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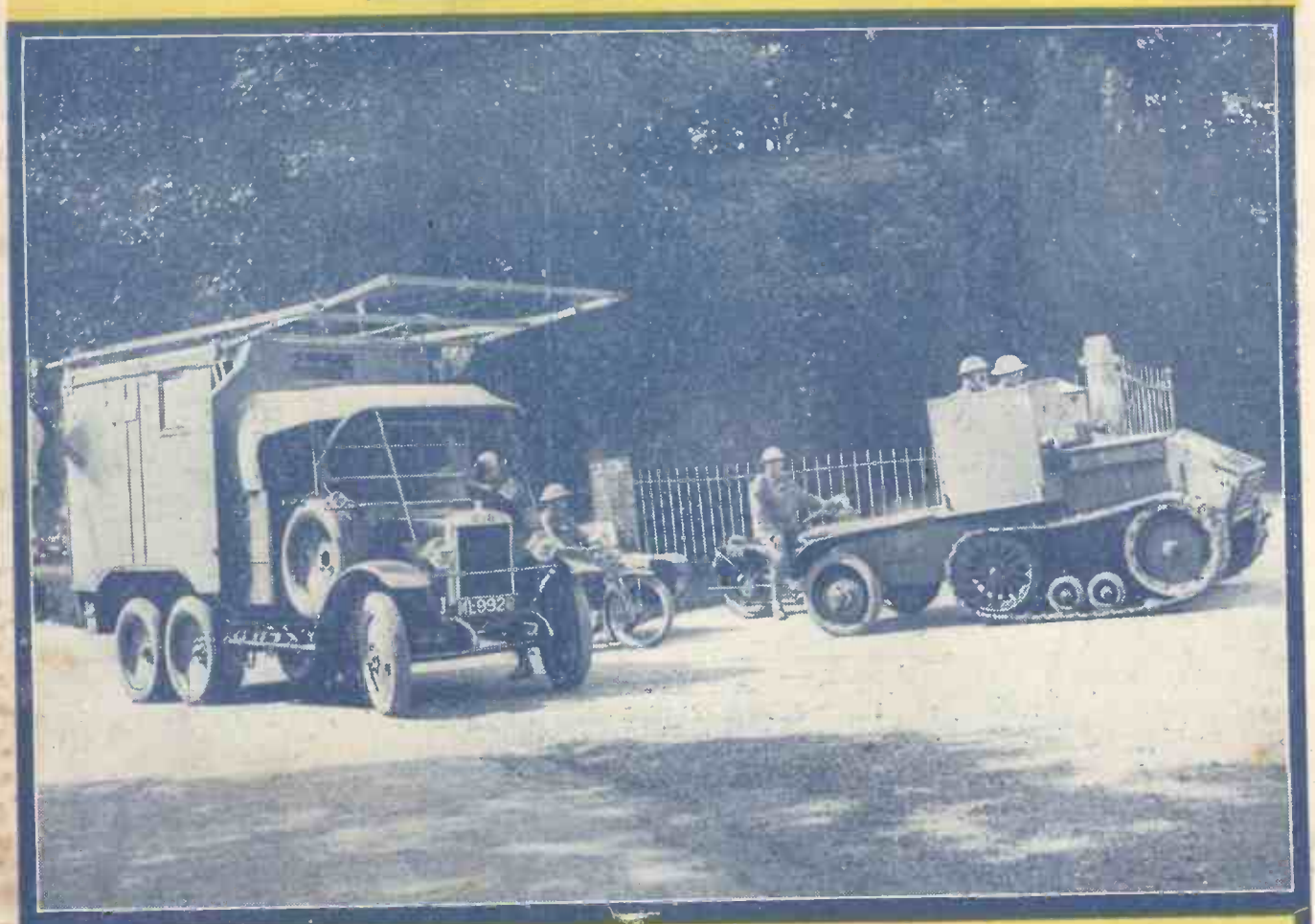
A CRYSTAL SET FOR 5GB (See Page 85)

Popular Wireless

Every Thursday PRICE 3d.

INCORPORATING "WIRELESS"

No. 276. Vol. XII. September 17th, 1927.



Special Features in this Issue

THE NEW UNIVERSAL CHARGER. A VISIT TO 5IT.
VALVES FOR USE IN REFLEX CIRCUITS. WHITE LINES IN RADIO.
SAFETY FIRST. BROADCASTING FROM AUSTRALIA.

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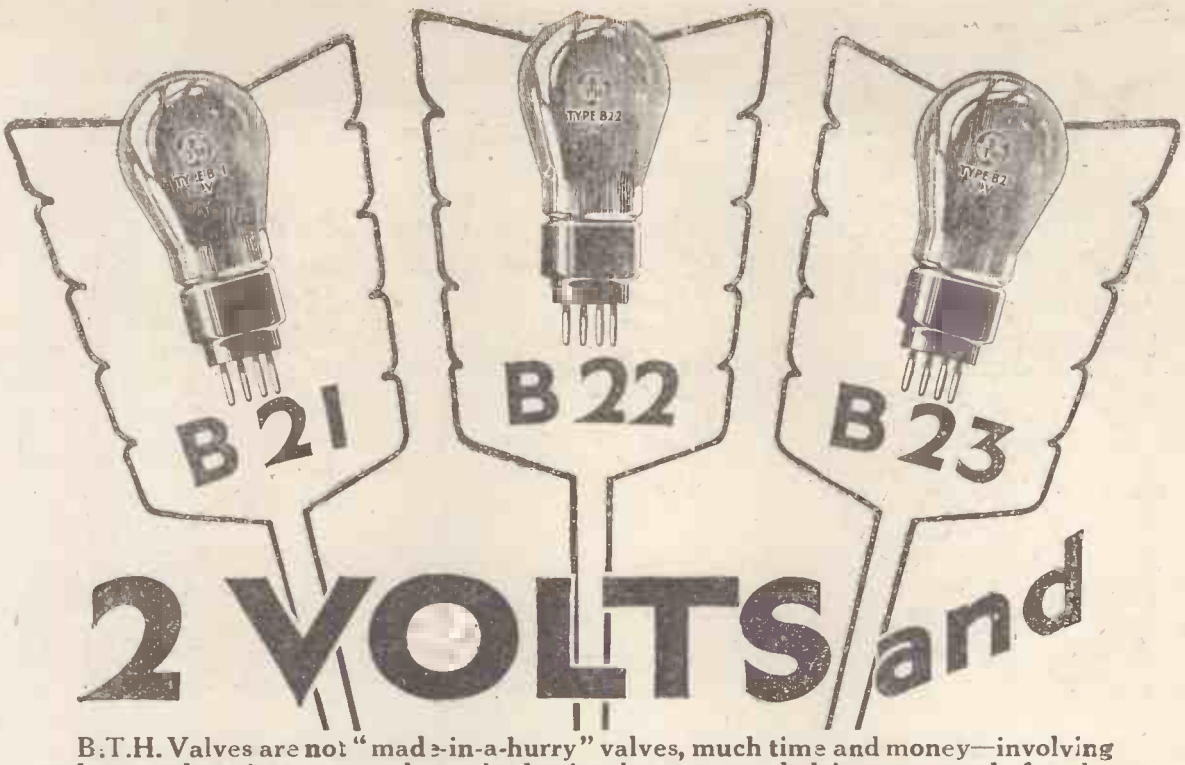

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RADIO NOTES AND NEWS.

Welcome, Little Stranger—Empire Broadcasting—Radio and Telepathy—Pity the Poor Crook—A Dogmatic Statement—Music and Molars—Broadcast Snips.

Welcome, Little Stranger.

TIME enough has passed since 5 G B opened to permit one to say that on the whole this station is doing well. Opinion has been very mixed, but I think the "thumbs up" have it. I myself, living not far from Keston, find the signals slightly weaker than those from 5 X X, but adequate; a little Morse, perhaps, but no other trouble.

Coils for 5 G B.

I HAVE no doubt that the poor results got by many people are due to the fact that they are not skilful manipulators, having done no previous tuning other than for their local or nearest station. Tuning is not simply a question of turning handles till the music comes; the secret of success is the arrangement of proper proportions of inductance, capacity and coupling. As to the new coil, if you get 2 L O with a 35 aerial coil, a 50 coil should give 5 G B; the reaction coil need not, in most cases, be changed.

Empire Broadcasting.

MR. MARCUSE'S article in "P.W." for September 3rd very clearly and moderately sets forth the facts of *his* side of this business, which are entirely satisfactory, and I believe we shall hear some remarkable reports about his transmissions. The facts are not so satisfactory in so far as the B.B.C. is concerned; indeed, I think the B.B.C. has been "caught out" and is trying to explain it to the "umpire." Its plea that it wants to be able to provide a perfect service, etc., etc., would be all right if such a long-distance service were at present possible. But we all know it is not.

The Australian Relay.

FOR example, on Sunday, September 4th, the B.B.C. relayed some items from Sydney, Australia, a pretty piece of technical work, too, but distinguished by that harmonic rise and fall in signal strength with which the transatlantic relays have familiarised us. Until that rhythmic "fading" is overcome no service over very long distances will come up to the B.B.C.'s standards. But even at this stage the results are good enough to go on with.

The Decrease in Licences.

IN our issue of August 27th, we published a letter from Mr. J. E. Bird in which he pointed out that there had been a drop in licence renewals during July; from this he argued a drop in the public's radio interest. No doubt he is right. Summer brings other attractions, and a corresponding drop in sales of apparatus. But I'll warrant that this winter will see more listeners than ever.

Fair's Fair.

A READER ("Satisfied")—glad to find one with that name—writes replying to Mr. Bird much in this strain, and adds the hope that Sunday will not be tampered with. Hear, hear! The items are in keeping with the day, and all round the B.B.C. is doing its best to please the majority. I suggest, ladies and gentlemen, that we give the B B.C. a rest from this nagging about the programmes. Let us sit back and reflect what they have accomplished. Really, it's a wonderful service!

Radio and Telepathy.

THE correspondence we are publishing about this subject is very interesting to me because I have experienced several remarkable experiences of what I imagined to be "telepathy." My state of mind regarding them is now one of scepticism. I had a long correspondence with a Professor of Psychology at the University of London, and he told me that the verdict of

(*Continued on next page.*)

5 W A's "SUNSHINE" CARNIVAL.

The Cardiff broadcasting station recently held a carnival in connection with its Children's Radio Circle in aid of local hospitals. In the above group can be seen Mr. Appleton, 5 W A's station director (extreme left), and Mr. Settle, the assistant station director (second from right).

NOTES AND NEWS.

(Continued from previous page.)

psychologists was that no case brought before them had passed the tests they applied. Moreover, the radio tests carried out at 2 L O and 3 L O (Melbourne) were "washouts." My information is that no instance of genuine thought transference has been recorded.

Practical Hints.

IN answer to Mr. W. L. Lawrence's letter in "P.W." for August 27th, which asked Mr. B. A. Starley for information about telepathy, the last-mentioned gentleman writes to say that the "receiver" must not try to render his mind a blank, nor must the "sender" use his will or try to hold the "object" in his thoughts. Will and senses are required to be out of action. Mr. Starley is encouraging enough to say that facility in achieving such quiescence can be acquired by practice. What I fail to see is how thought can be transferred if there is no thought to transfer. However, I don't wish to butt further into this matter; it's one for experts.

Programmes in Welsh.

THE long agitation for an all-Welsh station has elicited from the B.B.C. a statement that, having regard to its other obligations, it has done what it considers right to satisfy the artistic and linguistic aspirations of Wales. A considerable proportion of the Swansea and Cardiff programmes are in Welsh, and under the new regional scheme there will probably be more and more Welsh, but the B.B.C. "does not envisage the possibility of a purely Welsh service." I agree with the B.B.C.'s attitude for many reasons, but apart from high policy, which is doubtless behind its decision, I agree mainly because the language of this Kingdom is English.

Pity the Poor Crook.

ANOTHER risk has been added to the already exciting profession of thieving, for an American has produced an invisible, wireless-controlled camera, which operates in light or darkness, its shutter working whenever a person passes between it and a certain device fixed at one side of the room. It can take 160 pictures and works noiselessly. Not much chance of an alibi if you are confronted with a studio portrait of yourself with your hand in the till.

Weel, Weel!

AT last it has come. A Scots firm is about to launch a wireless shop on wheels in the form of a motor-van fitted with a demonstration set and a collection of radio components and accessories. It will also collect and deliver accumulators. It's a bright idea, and particularly suited to a scattered population. How comforting it would be to hear the wireless man's knock just as one's H.T. battery ran down!

A Dogmatic Statement.

THE "Birmingham Daily Mail" says that so far every radio photograph sent across the Atlantic looks as if it had had a bad crossing. As a joke—fair; as cold truth—rotten! I have seen a number of very fine examples of radio-photos sent across the Atlantic. What the blockmakers and printers have done with them is another matter. Let the Brum "Mail" hold its breath for, say, two months, and I think it will have a pleasant surprise. The new Wright system is a corker.

B.B.C. and Music.

SOME time ago, I remarked that the continuance of the Queen's Hall Promenade Concerts by the B.B.C. would be one of the wisest things that Corporation could do. I now beg to call attention to the overwhelming success of my prophecy. Everyone knows how fine the concerts are and how they have been crowded out. Sir H. Wood is now a firm convert to the belief that broadcasting helps music and the musical world, and I hope Mr. Gulliver and the theatre managers will note the attendances at Queen's Hall. Mr. E. Newman still keeps his nose at an extreme angle and will probably die in the last ditch with Sir. T. Beecham. Sorry!

