magnitude and distribution of the "charges" will largely depend upon chance, and this again introduces an undesirable factor of uncertainty in the working of the valve.

Sometimes, when a set is run from the mains, the anode receives its full positive potential some time before the cathode warms up sufficiently to produce its normal emission. During this time, particularly, the electrode insulators and the inner wall of the bulb are liable to be positively charged by leakage current from the point where the anode is fused into the glass. Should any stray electrons strike against these positively charged parts, secondary emission is likely to occur, and for the time being such parts start to function as extra electrodes. But since they are all capacitatively coupled to the electrodes proper, they react one upon the other, and so give rise to disturbances, which are then magnified up in passing through the subsequent amplifier valves.

A Special Anode "Trap."

Metallising the glass surface of the valve tends to prevent the formation of "wall" charges, because the metallic film is connected to the filament, and so is kept at a uniform earth potential.

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 all other sources 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 walls of the tube.

Should any electron attempt to overshoot the anode, by taking a curved or fringing path, it is promptly "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 the famous Dr. Armstrong, of "super-regen." fame. We may expect to see some ingenious cures developed.

A FINE McMICHAEL SUPERHET

Listening to the latest McMichael 5-valve 7-stage A.C. superhet. Twin moving-coil loudspeakers are fitted, and the set is equipped with a giant tuning dial, illuminated by overhead floodlighting.

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. E. 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 overcome left me gasping.

In one case, for instance, in which he was called into consultation, a noisy generator was causing interference to listeners nearly fourteen miles away! It seems almost incredible, doesn't it? It appears in this particular case that the static was being picked up by wires in the vicinity of the motor, and was being carried along the wires 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?

I think we have cause to be very thankful that enterprising firms such as Belling & Lee have devoted so very much time to this problem, for otherwise it might be a jolly sight worse than it is.

Credit should also be given to the invaluable work that is being carried out by the Post Office engineers in this direction. But the success of their endeavours is dependent to a large extent upon the co-operation of the listening public, for they obviously cannot track down a source of interference unless it is brought to their notice that the trouble exists.

Will readers please note that applications for the catalogues reviewed in "The Link Between" should be addressed to G. T. Kelsey, John Carpenter House, John Carpenter Street, London, E.C.4., mentioning the number given at the end of the review.

If, therefore, you are experiencing a chronic form of "man-made" static interference, you will be rendering a great service both to yourself and to others if you report the matter. Forms for this purpose can be obtained at any post office, and the advice offered is quite free.

A Fine Constructor Book.

It is a noted characteristic of Ferranti that when they do a thing they always do it well. Little wonder, therefore, that I should find so much to eulogise over in their booklet entitled "Constructional Power Amplifiers."

This booklet is just the thing for anybody who is anxious to construct a really super amplifier, for it is produced by a firm whose reputation in the radio world has been built up on its vast knowledge of all matters connected with audio amplification. And the great thing about this booklet is that it is presented in a way which anybody can understand.

It contains full constructional details, including circuit and wiring diagrams and photographs, for four different amplifiers, ranging from a battery-operated amplifier giving an output of approximately 1,000 milliwatts to an all-mains version (A.C.) capable of providing an output of approximately 12,500 milliwatts.

The booklet is priced at sixpence, and "P.W." readers can apply for it through the medium of our catalogue service, *providing a sixpenny postal order is enclosed to defray the cost of postage.* Applicants failing to comply with this simple regulation will, I am afraid, risk disappointment. (377)

Wright & Wealre's Latest.

I think it is probably true to say that coils go out of date quicker than any other radio component, not because of any inherent failing in the coils themselves, but due to the rapidly changing conditions of the European ether.

And it seems a pity to have to scrap a set of comparatively recent vintage merely because the coils are not adequate for modern requirements.

But why contemplate scrapping it when a change of coils might meet the case?

Those of you to whom these remarks apply would be well advised to obtain a copy of the latest Wearite catalogue, for therein you will find details of a large number of coils that will enable you to bring your sets up to date. (378)

RADIOTORIAL

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

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

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

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

QUESTIONS AND ANSWERS

IS THE OSCILLATOR OSCILLATING?

F. P. (Sanderstead, 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 the bit about the fingers because it is a *mains* 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 into the 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 oscillator itself if other connections go 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 short 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 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-Taggart'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 connecting 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 accentuate any liveliness 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.