5 G B.

AN IMPORTANT ANNOUNCEMENT

The B.B.C. announces that 5 G B can be definitely counted on for a year, during which no other new station will begin service transmission.

The Ter-ruth.

IN this connection I would point out that that very plain speaker, "Truth," in referring to the Queen's Hall concerts, says, "The microphone is a welcome addition and all the more so because there was no sign during the first week that the possibility of hearing the Promenade concerts on wireless sets has reduced the attendances at the Queen's Hall. On the contrary . . . . the hall was filled to capacity." Goodness me, can't "the other side" in this so-called war see that radio is the finest publicity it could possibly have? It stands out a mile!

Music and Molars.

I HEAR, with unmoved feelings, that a dentist has installed a receiver in his waiting-room, in the belief that his victims come to the chair refreshed and calmed for the ordeal. It is a coincidence that on the day before I got this item of news I had passed swiftly and painfully through a dentist's horrible hands. Looking back, I realise that if during the few minutes I waited anyone had asked me to listen-in, I should simply, without noise or ostentation, have strangled the fiend and poked his carcass under the table whereon the "Punches" of yesteryear lie. Yes, I think so!

Note for Clubbists.

TO that large and intelligent public living within reach of Stepney, E., I commend the Stepney and District Radio Society, which re-opens on September 19th at its headquarters, Men's Institute, L.C.C. School, Ocean Street, Ben Jonson Road, Stepney, E.1. All men are clubbable animals, though not all of them know it, or know how clubbing in radio matters helps one along, bringing new friends, facts, and interests to light. Turn up and have a look at the Stepney show, which is all-alive-o! take my word. Hon. Sec., M. H. E. Abrahams, 129, Old Montague Street, Whitechapel Road, E.1.

The Irish Kite-Flyers.

THERE seems to be some attraction in kite-flying for Irishmen, probably due to their highly-developed political instincts. Early this year we were startled by an Irish kite which took up a wire and got signals from all the North American stations on a crystal set. Begorra! Now I hear that the Wireless Society of Ireland is at it again at Ballycorus Head, receiving on a wire flown by a kite at 400 feet—merely Dublin, Manchester, and Daventry. Why this return to primitive methods? G. M. Marconi flew *the* kite at Newfoundland years ago in his historic and successful attempt to bridge the Atlantic. But sure, yer honour, he is half Irish!

Broadcast Snips.

SEPTEMBER 14th, from Newcastle, a play by John Drinkwater, entitled "X—O," performed by the Newcastle Repertory Company. September 15th, from 5 G B, "Madame Butterfly." September 16th, from 5 G B, "Spindrift," a light nautical programme. September 21st, from 2 L O, "The Liars," a comedy by the great H. A. Jones. September 23rd, from Cardiff, "The King's Highway."

Wireless "Lighthouses."

TRINITY HOUSE has recently put into commission at Round Island (Scilly Islands) the first of a number of wireless beacons designed to emit distinctive signals at regular intervals (just as a lighthouse sends out distinctive flashes) to enable ships fitted with direction-finders to get bearings in thick weather. The beacon works on 1000 metres (I.C.W.) and has G G G for a call-sign; power, ½ kilowatt. The whole affair works automatically and is controlled by a master-clock.

ARIEL.

SHORT WAVES.

"Latest Cohen Type Speaker."

Now let someone invent a Murphy speaker, too, and the broadcasting of "Abie's Irish Rose" will be a very simple matter.

* * *

A bull recently rushed into a house and damaged a gramophone and many records. A reader wants to borrow it for his neighbour's loud speaker.

* * *

NO RECORD.

A Melbourne radio enthusiast is reported to have twenty-five different loud speakers.

That's nothing, though; look how many Solomon had.

* * *

Mrs. A.: "Is your husband doing anything to cure his deafness?"

Mrs. B.: "No, he's waiting until we get tired of our new loud speaker."

* * *

THIS WEEK'S PROBLEM.

Can a man sitting on the latest novelty—an armchair, which is also an absolutely self-contained three-valve loud speaker receiver—be said to be well up on wireless?— "The People."

* * *

THE BLOOPER.

When Jenkins hunts for K G O,
For miles around the listeners know
Who twists and twirls his radio—
"That's Jenkins."

With whoops and howls the heavens abound,
The local stations fade from sound,
And fiercest static goes to ground
For Jenkins.

But Jenkins with his one-valve set
Has never logged that station yet,
No K G O can Jenkins get—
Not Jenkins.

Yet always have I yearned to know
If, in their Oakland studio,
Our Yankee friends of K G O—
Get Jenkins?
(Sydney Paper).

Seymour Hicks—Broadcaster

AN INTERESTING INTERVIEW WITH "ARIEL."

ALTHOUGH I have known Mr. Seymour Hicks some time now, I had no idea he was interested in wireless. This discovery I made only the other evening when, in the dining-room of his house in Welbeck Street, he showed me his multi-valve set.

"I never realised," he told me, "how much pleasure one can get out of a wireless set until one day I took courage and went and bought one. I think I've got almost every station there is in existence! It has been the means of whiling away pleasantly many a tedious hour."

Both his charming wife, Ellaline Terriss, and their daughter, Betty, are very fond of wireless, and one and all have broadcast at some time or other, so one evening at Wyndham's Theatre, he told me the reason why he does not broadcast more often.

"For one thing," he said, "I feel always that before the microphone I am at a complete loss as how to entertain my unseen audience. I happen to be one of those artistes whose entertainment value is diminished considerably by not being seen."

According to Mr. Seymour Hicks almost every comedian to-day, were he deprived of the comical situations in the play he is acting in and the hundred and one expressions of a mobile face, would not have such a successful career.

When Humour Fails.

"That is why, even for a comedian, to put over humour successfully on the wireless is very difficult. Within the draped walls of Savoy Hill one cannot rely on situations, on the tricks and mannerisms that the 'putting over' of many a so-called amusing line demands. In its hearing alone it must be funny, and, believe me, to write that kind of humour is a very difficult task indeed.

"That is the first big fault I find with the wireless programmes of to-day," went on Mr. Hicks. "Sometimes to me they seem to completely lack humour. On the other hand," continued Mr. Hicks, "when there is humour it is produced in such a way that it does not get the desired effect. How many times have I listened to little bits of humour which were really excellent, but which came over so badly that the points were entirely lost.

"The effect each gave me was that a joke was being cracked among the audience in the studio. One could imagine: 'Look, that's my daughter, Emily, who's broadcasting—she's so clever, etc., etc.' It seemed to amuse those present to such an extent that it amused us listeners not at all."

I explained that the B.B.C. now endeavour to get the theatre atmosphere as much as possible into the studio.

"That is a very good idea. To my mind the studio audience is of great help to the artiste performing. Even artistes of great and lengthy experience of all kinds of theatres and publics, enthusiastic and fickle, have succumbed to the microphone, and been guilty of terrible attacks of stage fright.

"I think, however, that stage fright at Savoy Hill will be less frequent when the real atmosphere of the stage is introduced. The very intimacy of the thing is frightening. It's a very good idea also to make the studio

A recent portrait of Mr. Seymour Hicks.

larger. The smaller studios are conducive to uneasiness. The introduction of real footlights and a miniature stage would, I suggest, be an improvement."

I asked Mr. Seymour Hicks for a criticism of wireless programmes.

"I am rather reluctant to criticise," he said, with a smile, lighting another cigarette. "I feel I am not in a position to do so, having broadcast so little. From the point of view of a listener, however, I do not mind giving you my opinions."

Seymour Hicks' favourite item in the B.B.C. programme is naturally music. Not the dance music, of which he feels there is more than enough, but the serious kind of music.

'One must take the broadcasting programme entirely from the point of view of a listener's entertainment. If you pay for your licence you expect to get the most out of it. Looking at it from this angle I do not see the value of so much dance music when I feel so certain that it is never danced to, but accepted entirely from its entertainment value. The serious music I find most pleasing. The programmes rendered, say by the Squire combination, are a most gratifying change from everything else. The way certain instruments come over really amazes me. The piano and violin reception is so perfect that it seems as if they were being played in the room itself."

He also thinks that there is too much talk in the programmes, and at most inappropriate times.

"It is not a good scheme," he mentioned, "to have a talk about beetles just as one is about to commence dinner. To my mind the wireless programme is very weak between the hours of six and eight. It is at these times that it should be made powerful."

The "Ideal" Programme.

Mr. Hicks liked the idea of a thé-cabaret-dansant being broadcast at about five o'clock.

"It should prove novel and effective, and of great use to people who are in the habit of giving tea parties at this hour."

I asked Mr. Hicks whether he thought it was a good idea to broadcast musical shows.

"It all depends," he told me, "on whether the show is good or not. If it is a bad show, wireless is such a good advertisement that it would immediately kill any chances the show had. Radio can take away the public from a theatre just as easily as it can bring it there.

"In conclusion, I would like to say my idea of a perfect broadcast programme is:

"50 per cent light entertainment, including revues and musical shows.

"25 per cent serious music.

"15 per cent dance music.

"5 per cent Talks.

"5 per cent News.

"If one followed this suggestion I do not think one could go far wrong in satisfying the tastes of listeners. I do, however, take off my hat to the B.B.C., who are fulfilling so well such a difficult task; for I must say, as time goes on, their programmes get better, bigger and brighter."

BROADCASTING FROM AUSTRALIA.

Where the Licence Money Goes—The Regional Scheme—The Wireless "Danger" Scare.

BY THE EDITOR.

THE successful reception of short-wave broadcasting from Australia, and the relaying of it by the B.B.C., has done much to stimulate even greater interest in Empire broadcasting. 3 L O, the Melbourne Broadcasting Station, and 2 F C, the Sydney Broadcasting Station, are two of the most popular in Australia, and Major Corder, of the Broadcasting Company of Australia, is mainly responsible for the initiative taken in inaugurating these experimental transmissions.

A study of the Australian (as well as the South African and Indian) newspapers shows how very greatly the imagination of people abroad has been stimulated by the idea of Empire broadcasting, and we hope that before very long something will be done in this country by the B.B.C. to attempt to transmit to Australia a British programme for relaying to Australian listeners by Australian broadcasting stations.

Mr. Gerald Marcuse has also had success in connection with short-wave work. His first experimental broadcast was clearly heard in Melbourne, and we hope that he will have similar success with succeeding experiments.

Australia is certainly alive to the importance of Empire broadcasting, and at Melbourne there is being completed the most powerful short-wave station in the Southern Hemisphere. The wave-length will be 29·8 metres and the power 15 kilowatts, which is half the power of 5 G B and five times that of 2 L O.

"Official" Experiments Required.

In this country the B.B.C. has stated that it considers that uncertainty would inevitably mar the efforts of a British short-wave station. We have already outlined the B.B.C.'s policy in this connection in some detail, and there is no need to repeat it here. The fact remains, however, that broadcasting authorities in Australia have *decided on a policy which is directly opposite to that of the B.B.C.'s.* In Australia they are getting on with the job, and it may be said that an Australian Empire broadcast service has now been started. In this country no official service has been started, or is likely to be started for some time to come, and it has been left to Mr. Gerald Marcuse to "carry on" to the best of his ability—and at his own expense.

The B.B.C., however, states that it intends to carry out experiments in the relaying of Australian and other long-distance programmes, and in time, maybe, its full plan for receiving and distributing these Empire programmes will come into the sphere of practical politics. Meanwhile Australia, like Holland and America, has given us the lead.

* * *

Some interesting figures were published the other day about the growth of broadcasting. According to the official report there are now 2,306,285 licence holders in this country. This means an annual revenue for broadcasting of exactly half that figure in cash, as the licences cost ten shillings each.

Where the Money goes.

Listeners have often asked themselves: "Where does this money go, and how much of it reaches the B.B.C.?" The answer to this question is illuminating, if not satisfactory. The Postmaster-General retains, as a first charge, the generous allowance of 12½ per cent, which undoubtedly is more than enough to cover the cost of the issuing of licences, etc. After this charge has been made, the Post Office takes off 10 per cent on the first million, 20 per cent on the second million, and so on in an ascending ratio, so that 50 per cent would be taken off when the fourth-million licence had been issued.

Consequently, the listener is not only paying for his nightly entertainment, but is

Mr. Albert Barnes, formerly the engineer-in-charge of the Swansea Relay Station, has been appointed engineer-in-charge of the new Bombay Broadcasting Station, which is now in course of erection.

contributing a very big amount to the upkeep of the Post Office. He is, in fact, nothing more nor less than a taxpayer!

Of the rest of the revenue, about 80 per cent is spent on the programmes, according to the B.B.C., while the administration charges cost about 10 per cent.

The Regional Scheme.

What we would like to know is: "What proportion of these fees, these vast sums of money, are spent on the support of good programmes?" Perhaps one day the B.B.C. will be really frank about this interesting question.

* * *

Now that the excitement of the inauguration of 5 G B has died down, listeners are asking when the Regional Scheme will be really completed. At the moment it is thought that in about six months time the first of the big high-power stations will be ready, and that by 1929 all five stations, constituting the Regional Scheme, will be in active service, and the present twenty-one medium-power stations scrapped.

Although the definite sites for these new stations have not yet been fixed upon, we understand that the B.B.C., now that 5 G B has been opened, is very carefully considering this problem. The sites will probably be chosen based upon the examination and the tabulation of the success of 5 G B in various parts of the country. The main thing is that the stations will have to be placed so that all listeners in the regions which they serve will be able to receive at a better or at least at as good a strength as at present, plus an alternative programme.