"But I have got a spot of trouble that does not seem to have occurred in the other cases that I know of. It is a definite falling off in sensitivity on foreign stations since the new arrangement was fitted.

"I do not notice any difference on the more powerful stations (except the improvement in freedom from 'atmospherics') but on the weaker stations I feel that the set is not pulling its weight as it used to. In fact, it feels as though it might be a little off-tune or mis-ganged. Do you think the new aerial might have that kind of effect?"

It is quite on the cards that the alteration to the aerial circuit has thrown out the aerial trimming, so we should adjust to a weakish station on the lower part of the medium waveband, and try the effect of re-trimming the aerial circuit. (Don't alter the other trimmer, or trimmers; they could not possibly be affected by aerial alterations.)

If there is any maladjustment due to the use of the screened lead its effect will almost certainly be to require a decrease in the aerial trimming, so slacken off slowly and try to find a new position, giving better results than the present setting.

Should the trimmer be already almost at its minimum, and only slight reduction possible, you will have to increase the others slightly, but avoid alterations to them if you can.

SAVING THE S.G.'S CURRENT WHEN WORKING ON GRAMOPHONE PICK-UP.

S. W. S. (Lewisham, S.E.).—"I hope to go over to mains valves after Christmas, but is there anything I can do till then to cut down H.T. battery costs? What I mean is, can I put in a switch to cut out the S.G. valve when it is not being used?

"As I am over to records quite a lot. I wondered if there was any need to keep the H.F. valve alight then? I know it is not taking a big current, but believe me every speck I can save I shall be glad of, as it is the H.T. batteries that seem to run away with the money in my set. The last battery lasted only a month."

There is usually no objection to breaking the H.F. valve's filament circuit, by means of a separate on-off switch, and so cutting this valve out of action

(*Continued on next page.*)

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 dud condenser, faulty insulation, or some similar foe to the H.T.

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 S.G. valve.

THE WIRE FOR LOUDSPEAKER EXTENSIONS.

C. G. B. (Winchester, Hants).—"Does the wire used to connect the set to an extra loudspeaker (a 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. (Lanark).—"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 off-set 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-obtained bias is not constant in the same way. When the H.T. ou 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 caused it, so there is an automatic tendency to correct any fluctuations when a biasing resistance is used.

Since the operation takes place instantly and without external adjustments of any kind, it is known as automatic bias.

BARRY KENT CALLING

News and Views from the "Big House."

Radio Variety.

ERIC MASCHWITZ, the B.B.C. Light Entertainment chief, tells me that his plans for "Radio Variety" are making good progress. The finished product will be revealed early in December. This is the first serious attempt to get away from the ordinary stage and music-hall technique.

The chief difference will be intimacy of appeal, the artists addressing themselves to the individual listener and disregarding the physical audience, if any. It is high time that such an attempt was made. The public have not been happy about B.B.C. Variety for a long time and have not known the reason.

* * *

An Applause Problem.

The Music Department of the B.B.C. is very indignant because the applause of the last concert of the Promenade season was "cut" from the microphone after five minutes. Apparently the climax of enthusiasm was reached five minutes later, when the audience sang "For He's a Jolly Good Fellow," and gave Sir Henry Wood the greatest ovation of his forty-one years at the Queen's Hall.

Most of this was denied to the listening public. Strong protests have been lodged, and it is believed that the matter will be adjusted in future years.

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 imminence 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 reorganisation 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.

USING MAINS VALVES

IN a set which is required to give a high undistorted output, say 3 to 5 watts, it is 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 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 the resistance net-work is properly devised there are likely to be serious variations of anode voltage as the grid bias is varied.

THE "CIRCLE"

Candid comments on recent programmes by our Broadcasting critic.

TO me 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" we had ninety minutes brimful of interest. Of course, I didn't listen to every item of the week, and I may have missed a gem.

* * *

The Proms. have finished, only to give way to a fresh series of concerts of identical nature. The latter have taken the same hour and a goodly length of time. So we are as we were. We score nothing. Where broadcasting is concerned music is still the aggressor.

* * *

But The "Circle" atoned for much, thanks to the play and the players. I thought Austin Trevor as Arnold Champion-Cheney, M.P., gave a superb performance. The way he altered his tone of voice to suit his changing moods and circumstances was very clever. At first (before he was disillusioned) he reminded me strangely of Noel Coward and his clipped forceful phrases.

"Perfect For The Occasion."