Manchester, for instance, when the present station ceases to work, will probably be served by a station erected somewhere on the southern end of the Pennine Chain—high up on the hills somewhere, in a centre serving Manchester, Sheffield, Stoke and Derby. 2 L O will probably be about twenty-five miles out in the country, and the St. Albans and Chelmsford districts have been mentioned as probable sites.

A Wrong Impression.

A week or two ago a young listener was found dead, with the telephones on, near his wireless set. In his mouth was a piece of flex and in his hands was an extension flex from a table lamp. It is thought that while operating his set he placed his hands on the iron post of his bed, which was near by, and so received an electric shock of 230 volts.

It will be remembered that last May, as a B.B.C. engineer has pointed out, a woman at Wembley received a fatal shock while using headphones. She was holding the metal part of a lamp which was proved to have been faultily wired and, at the time, there was a widespread feeling that wireless was somehow or other responsible for her death.

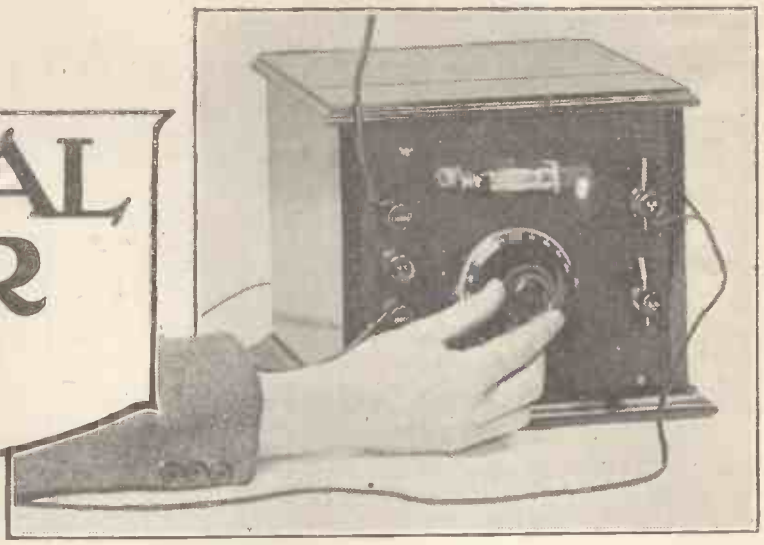
But, as a matter of fact, it was clearly shown that the faulty lamp insulation was the cause of the accident.

Cases like this, when ignorantly reported by the Press, do a great deal to scare ordinary listeners. Although, however, there have been several cases of people being killed in circumstances as above, *there has not yet been a single fatality directly due to a wireless receiver.* And, furthermore, there is not the remotest danger of anything of the kind.

The above is the gist of a statement made by a B.B.C. engineer, and it is a statement which anybody with any knowledge of wireless will substantiate.

For the benefit of our readers who have just taken up wireless and have no technical knowledge of the subject to speak of, we would emphasise again that a wireless set to-day is as harmless as a gramophone. But if, of course, any of our readers begin to interfere with the electric-light system in their houses without knowing what they are doing, then they have only themselves to thank if they get a shock, and, perhaps, a serious shock.

A CRYSTAL SET FOR 5 GB



Designed and Described by G. P. KENDALL, B.Sc.

BY this time many people will have discovered for themselves that an alternative programme, although very attractive as an idea, is not quite so easy to achieve in practice as they had thought. The fact is that most "local" receivers are rather flatly tuned, and the mere opening of a high-power station on the 200-500 metre band does not mean that one can tune at will from the local transmission to the alternative one, simply because the necessary degree of selectivity

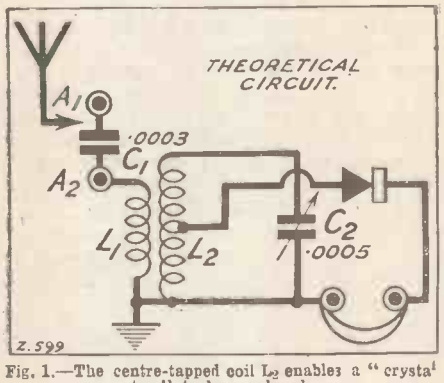


Fig. 1.—The centre-tapped coil L_2 enables a "crystal tap" to be employed.

is lacking, so that one cannot get rid of the nearby station when the other is wanted.

Special Sets.

It is possible to "make do" with an existing set by using a good wave-trap (a dependable one appeared in "P.W." No. 271), and in the case of a large set this will, no doubt, be preferred to rebuilding by many people. When a new set is being made, however, it will be as well to see in future that its selectivity is up to the standard now required, even though it may be intended mainly for local work. In the case of a crystal receiver it is not difficult to achieve this end by using a suitable circuit and specially-wound coils, an example of such a design having appeared in "P.W." No 263, under the title of "The Knife-Edge Crystal Set."

Using Plug-Ins.

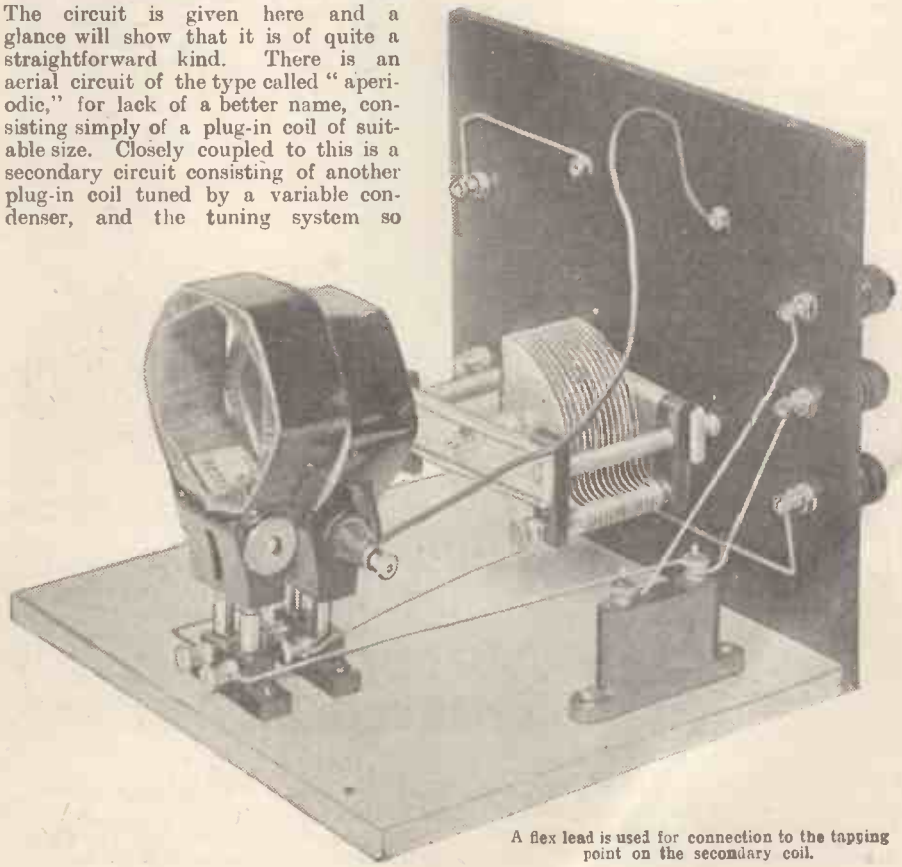
Many constructors, however, appear to object to having to wind special coils; and, moreover, they already possess plug-in coils which they wish to use, and therefore a crystal receiver has been built in the "P.W." Research Department which is intended to show how the desired results can be obtained with standard coils. The circuit is given here and a glance will show that it is of quite a straightforward kind. There is an aerial circuit of the type called "aperiodic," for lack of a better name, consisting simply of a plug-in coil of suitable size. Closely coupled to this is a secondary circuit consisting of another plug-in coil tuned by a variable condenser, and the tuning system so formed possesses quite a useful degree of selectivity if really good coils are used. This is an important point, for it is useless to expect high selectivity if your coils are of poor efficiency. This factor is so vital that I will mention three makes of coil known to be good, and which you will be safe in using when in search of selectivity. Here they are, not arranged in any particular order: Gambrell, Lissen, Lewcos. (Not the *only* good makes, of course.)

The tuning arrangements, then, are capable of a fair degree of selectivity; but we must be careful not to flatten out the tuning too much when we come to connect the crystal and 'phones across the

(*Continued on next page.*)

COMPONENTS REQUIRED.

- 1 Ebonite panel, 8 in. × 7 in. × ¼ in.
- 1 Upright cabinet to suit, and baseboard 7 in. deep.
- 5 Terminals.
- 1 ·0005 mfd. variable condenser (square law preferred) with plain dial.
- 1 Crystal detector.
- 1 ·0003 mfd. fixed condenser.
- 2 Baseboard-mounting coil sockets.
- Wire, screws, etc.



A flex lead is used for connection to the tapping point on the secondary coil.

A CRYSTAL SET FOR 5 G B.

(*Continued from previous page.*)

secondary circuit. The easiest way of avoiding this is simply to connect the crystal across only a part of the secondary, and if a suitable fraction is chosen, there is no loss of signal strength, but even a slight gain, while the selectivity is very definitely better than would be the case were the crystal connected across the whole of the circuit. In order to do this conveniently, it is usual to wind a special coil with a number of tappings, so that the best point can be found by experiment; but, at a pinch, a standard centre-tapped plug-in coil can be used, the crystal being connected to the tapping.

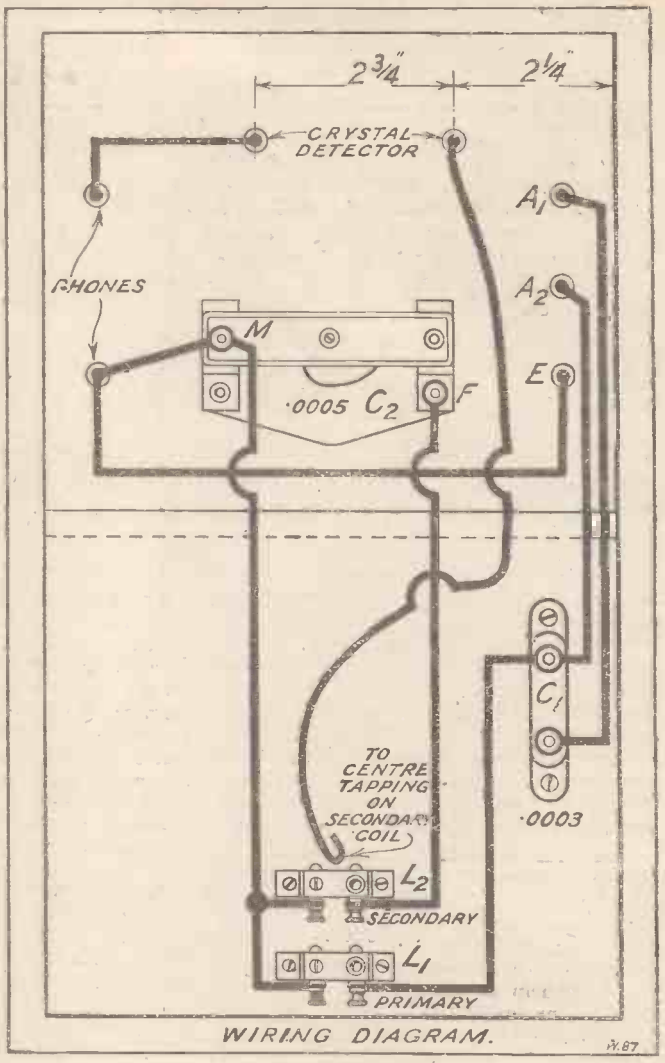
Adjusting Selectivity.

The sizes of the coils have an important bearing upon both signal strength and selectivity in this arrangement, and it may be as well to explain this point before proceeding further. A useful general guide is this rule: the larger the aerial coil, up to a certain limit, which varies according to the size of the aerial and the wave-length being received, the louder the signals but the flatter the tuning. To get sharp tuning, therefore, use as small a coil as will still give adequate signal strength. A No. 40 is usually about as large as can be used with advantage, while a No. 25 is desirable if high selectivity is required.

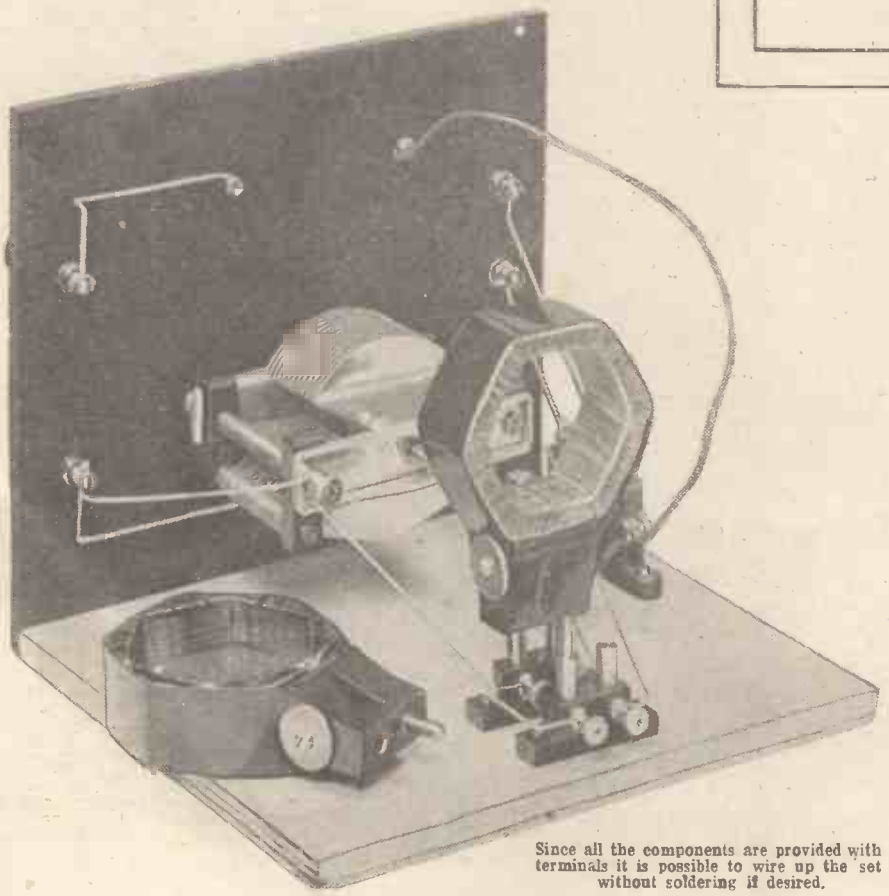
The longer the wave of the station being received, too, the bigger the coil that can be used without unduly flattening the tuning of that station. It must be remembered, however, that if at the same time you are trying to cut out a shorter wave station, a coil which is not too big for sharp tuning on the longer-wave station may be too large for selectivity where the undesired station is concerned, and may cause it to come in all round the dial. In such a case, of course, you must try a smaller size of coil in the aerial circuit until you find one with which the undesired station tunes in and out more sharply.

While you are experimenting with coil sizes, also, you should try the effect of connecting the aerial to terminal A_1, which brings a small series condenser into circuit.

The secondary coil, L_2, governs the range of waves to which the set will tune, and for the ordinary broadcast waves from 250 to 500 metres a standard No. 60, centre-tapped, is the correct size. For the reception of 5 G B it is slightly better to use a centre-tapped No. 75, since Daventry Junior is near the upper end of the tuning range of a No. 60, and hence requires a fairly large setting of the condenser to bring it in, and this is not conducive to good signals. The gain with a No. 75, however, is not very great, and scarcely justifies the purchase of an extra coil if you do not already possess it. For the reception of 5 X X you will need a No. 250 centre-tapped coil for the secondary and a plain No. 100 for the aerial socket.



WIRING DIAGRAM.


Since all the components are provided with terminals it is possible to wire up the set without soldering if desired.

The actual construction of this little receiver is very simple indeed. The panel is drilled for the variable condenser, the crystal detector (which may, of course, be of any good type, "permanent" or cat's-whisker, as desired), and five terminals, and, when these parts have been fitted, it can be attached to the baseboard by means of three brass screws. Upon the baseboard it is only necessary to mount the two coil holders and the fixed condenser, and then you can proceed to wire the set up, an operation which will probably not take you more than twenty minutes or so, if you are handy with your soldering iron.

"WHITE LINES" IN RADIO

An article every valve user should read.

By PERCY W. HARRIS, M.I.R.E.
(*Editor of "The Wireless Constructor."*)

THE white line is one of the most useful "safety first" devices in motoring. If we keep to the left side of it we can negotiate very difficult corners with very little anxiety. We know that if we keep within the line all will be well, and thus it is a good general guide to follow.

There are certain useful white lines in radio, and if we bear them in mind they will keep us clear of very awkward difficulties. Non-observance of these white lines will lead to all kinds of troubles—some obvious and some quite the reverse. The latter are often attributed to components which are innocent of all offence.

Take, for example, the white line of valve overloading. Among the causes of distortion probably none is more prevalent than this. Loud speakers, resistance units, low-frequency transformers, even circuits, are regularly blamed for distortion which inevitably arises from valve overloading.

It will help us to follow what valve overloading means if we continue with the motoring analogy. Everyone knows that a small and low-powered engine cannot be made to do the same work as the powerful unit in a large motor lorry. Yet many wireless enthusiasts, in trying to fill a large room with a loud speaker fed from a humble little general-purpose valve, are much like the motorist who expects to move a pantechnicon with a Baby Austin. If we want to get pure undistorted loud-speaker reproduction (presuming the loud speaker itself is of good quality, and a very large number are), we must pass a current through its windings which will rise and fall with a very considerable amplitude, for it is the amount of rise and fall through the windings which determines the volume of sound.

"Super-Power" Valves.

Two things will determine the rise and fall possible with a valve. The first is the intensity of the electron spray from the filament and the second is the power to make this spray pass in the form of a current through the plate circuit. This latter is determined by the high-tension voltage used. You may have a valve with a wonderful "emission" or power to spray the electrons, yet if you use this valve with too low a high-tension voltage you will not be utilising it to the extent that is necessary. Similarly a big high-tension voltage alone is of very little use if this electron spray from the filament is meagre.

Within the last year or so there has come into general use a type of valve called for lack of a better term the "super power" valve, which has a tremendous electron emission when used with a voltage for which it is designed. Again, using the motoring analogy, we can say that the power is there when you open the throttle. Such a valve is useless without sufficient high-tension voltage, just as a powerful engine is useless if you cannot open the throttle sufficiently.

The ordinary general-purpose valve with a high high-tension voltage is like an engine with very little power and a throttle which will not open very wide. Its widest throttle opening will not get any more power out of the engine when it is working at its limit.

Distortion Through Overloading.

Valve overloading shows itself as a rattling harsh tone on powerful notes of music, although the effect does not appear uniformly. Owing to the different intensities in reproduction we can get very loud signals without distortion on some forms of music, while others, which do not seem particularly loud, require a very big swing or fluctuation of the loud-speaker current to give what appears to be the same intensity of sound. If, in any of the speech or music you are trying to reproduce, the swing required is beyond the limit possible with that valve, or beyond its "white line," you will get distortion, and it is "up to you" to see that the space between the kerb and the white line is sufficient for any movement your car wheels are likely to make.

There has been a great deal of interesting correspondence in "P.W." regarding the relative merits of resistance-capacity and transformer amplification. All the arguments, or practically all of them, have centred round the reproduction curve given by these types of coupling, rather overlooking the fact that however "straight line" the reproduction by either type of unit, the way we shall hear this reproduction is through the medium of the loud speaker. Just what kind of reproduction line has the loud speaker?

Some Astounding Facts.

I have recently received from America particulars of a paper delivered to an important association of wireless manufacturers. In this paper certain astounding facts were given regarding the reproduction given by loud speakers and almost for the first time some loud-speaker "curves" were given. The figure accompanying this article, for which I am indebted to "Radio Broadcast," of New York, shows the frequency response of three loud speakers, curve A being a representative horn type, curve B an average cone speaker, and curve C "one of the best cone speakers that has been produced." Rather startling, are they not? The Himalayas are a plateau compared with curve A, from which you will see that however perfectly your transformer or resistance-capacity coupling reproduces the low tones they are simply "not there" when it comes to this loud speaker. It is all the same to the loud speaker in curve A whether or not your transformer is completely deaf to any frequency under a couple of hundred or so, while the frightful peak at the end means that this particular loud speaker will over-accentuate certain of the higher notes in a way which is all too familiar.

(*Continued on next page.*)

Mr. Harris making the measurements in his laboratory necessary to obtain data for the accompanying and others of his "P.W." articles.

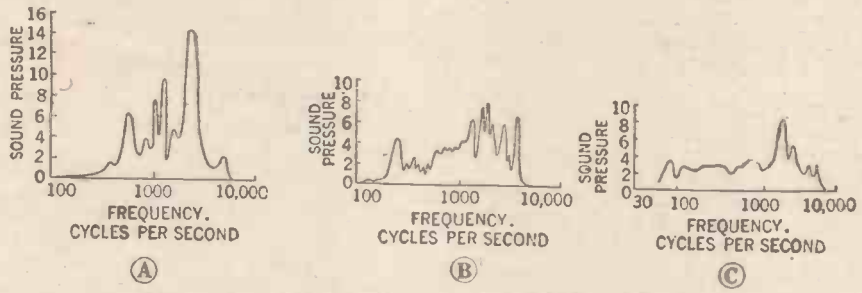
"WHITE LINES" IN RADIO.

(Continued from previous page.)

Curve B is not so bad. It certainly begins to give the reproduction of the lower tones much better than curve A, but an ugly peak suggests that accentuation of some of the medium tones would be rather marked. Curve C is a much more useful affair. It will, as you see, reproduce the low tones from fifty to, say, one hundred and fifty with quite an appreciable fidelity, and the slight inequalities will not be noticed between thirty and a thousand.

Distribution of Sensitivity.

Another very important aspect of reproduction that is frequently overlooked is that the intelligibility of speech is very vitally affected by the distribution of sensitivity over various sound frequencies. In the paper to which I am referring, it is pointed out that from a standpoint of intelligibility or articulation the low frequencies are not so important, but if no frequencies below 500 cycles are reproduced there will be but 40 per cent of the speech energy present in the loud-speaker output. On the other hand the high frequencies carry little energy but are important from the standpoint of intelligibility. If all over a thousand cycles are cut off, 80 per cent of the energy remains, but only 40 per cent of the articulation and intelligibility. With this consideration and others it seems certain that frequencies between about 75 and 5,000 should be reproduced equally for faithful reproduction of music.



Curves illustrating the frequency response of three loud speakers.

The Voltage "White Line."

But this is leading us a little away from the subject of the white lines of radio. A very much neglected dividing line is the white line of accumulator voltage, for if we discharge our accumulators below a certain point, deterioration and sulphating set in rapidly. The ordinary voltmeter test on what is called "open circuit" (that is when we measure the voltage of the accumulator when it is not discharging current through the set) is practically valueless, as many accumulators will show two volts per cell after standing an hour or two idle, although directly they start discharging current the voltage will drop. The best way of all of seeing whether you have crossed the "voltage white line" is to test the voltage of each cell of your accumulator, not only when it is lighting the valve filaments, but when it has done so for an hour or more. It is not a bad plan to take a hint from the shampoo manufacturer and make "Friday night voltmeter night," and take the measurements just before you go to bed.

Modern valves will stand a great deal of abuse, even if we do not ourselves throw them from aeroplanes or pull them in half with elephants, but that is no reason why we should have to pay out good solid cash for a new valve when it is not really necessary. Watch the white line of filament voltage. Most valves are designed to work somewhat below the voltage of the accumulator with which they are used. For example, what are generally called "six-volt valves" work well round about five or five-and-a-half volts, and "four-volt valves" round about three to three-and-a-half or perhaps a little more. The fixed resistor does a great deal to prevent overrunning valve filaments, perhaps the most frequent cause of short life, or if you favour varying filament voltages for any reason, remember that you will *never* gain anything by running the filament at a higher voltage than that specified by the maker, and you will *always* lose something by so doing. It is a good plan, therefore, to furnish yourself with a very prominent white line by wiring a fixed resistor in series with your variable filament rheostat. You can then move the variable resistance round to the "full on" position, knowing quite well that the valve will not be harmed by your so doing, while when you want to do any dimming (if, indeed, you do), you can "play about" with impunity.

A CONDENSER PROBLEM.

By W. OLIVER.

IT is, of course, a well-known fact that a condenser in series with the aerial (or earth) lead helps to sharpen up the tuning of a set and make it more selective. With a view to obtaining this effect, many listeners connect their aerial tuning condenser in a series position, instead of joining it in parallel across the aerial inductance.

Sooner or later, however, they usually make the rather painful discovery that the method has a strong disadvantage: with the moving plates near their minimum setting, tuning is sharp but signals weak; as they are rotated towards their maximum setting there is a gain in signal strength but a loss in selectivity.

This means, in practice, that the best all-round results can only be obtained with stations that, by reason of their wavelength, happen to come in about mid-way through the tuning range of the condenser, i.e. round about 90° on the dial. Those on lower waves are more sharply tuned, but not nearly so loud; while those on higher waves are louder, but decidedly flat in tuning.

Series Fixed Condenser.

The remedy for the trouble is to remove the variable condenser from the series position, and substitute for it a fixed condenser of suitable capacity, afterwards connecting the variable condenser in parallel across the aerial inductance for tuning purposes.

The capacity of the fixed condenser should be round about ·0001 to ·0003 mfd., but the most suitable value for any particular installation is, of course, best found by experiment. The condenser should be neither too small to give adequate signal strength, nor too large to give sharp tuning; it is necessary to strike a sort of "happy medium."

The fixed condenser may be connected in series with either the aerial or the earth lead. With some installations the former position gives the best results, while with others the latter is better, so it is best to experiment a little before permanently connecting it inside the set.

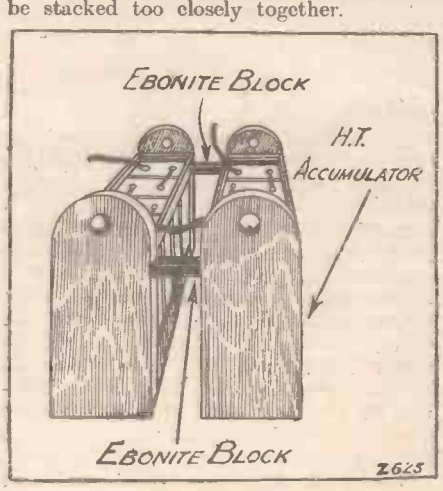
It should be remembered that a condenser in series with the aerial or earth lead will only give good results, as a rule, on wave-lengths below about 700 or 800 metres. In view of this, it is advisable to have some means of cutting it out of circuit when using the set on high wave-lengths.