Finally, when he was acting according to his father Clive's instructions, in the interview with his wife, his voice and manner underwent a complete change, but perfect for the occasion. His part was a big one, and thus he was as responsible as anyone for the success of the broadcast.

* * *

Ronald Squire acted as we expected he would. The complete cynic. He was this throughout. The part called for it.

* * *

Eva Moore (Lady Catherine Champion-Cheney) provided all the comedy—such rich comedy, too. Her type of part is familiar. Though we scorn it, we are amused by it. Wonderful character-drawing this. Eva Moore interpreted the part to perfection.

* * *

Lord Porteous, played by Harcourt Williams, was a trifle overdrawn, I thought. His rasping irritability produced too many unwonted vibrations in the loudspeaker when he first appeared. The stage copes with this better than the microphone. It was just too unpleasant a noise to be enjoyed. He became mellower as the play progressed, and I liked him better for it.

The vivid, forceful language of Somerset Maugham is a joy to listen to, especially from such a cast.

* * *

One noticed that the producer employed one effect only. Right at the end of the play one heard the departure by car of Elizabeth and her lover, Teddy Luton. But the effect was striking, as the departure coincided with a boastful claim by Clive 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.

* * *

Val Gielgud should be very satisfied with this broadcast. It will not be soon forgotten.

* * *

It is clear that the series "I Knew a Man" is the series of the term. Following H. G. Wells' talk on Huxley came Professor Noel Baker on "Nansen." This again was a vivid talk teeming with interest and hero-worship. An extra feature was the speaker's excellent voice and delivery. I have never enjoyed either more.

* * *

"Young Ideas" is a veritable mixed grill. This week it included Sir Malcolm Campbell offering such counsel to the young as: "Never mind failure. Anything you get 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. Then a learned talk on the stars, with the hint that new stars may still be discovered if we look for them. The fourth item was an impossible story with a snag 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 a lot of fairy-story stuff we would tell our babies. On the whole the bill was very mediocre, as might have been expected from such a title.

* * *

The Western Brothers were alone 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, chaps! Jolly good show!"

C. B.

AN ALAN HUNTER INTERVIEW.

"THE 'GUV'NOR' GAVE ME MY CHANCE!"

Says Len Bermon, who is Leaving Henry Hall's Band.

DARK, alert-eyed, smiling Len Bermon, 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 Bermon is what one might call one of the veterans of the band. He joined Henry Hall's "boys" six months after they had got together. He came as drummer—from Jack Harris's Embassy Club band—but he was to earn name and fame among thousands of listeners as 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. "Like to try it, Bermon?" asked Mr. Hall. And the anonymous drummer of the band stepped right into the limelight 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? Well, 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 Guv'nor's' confidence in me that got me on. 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!"

And so Len Bermon joins the ever lengthening trail of stars made by Henry Hall. Phyllis Robbins, Kitty Masters, Les Allen, and now Len Bermon. 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.)

Something like sixteen inches by thirty! Of course, my pocket-money did not allow new parts, so sometimes, as in the present case, I "scrounged" from the only real wireless shop we had. This set was a success.

It was then that I "blew" my first valve, by putting the 100 v. H.T. where the 2 v. L.T. should be. This cooled me down a bit, but I soon bought some valves at 3/6 each, bright emitters, of course; these went well. Then I came across a circuit for a reflex set, which I built. This was at the time Marshal Foch was buried. I received Paris at loudspeaker strength, and was bucked no end! Having made too much mess, I was banished to a room in the roof.

A friend gave me a horn type loudspeaker unit, and, with tins of graded sizes, I made a horn to fit the unit. This was another success, but not good to look upon. Cone speakers came next. I bought a unit and made a cone, getting good results. It was not enclosed with the set in a cabinet, as my sets rarely had a cabinet, and were in pieces too often to need one!

It was about 1931 before I tackled short waves. The first time I heard America—Pittsburgh, I think it was—the roof nearly went off! Not long after this we moved from Hampshire to our present location, and one of my greatest troubles was hand-capacity, until I built the "W.L.S. Short-Wave Two," and that was grand. Even so I am afraid I did not use the specified coil.

Any hints and tips, circuits, etc., which I found good I cut out and kept. And although at times I have wandered to other sources for information, in the end I have returned to "P.W." Also I can assure "W.L.S." that I have duly digested his words contained in May 18th, 1935, issue re "Tidiness." My room is A1 as regards tidiness!