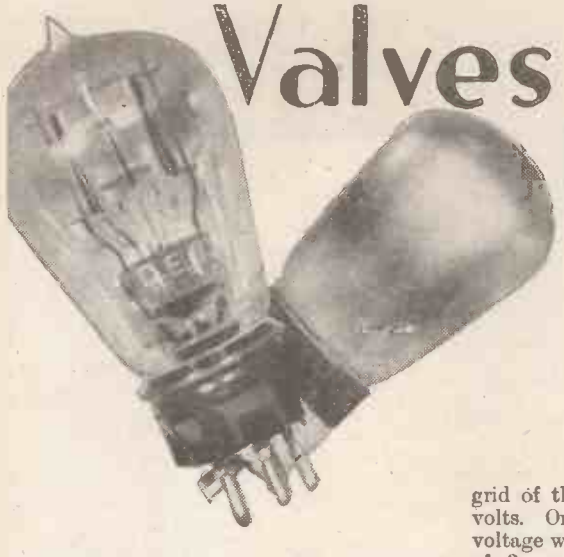
H.T. ACCUMULATOR LEAKAGE.

AFTER a short period of use the frames of H.T. batteries are liable to become damp through evaporation from the acid. If the units are packed closely together leakage will occur.

A battery of 120 volts which, on the current consumption of the valves, was expected to last about five months per charge, ran three months on first full charge and only six weeks on the second! Examination showed traces of mildew on frames, although the battery was kept in a perfectly dry place. The leakage is the more serious as it takes place continuously, and not only whilst the battery is in use.

Strips of grease-impregnated cardboard placed between the units will help to decrease leakage, or, better still, a small block of ebonite should be attached to each end of the frames, as shown in the diagram. It will then be impossible for the units to be stacked too closely together.





Valves for Use in Reflex Circuits

Reflex receivers, in common with all other types of valve circuits, require the correct valves if maximum results are to be obtained. In many cases the substitution of a certain valve, possibly differing little from that already in use, may make all the difference between fair and really good results. An interesting article.

By C. P. ALLINSON, A.M.I.R.E.

A FRIEND of mine came round the other evening complaining that he was in trouble with his two-valve reflex receiver. This set consisted of a dual valve followed by a detector, and in view of the fact that the first valve was amplifying at high frequency as well as at low, my friend had decided that the best valve to use was an H.F. valve, and he was using one of the high-impedance high-amplification types in this position. The result was that he found that the set would do very little but howl.

It has been my experience during the last two or three months that many users of reflex circuits are uncertain as to the best valves to employ, and in some cases they do not realise how the substitution of a certain valve, differing little from that actually used, may make all the difference to the performance of the receiver.

One cannot always lay down hard and fast rules as to the valves to employ, since much depends on the volume and power they will have to handle; and this, of course, depends on the distance from a broadcasting station at which the set is being used.

A Two-Valve Circuit.

Let us take a reflex receiver which employs the circuit shown in Fig. 1 as an example, and consider what are the most suitable valves to employ under varying circumstances. It will be seen that the H.F. valve employs a neutralised circuit, this being of split primary type, while Reinartz reaction is provided for in the detector circuit as shown. The L.F. output from this detector valve is introduced into the first valve circuit by means of an L.F. transformer, and these speech currents are reproduced by telephones or a loud speaker, shunted by a condenser, C_7, so as to by-pass any H.F. component present in the H.T. lead. In view of the fact that the dual valve has to handle L.F. currents, it is necessary, of course, if pure reproduction is to be obtained, that a sufficient value of H.T. be applied, together with suitable grid bias.

Now, suppose that this receiver is located at two or three miles from a main station. On my aerial, a small one, situated at 2½ miles from 2 L O, I find that the carrier voltage applied to the grid of the first valve is between 5 and 7 volts. On the top of this we apply an L.F. voltage which may be in the neighbourhood of 3 or 4 volts, while occasional peak values of a much higher value may be obtained from time to time when a very high note or a loud, sustained passage is being reproduced.

It is therefore necessary to have a valve in the dual position which will handle the combined voltage swing, which on an average will be 10 to 12 volts, and may reach values of 15 volts or more. It will therefore be seen that the ordinary small power valve, which is capable of handling a swing of 9 volts either way, will not be suitable for use in this position, since it will result in distortion being obtained on the L.F. signals, either due to grid current or, if a high value of grid bias is employed, owing to lower bend rectification.

Suitable Valves.

I have repeatedly found this to be so in practice in the experimental work which I have been carrying out recently on reflex circuits, and I have found that if I want to obtain really pure reproduction on the local station, it is absolutely necessary to employ a super-power valve as the dual valve with at least 120 volts H.T. and a suitable value of grid bias in the neighbourhood of 18 volts negative.

Suitable valves are the D.E.5A, P.M. 256, S.T. 63, etc., in the 6-volt class.

Of course, owing to the low amplification and low impedance of this valve, the degree of H.F. amplification obtained from it is not too good; but I have found it imperative to use this type of valve if I wish to get anything like satisfactory purity and faithfulness of tone.

For Distant Stations.

Now suppose, however, that we take this receiver out to 12 or 15 miles away. At this distance it is doubtful whether the carrier voltage impressed on the grid of the H.F. valve will be more than 3 or 4 volts, and the L.F. voltage will, of course, be proportionately lower than that obtained in the first instance. The result of this is that an ordinary power valve, such as a D.E.5, S.T.62, P.M.6, B.4, etc., may be employed as the dual valve without distortion being obtained owing to it being overloaded, a suitable value of H.T. being between 100 and 120 volts. At the same time, owing to the fact that these valves have a higher amplification factor than that given by the super-power type of valve, it is extremely likely that the actual volume and power obtained on the receiver will be very little less than that obtained when used very close to the local station.

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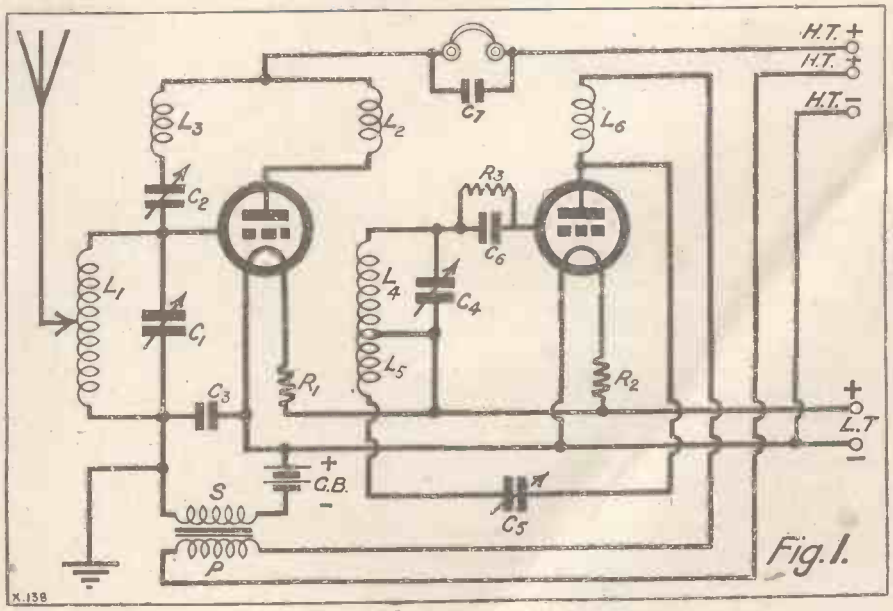

Fig. 1.

VALVES FOR USE IN REFLEX CIRCUITS.

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It is obvious that the use of these small power valves will result in economy in the H.T. current consumption as compared with the super-power valves, and a smaller grid-bias battery will be required, which is a consideration as regards the initial cost and the upkeep of the receiver.

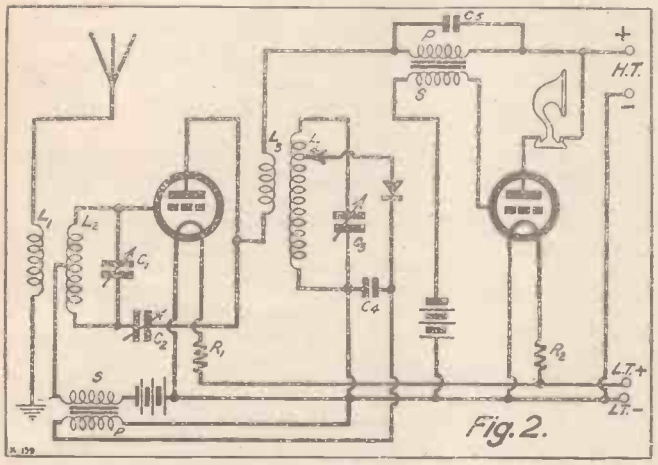

Fig. 2.

We will now wander farther afield and take the same receiver, and operate it at some 50 miles from the local station. It now becomes apparent that the total energy handled by the dual valve is very small, and it will be found possible in many cases, to use a high-impedance high-amplification valve for the dual purpose.

I have satisfactorily used a valve having an impedance in the neighbourhood of 20,000 ohms and an amplification factor of 20 in this position when receiving weak or distant transmissions. The result has been quite a marked improvement in signal strength, since not only is the H.F. amplification improved, but the larger amplification factor gives a better degree of L.F. as well. It is necessary, however, that the loud speaker be a very high-impedance instrument, as otherwise the low tones will be completely lost, and the resulting speech and music will be poor and thin. At the same time, of course, it will be necessary to reduce the value of grid bias applied to about 1½ to 4½ volts, this value depending on the actual valve which is being used and the H.T. voltage.

A Popular Arrangement.

A certain amount of care, however, will be needed in operating the receiver when using a valve of this description in the first socket, since it will be extremely liable to go into L.F. oscillation when reaction on the detector valve is increased, and a more suitable valve to employ under these conditions is a general-purpose valve having a medium impedance and amplification.

It is, however, to be recommended, in most cases, that a small power valve be used for the dual-purpose function and in cases where the set is to be used extremely close to the local station, the super-power valve is required.

A type of circuit which has enjoyed great popularity lately is shown in Fig. 2. This consists of a dual valve followed by a crystal detector and a further stage of low-frequency amplification, and some advice on suitable valves to use in this receiver will, no doubt, be welcomed by many. It will be seen that this receiver employs the split-grid coil method of neutralisation. This is a most suitable scheme for use in reflex circuits. Transformer coupling is employed between the H.F. valve and the crystal detector, the circuit using the crystal tap as shown. The L.F. output from the crystal detector is fed back to the first or H.F. valve and amplified at low frequency, the L.F. output from this valve being coupled to a further L.F. amplifying valve by means of a second L.F. transformer. Grid bias is employed on the first valve, and this may be applied from a common grid-bias battery, instead of the arrangement shown which I have used, in order to make the theoretical diagram as clear as possible.

The advice previously given as to the first valve for use in the Fig. 1 circuit will apply to the first valve to be used in the Fig. 2 circuit, while the second valve should be of the same type as the first. Although the second valve will not have to do double duty, in that it does not have to amplify the high-frequency current, it has nevertheless to deal with the low-frequency currents which have been already amplified and the valve will, therefore, have to be capable of handling as much power as the first one, and in some cases it may be advisable to use a valve capable of handling more power than the first one. In most cases, however, a similar type of valve to that used in the first socket will be found perfectly satisfactory in the second.

For use close to the local station, two super-power valves are indicated if it is desired to obtain the utmost purity of tone. At, say, 15 miles, two ordinary power valves may be used. On very weak transmissions, where it is possible to use a high-impedance high-amplification type of valve in the first stage, it will nevertheless be advisable to use a small power valve in the second stage, in most cases.

Double Reflexing.

Should it be found possible to employ a high-impedance valve for the dual valve, it will be necessary to use a suitable transformer for the one which is used for passing on the L.F. currents to the last valve. It will be necessary for this instrument to have a very high primary impedance if it is desired to obtain faithful reproduction of the lower notes in the musical scale. The use of two high-impedance valves will, however, be very likely to introduce L.F. oscillation which will be difficult to control.

When weak signals are being dealt with there are numbers of general-purpose valves on the market which are quite suitable for use, even in the reflex position, while even in the Fig. 2 circuit they will be capable of handling the volume obtained, in the second position also.

There is yet a third type of circuit in which two valves are employed, in this case both amplifying at high and low frequency. A circuit of this type is shown in Fig. 3. In cases where the set is used close to a broadcasting station it will readily be appreciated that the second valve will have to handle a very large amount of power. It has already been shown that it is usually necessary to use a super-power valve in the first stage, and therefore a super-power valve is required in the second stage if it is desired to obtain distortionless reproduction. There are also a few other courses open. For maximum volume and purity a large power valve, such as the L.S.5A, which has an extremely low impedance and a very large grid base to its characteristic curve, may be used. Another thing to do is to employ some limiting device by means of which the second valve will be prevented from being overloaded. A

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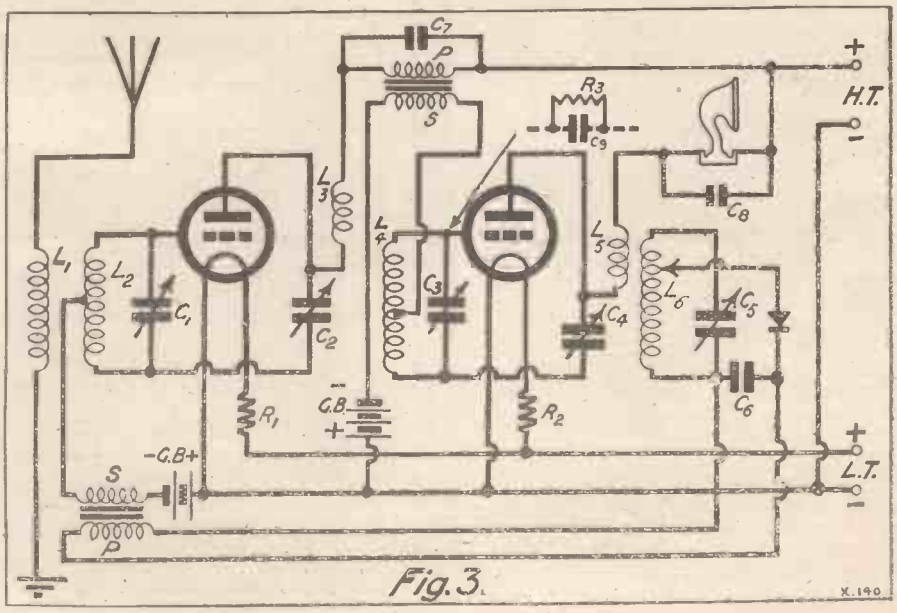


Fig. 3.

HINTS FOR THE HOME CONSTRUCTOR.

Some Useful Ideas that Will Help in the Construction of Your Set.

By J. NASMYTH, S.I.Mech.E.

IT is surprising how many people who make their own sets rely absolutely on the tool shop for their tools. If they happen to have the misfortune to break a drill or tap, during an evening or week-end when all the shops are shut, everything has to be put aside until new tools can be obtained. They also find many small details very worrying, details which become second nature to anybody with practical workshop experience. So perhaps a few practical hints would not be out of place.

Drilling Panels.

If a good size piece of ebonite has been drilled, it is very annoying to find that a slip has been made in marking-off, with a consequence that the panel has some unnecessary holes which look unsightly, even if they are filled with Chatterton's Compound. A good scheme is to obtain a piece of cardboard exactly the same size as the panel. Mark it off in pencil, and drill it just as if it were the actual panel. Now check it over to make sure that every hole is correct, if all is O.K. clamp it to the panel so that both the cardboard and panel coincide, then drill through the holes made in the cardboard. The holes in the ebonite will then be found to be correct.

The last small drill has broken, and there are still a few more holes to drill. What is to be done? Get hold of a knitting needle that is just smaller in diameter than the holes that have to be drilled, hold it with a pair of pliers over a gas flame or in a coal fire until it becomes white hot. When it is hot enough, hammer out the end until it is a little wider than the diameter of the hole to be drilled. This end is now flat, and the sides must be ground on a grindstone so that they taper towards the round end of the needle. This is done so that the drill will clear itself when going through the material it is drilling.

Now grind the cutting edges just as a flat drill is ground. Should any reader be doubtful as to how a flat drill is ground, a brief explanation will put them on the right track.

A Home-Made Drill.

Hold the drill against the surface of the grindstone at an angle of about 45 degrees from the left in a horizontal plane; and about 20 degrees down in a vertical plane. Press gently but firmly against the stone until a good clean edge is obtained. Now turn it over and do the other side exactly the same; be sure that both cutting edges are the same length, otherwise the drill will cut larger than is required.

The drill now wants hardening, and the next few lines apply to other tools as well as drills. The drill is now in a soft condition and would not cut. Heat it again to a white heat, plunge it into cold water, and move it about so that it cools evenly. The construction of the steel has now quite changed, and it is too hard to be of any use, as it would break; it has, therefore, to be tempered in order to keep it hard and yet make it tough.

Clean it up with a piece of emery cloth, then put it over a flame so that the flame plays on the drill about 1½ inches from the cutting end of the drill. It will soon be noticed that some colours are creeping towards the end, due to oxidisation. As soon as the cutting edges become a dull straw colour plunge it again in water, and as soon as it has cooled down it will be ready for use.

Tapping Ebonite.

All holes that have to accommodate screws should be tapped, rather than making the hole so large that the screw falls in or else forcing the screw in the hole with a screwdriver; the last two methods often happen when no tap is handy. A very good substitute can be made from a screw itself. Find one the same size as the ones that are to be used, and cut three grooves running from end to end, just like a real tap; if it is screwed into the holes that require tapping, it will act exactly like a tap.

When holding any soft metal or material in a vice, the hard clamps of the vice will cut into the soft metal, and should it be an object such as a screw, the thread will be badly damaged.

Find a cocoa tin, and cut out the sides, these can be moulded to fit over the vice clamps by holding half of a side in the vice, and knock the top over with a light hammer, so forming a right-angle, the other side can be dealt with in the same way. It will then be found that small objects can be held just as well, and will not be injured in any way.

VALVES FOR USE IN REFLEX CIRCUITS.

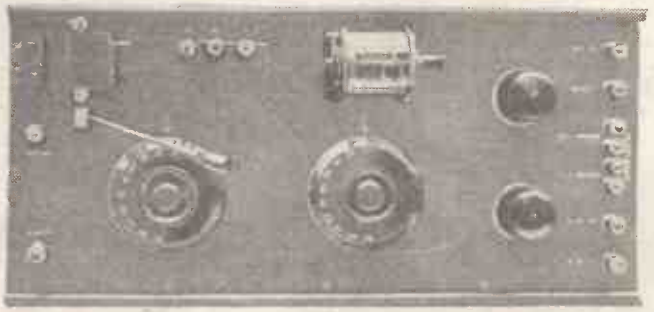
(Continued from previous page.)

method of this description is shown in dotted lines at C_9 and R_3, this consisting of a fixed condenser and a high resistance, such as a grid condenser and a grid leak. Provided the correct value of grid bias is used when this method is employed there is no fear that distortion will be introduced owing to rectification resulting. It will be found that this arrangement has a limiting effect on very strong signals, yet it will not reduce the strength of signals on weaker transmissions.

Unless precautions of this description are taken it will be found that on tuning in to very strong signals the second valve will be forced into oscillation. It is, of course, possible to use other methods for preventing this occurring, but these generally introduce some complication into the receiver. If the coupling between the first and second valves could be reduced, then voltages would be reduced, then less H.F. energy would be transferred and the L.F. currents given by the crystal detector would be less, so that the load on the two valves as regards L.F. voltages would be reduced. Again, the coupling between the aerial and the first H.F. valve might be reduced, thus reducing the H.F. voltage as well as the L.F. voltage on this valve. This, however, would introduce extra controls, which to many experimenters might prove a disadvantage.

When used at a distance of 10 to 15 miles from the local station, as previously stated, a small power valve would be adequate to handle the amount of power delivered to the first valve.

Since, however, this would be amplified both at high- and low-frequency, the next valve would need to be a super-power valve in order to avoid any distortion being introduced.



An early type of reflex receiver, in which general-purpose valves were employed.

Of Paramount Importance.

When used for distant reception it may be found possible again to use a high-impedance high-amplification type of valve for the first stage, but it would then be necessary to employ a small power valve for the second stage, for in most cases any other type of valve would be overloaded in this position.

Reflex circuits have unfortunately fallen somewhat into disrepute, owing to the many careless statements which have been made about them by experimenters who have not been successful in getting satisfactory results. In my opinion, in nine cases out of ten, these unsatisfactory results have been mainly due to the employment of unsuitable valves, taking into consideration the conditions under which the set was being used.

I may state, in closing, that I have myself used a four-valve receiver, consisting of two H.F. stages both reflexed at L.F., with a valve rectifier followed by a further stage of L.F. amplification, with every satisfaction, this receiver bringing in distant stations at good loud-speaker strength in daylight. This was done without any precautions being taken in the layout, construction, or even in the wiring, the whole set being more in the nature of a rough hook-up than anything else. If, however, I had been using unsuitable valves or had been using the correct valves under unsuitable conditions, then, of course, I should have had trouble with the set. It is this kind of trouble which, when experienced with a reflex receiver, leads experimenters to condemn them so unjustly.

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

H.F. AMPLIFICATION

THE "SILITE" RECTIFIER—THE EXPONENTIAL HORN, Etc.

H.F. Amplification.

THE popularity of multi-stage high-frequency amplification of the ordinary kind has now largely waned. At one time it was thought that several stages of high frequency were essential for long-distance work, and one of the long-standing arguments was as to whether better results were obtained on the average with, say, two stages of tuned radio-frequency amplification than with one.

At first sight it would seem obvious that two stages would give greater sensitivity than one, but whether the set would be most satisfactory to use in that way is another matter, and many experimenters are of the opinion that unless the circuit is neutrodyned, and especially if reception is carried out with the set in oscillation, the disadvantages outweigh the advantages.

The difficulty of tuning exactly two tuned anode circuits separately is a well-known one, and when the circuits are brought into resonance there is great liability to oscillation.

The real merit of the Neutrodyne circuit becomes evident from these considerations, as this arrangement permits of separate tuning, if necessary, of any oscillatory circuit, and the tuned circuits may then be combined without altering the original tuning of either.

Sharpness of Tuning.

There is a method of using one stage of high-frequency amplification untuned and another stage sharply tuned. The tuning in the latter case, however, is not likely to be very sharp, as this condition can only be obtained if both circuits have a sharp resonance point. As a result of these considerations many experimenters are of the opinion that this latter method gives results little, if any, better than a single stage sharply and efficiently tuned, whilst, on the other hand, it complicates the wiring of the set and increases its first cost.

It would seem that separately and sharply tuned multi-stage high-frequency amplifiers are likely to pass entirely out of favour.

The "Silite" Rectifier.

To the list of electrolytic rectifiers has now been added a new type—or, rather, a new example of a well-known type—in which the electrolyte is dilute sulphuric acid (battery acid) and the rectifying electrode a special alloy containing, as its principal ingredient, silicon dioxide ($Si O_2$). This rectifier works in precisely the same way as the tantalum rectifier, except that the electrode just mentioned, which is now known by the commercial name of "Silite," takes the place of the tantalum. In these conditions the current can only pass into the liquid at the neutral electrode (usually lead) and out at the Silite electrode. This new substance was discovered by Clarence E. Ogden (U.S.A.), and is produced in an electric furnace, at a temperature of 5,200 deg. Fahr., from Kentucky sandstone (which is practically pure silica), with certain other substances which are not disclosed.

It has long been known that silicon has electrolytic rectifying properties, but no convenient method of turning these to account had previously been found. Silite is not attacked by sulphuric acid in any degree of concentration or at any temperature, but its valve action (that is, electrolytic rectifying action) is more pronounced in strong acid than in weak.

The Silite rectifier is now upon the market, and is adopted as standard by several manufacturers of battery chargers and other types of apparatus.

The Exponential Horn.

Reference was made in these Notes some time ago to a loud speaker, developed by the Westinghouse Electric & Manufacturing Company, in which an "exponential" horn was used. The description of the exponential horn was given at the same time.

This loud speaker, which is the invention of Dr. Joseph Slepian and Mr. C. R. Hanna (of the Westinghouse research staff), has now been brought to the commercial stage, and was recently demonstrated at Pittsburg before an audience of pressmen, musical critics, and electrical engineers. The horn was operated from the Westinghouse Research Laboratory, and listeners were stationed on a hill three-quarters of a mile away from the horn, thus putting its acoustical radiating powers to the "acid test." Gramophone records were used for the demonstration, and a wide range of frequencies was chosen, from the piccolos to the treble and contra bass notes of the organ, and including also a choir of 2,500 voices. This remarkable test is stated to have been completely successful, and the reproduction reached the audience with excellent quality.

The exponential horn is capable of application also to loud speakers of more modest dimensions, such as the ordinary domestic reproducers.

A Crystal Tube.

In a "new" crystal detector, the invention of Dr. Hugo Graf (Berlin), the crystal material is ground up into a powder and is formed into a solid cylindrical bar. This is secured inside the device in a vertical position, and the cat's-whisker is mounted upon a screw pillar, which is parallel to the axis of the cylinder just mentioned. By means of an external knob, this threaded pillar can be rotated about its own axis, with the result that the cat's-whisker mounting travels up and down, thus shifting the cat's-whisker along the detector cylinder so that a new sensitive spot may be obtained.

But the scheme does not seem to be very different from those incorporated in several other detectors I have seen.

Wood Panels.

I have once or twice, previously, in these Notes referred to the successful results which can often be obtained with wood

(*Continued on page* 118.)

WIRELESS ON MANŒUVRES

Three men of the 54th Div. Signals (East Anglian) operating a field radio station on manœuvres in Thorndon Park, Brentwood. The aerial is known as the fishing-rod aerial, and is attached to a "bayonet," which forms the earth. See also the photograph which appears on the "Broadcast Notes" page.

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L. 309

THE NEW UNIVERSAL CHARGER.

The first of two special articles in which full practical details are given of the wonderful new charging device. This can be used on either A.C. or D.C. mains, and appears to be the most practical solution to the universal home-charging of radio batteries.

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

WHERE alternating-current electric supply is available, it is universal practice to step-down the voltage from, say, 200 volts to about 10 volts for the purpose of charging a 6-volt battery. In this case, the power consumed is proportional to the current multiplied by 10 volts, whereas if the step-down transformer were not used and the current were drawn from mains at 200 volts, the power consumed would be proportional to the same current multiplied by 200 instead of by 10. Therefore, the use of the step-down transformer has the effect of enabling us to use just the power we actually require, instead of having to draw twenty times the power we actually use, and waste nineteen-twentieths of it in a series resistance.