Wishing every success to "P.W."

Yours truly,

R. E. A. Langridge.

St. Nicholas House, Milton Road, Dovercourt, Essex.

JUDGING THE TONE

(*Continued from page* 159.)

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 musical register, they add that little something which enables you to forget you are listening to a radio set and imagine you are hearing the actual performance.

It should be mentioned that a good reproduction of top can only be obtained from a station which is received at much greater strength than its neighbours, otherwise interference will be excessive. This will often limit high quality reproduction to the local stations. In any case, one usually listens to the locals more than any others, so it is worth while using a tone control to cut down the top 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* 168.)

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 yellowish, 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.

Despite, however, the most careful pumping and the most efficient "gettering," the modern valve, prince of radio products though it may be, still remains, as we have already seen, an imperfect article, so far as its completeness of evacuation is concerned. Nature, it would seem, really does abhor a vacuum. At any rate, she has made it apparently impossible for us, even in this age of multitudinous scientific resources, to produce that ideal state of emptiness

TECHNICAL JOTTINGS

Items of Interest to Every Enthusiast.

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

Interference.

IN these days of all-mains receivers, having aerial, earth, and mains connections, there is no shortage of interference. There is a plentiful supply of interference from every conceivable kind of electrical appliance, and if you happen to live on a main road with electric trams or 'buses, or near an electric railway, you have a little extra that the others haven't got.

In these circumstances it is not surprising that all kinds of experiments have been made to try to shield the aerial and the earth from picking up unwanted signals.

Shielding the Aerial.

It seems rather a contradiction to shield the aerial, because the very purpose of the aerial is to pick up anything that is going. But if you come to think of it for a moment you will see that it is possible to have the aerial so arranged and in such a position that it picks up the wanted transmissions but does not to any serious extent pick up local electrical interference. This, as a matter of fact, is not very difficult to arrange, but the trouble arises when we make a connection to this well-positioned aerial and bring the connection from the aerial to the set. This down-lead has to pass right through the enemy's camp, as it were, and it is often in *this* part of the aerial circuit that most of the trouble occurs. Consequently, if we adopt shielding of the down-lead, we may succeed in cutting out a good deal of interference which was previously received, as we thought, "on the aerial," without seriously reducing the pick-up efficiency of the remainder of the *un*-screened part of the aerial. A good deal of success has attended this type of shielding.

Dealing with the Earth.

For some curious 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.*)

TECHNICAL JOTTINGS

(Continued from previous page.)

which is available to all listeners with any genuine technical complaint. If you have any trouble with your reception conditions for which you cannot find a remedy, it is open to you to communicate with the B.B.C. or with the Post Office, and they will do their utmost to investigate it with a view to removing the cause.

Oscillation Troubles Over.

Not so long ago oscillation was one of the great troubles, but that was due to the extensive and often excessive use of reaction. Since those days we have had the high-frequency screen-grid valve and the H.F. pentode, and with these and other refinements in the pre-detector stages uncontrolled oscillation has become a thing of the past. I think it is fair to say that to-day the old oscillation nuisance has practically ceased to exist.

There are, of course, other kinds of troubles which have, to some extent, taken the place of the oscillation trouble; in particular there is the electrical interference of all kinds, to which I have already referred in these Notes. This again is a trouble which has been specially investigated by Post Office engineers, and if you are unable to cure it by means of the various devices on the market which are available, the Post Office engineers may still be able to do something to help you to overcome your difficulties.

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 efficiency, however, it was not always necessary to go to the length of screening the H.F. coils. The coils were very efficient at that time and, as you know, the efficiency 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 rather misses the point. 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 of the coils prevents instability 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 net 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-grids with H.F. pentodes, and if this has run you into 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; 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 not come nearer to the coils 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 disfavour with up-to-date experimenters, however, who are now going in more for the use of the heptode frequency changer. This has a number of important advantages, one of which is that it can be used with an intermediate-frequency amplifier even at relatively high frequencies.

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 what I never quite see myself is the *need* for remote control. I can well understand the need for an extension speaker or 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 position where 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 one point. It is surprising what a lot of trouble comes from bad connections in a set. You would think that this would be the least likely cause of trouble; in point of fact it is one of the most frequent causes.

Bad Connections.

Some components are supplied with very tiny fiddling terminal nuts with milled heads, so small 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 substitute 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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