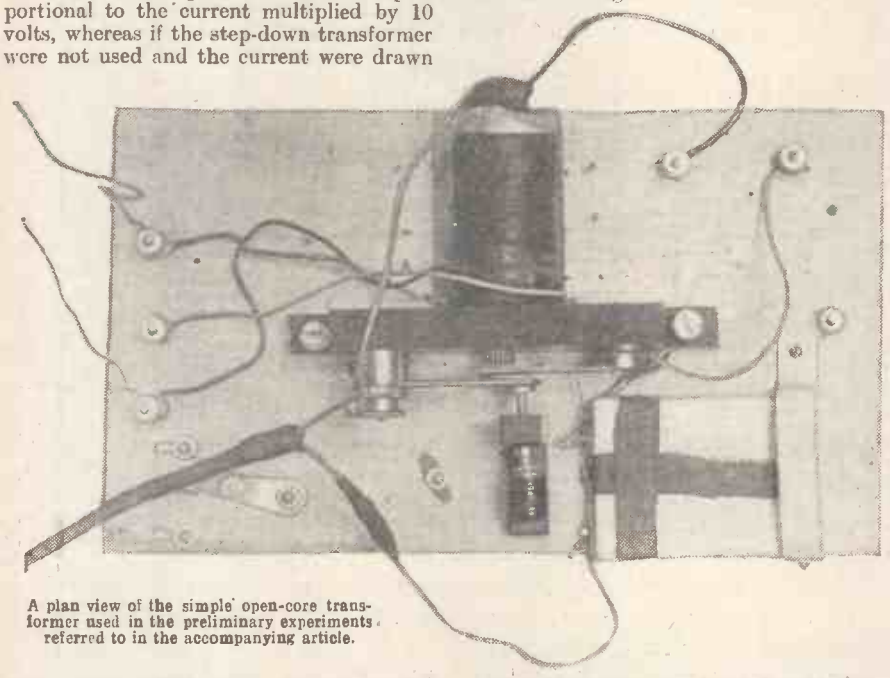
So important is this advantage that no manufacturer of battery-charging devices, where these are to be used for alternating current, would dream of following any other system than that of stepping-down the voltage.

Difficulty With Direct Current.

Where the electric-supply mains is direct current instead of alternating current, the position, however, is altogether different, as direct current cannot be used with a transformer. If direct current is passed into one winding of a transformer, nothing whatever is delivered from the other winding.

In consequence of this, those whose electric supply is direct current either have to send their batteries away to be charged, or they have to adopt some system for charging the batteries by connecting them into the main supply, so that they are "on charge" when the electric lights of the house are burning, or else they have to charge them by means of a series resistance.

Connecting in with the main electric supply is very inconvenient, and also requires a certain amount of technical knowledge; it is, moreover, contrary to regulations and is attended with a considerable amount of danger



A plan view of the simple open-core transformer used in the preliminary experiments referred to in the accompanying article.

If a series resistance is used, this dissipates about nineteen-twentieths of the total energy drawn from the electric mains, with the result that for every 1s. worth of electrical energy usefully employed in charging the battery, 19s. worth is wasted in the series resistance and serves no useful purpose. Consequently, where a battery is charged in this way *the process costs about twenty times as much as it need do.*

Hitherto, no device has been available to enable those whose electric supply is direct current to take advantage of the very valuable step-down principle universally employed with alternating current.

Interrupted Current.

If, however, the direct current, before being fed into the primary of a transformer, is automatically interrupted at a sufficiently high frequency, the transformer may be operated *exactly as though it were supplied from alternating-current electric mains*, and low-tension alternating current will be delivered from the output side of the transformer.

Producing A.C. from D.C.

This A.C. output may then be rectified in the usual way by means of any of the standard types of rectifier, and used for charging a battery or for any other similar purpose.

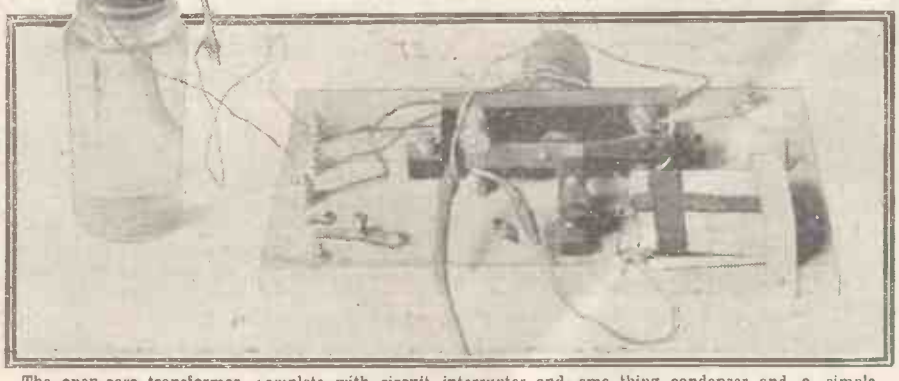
In this way we have a remarkably simple and practical method of stepping-down the high voltage of the direct-current electric-light mains to the low voltage required for battery charging. As already explained, this means that the *direct-current user* is enabled to enjoy the same advantages as the *alternating-current user*, as he is provided with a simple device which he merely plugs into a convenient electric-light socket, and by which he can charge his batteries with a minimum of expense and trouble.

D.C. from A.C.

The invention, as a matter of fact, goes further, for the device may be used *either* on alternating-current *or* on direct-current electric-light mains by the very simple process of connecting to certain terminals 1 and 2 instead of terminals 1 and 3 or, alternatively, of moving a small switch, which has the same effect.

In one of the accompanying photographs is shown a plain view of one of the first experimental models, in which an open-core transformer, consisting of primary and secondary windings upon a cylindrical fibre tube, of about ½ in. diameter, filled with straight iron wires, is provided with a vibrator interrupter in series with the

(*Continued on next page.*)



The open-core transformer, complete with circuit interrupter and smoothing condenser and a simple tantalum rectifier, makes a complete experimental version of the universal charger.

THE NEW UNIVERSAL CHARGER.

(Continued from previous page.)

primary, a special side-circuit being connected across the spark gap by which the spark is reduced almost to invisibility, even in the dark. With this simple arrangement a current of less than 100 milliamperes ($\frac{1}{10}$ amp.) at 200 volts in the primary circuit produces a current of 1 ampere (after rectification) on the output side.

In another photograph the arrangement just described is shown with a single-wave rectifier connected in the output circuit for delivering the rectified D.C. current for battery-charging purposes.

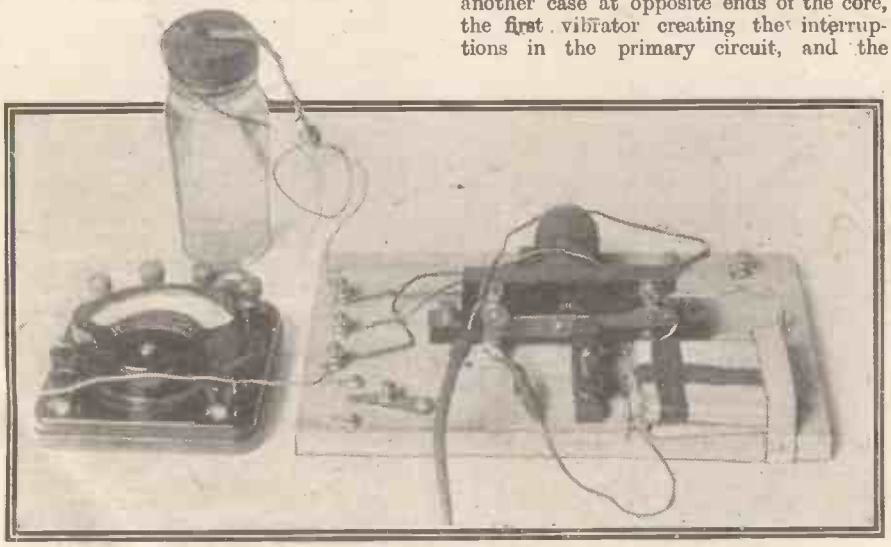
A third photograph shows the same arrangement with a D.C. ammeter connected in the low-tension circuit.

Semi-Closed Core.

The open-core transformer indicated in the photographs mentioned above is, of course, comparatively inefficient, and in one photo is shown a transformer with a special core, which is similar to the type commonly employed for small power transformers, but which has a gap at one part, the purpose of which is to allow of a certain amount of stray magnetic flux for operating the vibrator. The vibrator interrupter will be clearly seen mounted upon the top of the transformer, whilst the rectifier is at the back. The vibrator is fitted with special tungsten contacts.

Steady Output.

The reading of the D.C. ammeter on the low-tension side was absolutely steady, quite as steady as though the device were operated from alternating-current electric-supply mains.



A step-down D.C. charger with a D.C. ammeter connected to its output terminals in order to verify the current available.

Various other experimental models have been made, using closed core or semi-closed core transformers, and correspondingly higher efficiencies have been obtained. Transformers of the hedgehog type have been quite successfully used, but for various reasons it has been found more convenient to use the vibrator as a separate unit connected in series with the transformer primary, the interrupter in this case being of a simple and low-resistance type.

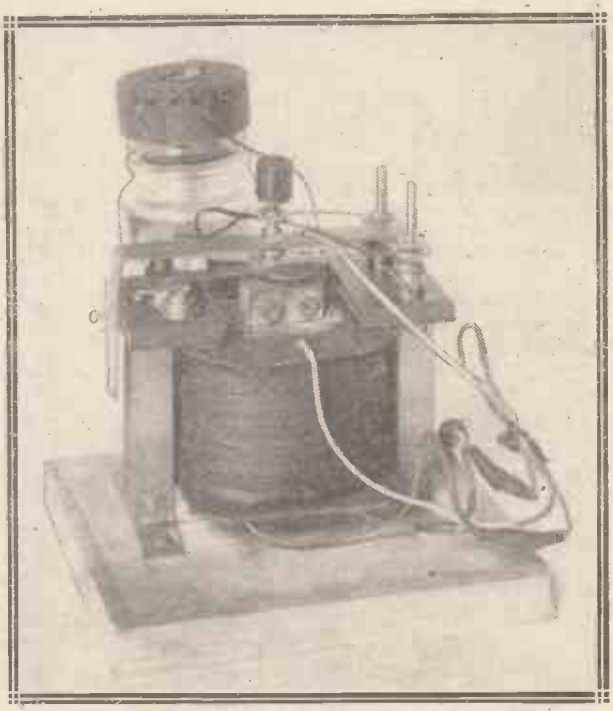
Vibratory and rotary interrupters have been used perfectly successfully and also a special electrolytic interrupter which has been developed for this purpose. The ordinary electrolytic interrupters as used with induction coils are quite unsuitable as they are far too large and they operate on a minimum current in the region of 10 amperes, which, of course, is just about one hundred times as great as the current drawn by this device.

Special Rectifying Systems.

When a vibrator or a rotary interrupter is used, it is a simple matter to arrange additional contacts so that the alternating current produced in the secondary winding may be rectified by the same vibrator or commutator which is used to create the interruptions in the primary circuit. It will be obvious that the two will be synchronous (or a multiple one of the other), and it is an easy matter to bring them into phase. In other cases I used a special transformer of a semi-open type with two vibrators, in one case mounted side by side, and in another case at opposite ends of the core, the first vibrator creating the interruptions in the primary circuit, and the second rectifying the alternating current from the secondary.

I am glad to say that considerable interest has been aroused by this invention and, so far as I can judge by the correspondence, there would seem to be a very large number of wireless users who hitherto have charged their batteries by the extremely wasteful method discussed at the commencement of this and the previous article, and they evidently welcome a device by which they will be able to effect a very large percentage saving in their battery-charging electricity bill.

As previously mentioned, patent applications have been in progress for some considerable time in connection with this invention, but, so far as I am concerned, bona fide experimenters are welcome to make up the device for their own private use. I have already been approached by manufacturers with a view to this invention being placed on the market, but I shall be able to say more on that matter a little later on. I believe this is the first time that an A.C.-D.C. charger has been put forward.



A special semi-open-core transformer fitted with a vibrator interruptor and connected to a tantalum rectifier on the output low-tension side.

ELIMINATING L.F. "FEED-BACK."

The Editor, POPULAR WIRELESS.

Dear Sir,—I am in complete agreement with your correspondent, Mr. Bettridge, in his letter in your August 27th issue regarding distortion in L.F. transformer-coupled amplifiers. I believe that a great deal of distortion, if not all (assuming the transformers to be good ones), is caused by L.F. feed-back in two and more stage amplifiers.

My experience in this direction indicates that the higher the primary inductance (which in turn generally means a more perfect transformer) the greater the tendency to oscillate.

Mr. Bettridge is of the opinion that most of the trouble is caused by H.T. battery resistance, I think that electrostatic feed-back caused by stray capacity coupling plays a big part.

Perhaps it would not be out of place to give a few hints for the benefit of less experienced readers, since it is an almost universal fault with Det. and 2 L.F. sets.

No. 1. Make the grid lead between the grid condenser and the grid of the detector valve as short as possible.

No. 2. Try reversing transformer primary leads.

No. 3. Don't use long leads when L.S. is connected direct in plate circuit of last valve. Use a filter circuit or output transformer.

No. 4. Shunt H.T. with large condensers.

No. 5. Reduce switching to an absolute minimum.

No. 6. Earth transformer cores and cases.

No. 7. Shunt transformer secondary with a high resistance.

Of course, the best way to get over the whole difficulty is to screen each stage from the next, since it reduces both electrostatic and magnetic coupling to nil, and then there is very little fear of the amplifier oscillating at either audible or inaudible frequencies.

Yours faithfully,

Lancs. RONALD S. HATCH.

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BROADCAST NOTES.

By OUR BROADCASTING CORRESPONDENTS.

Dance Music Back on 5 X X—Writers of To-day—The End of the Proms.—Nelson Keys : A Radio Tour—Mr. Levine on the B.B.C.—Broadcast Opera Begins—Sir Walford Davies—The B.B.C. Control Board—The Welsh Row.

Dance Music Back on 5 X X.

THE B.B.C. are to be congratulated on the promptness with which they restored late dance music to 5 X X. The original theory was that 5 G B would carry all the dance music needed for the 5 X X listeners. It was soon proved, however, that the short waves of 5 G B rapidly faded outside its service area. For some days, therefore, on three nights a week, many 5 X X listeners were deprived of their dance music. The matter has now been put right. The B.B.C. will need to keep in this receptive mood, because the present experimental stage of redistribution will involve many and sudden changes.

Writers of To-day.

This series of special broadcasts, initiated in London last year, will be resumed on Saturday, September 24th, at 7.45 p.m., by Mr. W. A. Darlington, the author of "Alf's Button." Other contributors to the series will be as follows: Temple Thurston (October 8th), Hilaire Belloc (October 15th), J. B. Priestley (November 26th), and Sheila Kaye Smith (December 31st). It is true that this is a comprehensive list of fiction writers, but this does not meet the point that most authors, and particularly the more brilliant ones, fail at the microphone, with consequent disappointment to many thousands of their admirers. With repeated experiences of this in the past, the B.B.C. will be expected to have sorted out the authors who really get across the microphone.

The End of the Proms.

Saturday, September 24th, is the last day of the Promenade Season at Queen's Hall. The B.B.C. has made a brilliant success of its debut at Queen's Hall, crowded houses, magnificent programmes, unexampled enthusiasm—all have gone to disprove the theory that Broadcasting means the end of concerts. Sir Henry Wood is delighted. After initial difficulties with the more conservative elements at Savoy Hill, he secured a free hand, and got well away. The final concert of the season, on September 24th, will be broadcast from London, 5 X X, and other stations between 8 and 10.30 p.m. Miss Muriel Licette and Mr. Norman Allin will be the vocalists, and Solomon will play the solo part in Tchaikovsky's Pianoforte Concerto No. 1 in B. Flat Minor.

Nelson Keys—A Radio Tour.

Mr. Nelson Keys is doing a tour of the wave-lengths during the week, October 3rd. He is fresh from America full of new ideas, and effervescing with good spirits. His last appearance in England was as Hard-Boiled Herman in "Rose Marie." It is splendid news that, in addition to this tour, Nelson Keys will appear before the microphone monthly for the next six months.

Mr. Levine on the B.B.C.

It was rumoured that Mr. Levine, the American millionaire air adventurer, was to tell listeners all about himself. Mr. Levine was seen in earnest conversation with B.B.C. officials in the Savoy Hotel. Then there appears to have been a number of exchanges, and people well informed on such matters were giving fairly long odds on Mr. Levine's chances for the microphone. But somehow or other, Mr. Levine is still a stranger to the British Listening Public. Perhaps the secret history of this affair will some day form the

This new Army radio device is a combined earth-pin and aerial reel, which fits on to a rifle just like a bayonet. A photograph showing the article in use appears on the "Technical Notes" page.

subject of a piquant chapter in Mr. Levine's autobiography. Savoy Hill is serenely silent.

Broadcast Opera Begins.

The winter series of studio operas begins on September 27th, with a performance from 5 G B of Verdi's opera Il Trovatore, with Enid Cruickshank, Vivienne Chatterton, Allan Turner and Sam Harrison in the cast.

Newcastle News.

Selections from "The Beggar's Opera," by Frederick Austin, is to be given by Newcastle on Friday, September 30th.

Sir Walford Davies.

It is reported that Sir Walford Davies is to do another long series of talks on "Music and the Ordinary Listener." If this is so, it is a terrible example of too much of a good thing. The very high degree of popularity obtained by Sir Walford Davies last season should have influenced the B.B.C. to hold him in reserve this season. But here again it looks as if the willing horse is to be worked to death and valuable goodwill thrown away. Under the circumstances, most listeners will hope for considerable variation in the theme developed.

The B.B.C. Control Board.

There are rumours of a mysterious new body at the B.B.C. called the Control Board. There used to be a body called the Programme Board, but this was buried not long since with suitable solemnity. It is presumed, therefore, that the Control Board has risen from the ashes of the Programme Board. Great secrecy surrounds this body. B.B.C. officials whom one meets about turn pale when it is mentioned. It is believed that it meets outside the building, it is supposed to exercise powers of life and death. Its composition is kept a secret as well as its meeting place. Nevertheless, it has come to be known that the following are members—Sir John Reith, Admiral Carpendale and Captain Eckersley. Perhaps this is all.

The Welsh Row.

The report on the Welsh Language and Literature by the Board of Education Committee contained the hardest knock the B.B.C. has ever had in an official report. Broadcasting was condemned as the worst enemy of the Welsh language. There was bitter complaint that in many homes in Wales no English would ever be heard if it were not for the wireless. Curiously enough, Mr. E. R. Appleton, Station Director at Cardiff, who had given evidence to this Committee, says that the Committee told him that all was well in the best of all possible worlds so far as broadcasting and Welsh were concerned.

But a member of the Committee has let the cat out of the bag. The real trouble is that Mr. Appleton is an Englishman; and there is a certain amount of justification in this complaint under present conditions, but when Cardiff becomes West Britain, then there will be no room for a Welshman in charge of the station. Of course, the basis of alleged nationality is all wrong as a qualification. The B.B.C. was wise to point out:

(a) That there are lots of sensible people in Wales.

And (b) that good music does not recognise national boundaries, real or alleged.

Receiving 5 G B in Birmingham.

The B.B.C. people have come to the conclusion that the complaints of Birmingham listeners against the reception of the new Daventry "experimental" station, 5 G B, are sufficiently numerous and serious to be worth investigating. They have therefore decided to make a thorough examination of local conditions, particularly in regard to the position of crystal-set users, who are the principal sufferers from the shutting down of the 5 I T transmitter.

A van equipped with wireless was to be seen in the city during a recent week-end, and on the following Monday engineers from London carried out a test of the reception from 5 G B in the city and immediate neighbourhood. By this means it was hoped that it would be possible to understand the difficulties and disappointments which have arisen in several districts since the new station started operations, and the result will be awaited with the greatest interest.

The aerial at the now obsolescent 5 I T transmitting station.

5 I T

Some personal impressions of the Birmingham Broadcasting Station.

By G. V. DOWDING, Grad.I.E.E.

TO 5 I T, the Birmingham Broadcasting Station, belongs the honour of possessing one of the largest studios in the world. It is truly a magnificent affair, and I shall have a fair amount to say about it later on. Both the studios and offices of 5 I T are located in a building in Broad Street erected especially for the B.B.C., and being planned for the specific purposes, and not adapted, as in the case of many of the other stations, it is most conveniently laid out. The street frontage is negligible, however, and only the doorway occupies this, the main building spreading out at the back of other premises.

But despite the unimposing entrance which provides access to a rather narrow, uninteresting passage, one soon appreciates the commodious nature of the interior. Turning the first corner one comes into a long corridor sprinkled with many doors bearing impressive notices such as, "Musical Director," "Board Room," etc., etc., But there is that dignified air of top hats and frock coats about the place that reminds one more of commercial pomposity than radio entertainment.

Mind you, this is only a personal impression—I did not actually see any top hats, although I had the distinct feeling that they ought to have been in evidence. Also, most of the people I met were quite normal sort of folk, but there was lacking that "joi de vivre" I was tending to associate with the world behind the microphone. I felt that I wanted to turn up some back numbers of the "Radio Times" to see if there were any "fun" in 5 I T's programmes!

The Main Studio.

Again it was, perhaps, rather unfortunate that when I saw 5 I T's large studio for the first time it was arranged for a choir practice and had a large number of neatly-placed chairs occupying most of its floor space, and the organ was prominently in sight! But it is by no means a dull and gloomy studio, for it has large windows all along two of its sides, and the curtains and ceiling draperies are bright and cheerful in colour. When the curtains covering the windows are drawn back—a simple operation as I was shown—the daylight simply floods in and the place becomes like a huge conservatory. In a novel manner the ceiling curtains, which are tastefully arranged in panels, can also be drawn back in order to vary their sound damping effects.

I was told that large augmented orchestras could be accommodated comfortably and still leave plenty of room for choirs and supernumaries, and this was plainly evident, for the studio is very much larger than one at another station in which I saw some forty performers at work with no undue crowding.

Activity in the Control Room.

Efficiency seems to be the keynote of the Birmingham station, more especially on the technical side. In the control room, for instance, every instrument has its "blue print" neatly arranged above it and, as I was looking around, I was informed that a very special test was in progress. My conversation with Mr. Cooper, the engineer-in-charge was, therefore, conducted in whispers. Two young men wearing telephone receivers were intently listening to something and, every now and then, one would turn to an ordinary telephone and speak to someone standing by at the other end. I had a suspicion, which I thought it impolitic to voice, that this activity vitally concerned 5 G B which was then but an experimental station, isolated and unattached.

Perhaps it might be as well if I explain exactly what a control room is. It forms the link between the microphones in the studios and the transmitting station and between this latter and the microphones used in outside broadcasts, such as the relaying of music from a restaurant and so on. Also, when the programmes of other stations are taken these are all passed through the control room before being handed on to the transmitter. In the control room an engineer wearing telephone receivers listens all the time and checks the purity and makes the necessary adjustments on the amplifiers from time to time to adjust the volume.

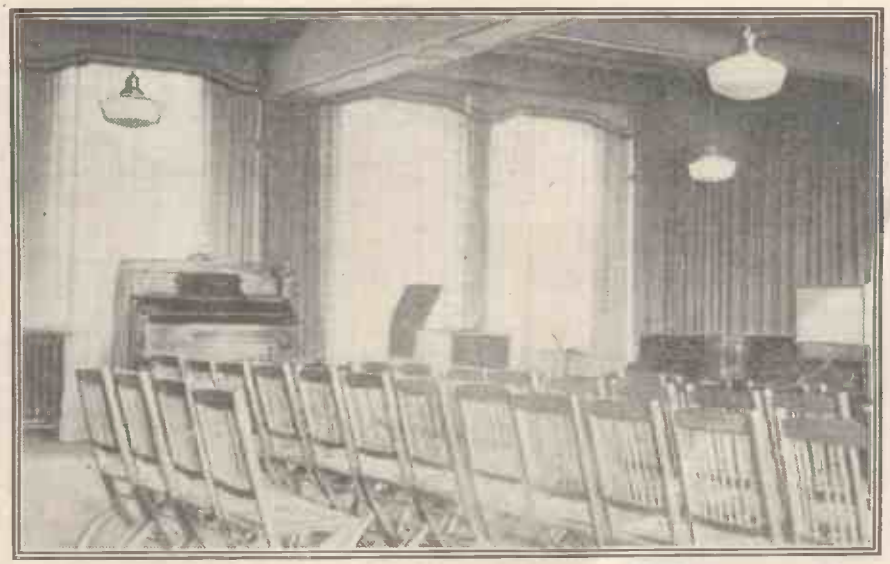
At the Birmingham station there are, or were at the time of my visit, six engineers in addition to Mr. Cooper and his chief assistant, and, in order to provide some variation in their work, shifts are arranged so that each man takes duties on succeeding days at the transmitting station, control room, a day as spare man standing by for relief and emergency work, outside broadcasts, and finally a day off duty.

Mr. Cooper has been with the Birmingham station ever-since the original B.B.C. took the station over from the well-known firm which was operating it for experimental purposes at Witton. He recalled the fact, when we adjourned to his office for a chat, that the station was moved to its second home in New Street in one night.

"Didn't you have a fire or something dramatic at New Street?" I asked him.

"Yes," he replied. "You will remember that we were situated on the premises of a cinema. Well, there was a café above us and the wooden floor of the kitchen of

(*Continued on next page.*)

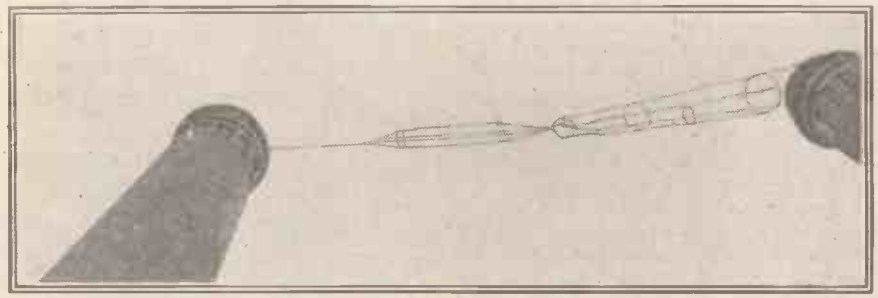


The main studio at the Birmingham station is one of the largest broadcasting studios in the world.

5 I T.

(Continued from previous page.)

this caught fire one night. It was first noticed by our engineer in the control room immediately beneath, and he at once telephoned the alarm to the fire station. At the time we were taking an S.B. from some other station, and our man was determined that he would hang on to the last moment. For a few minutes there was nothing but a fair amount of smoke,



A view of 5 I T's aerial, looking up from the base of one of the power station's chimneys. The "feeder" (seen coming down on the right) feeds into the centre of two small "sausages."

but presently the ceiling of the control room began to burn quite merrily and pieces of it commenced to fall down on to the instruments. Nevertheless, he remained at his post and the broadcast continued until the arrival of the fire engines. For twenty minutes, with the place teeming with smoke and water and with firemen shouting and dashing about with hoses and axes, he continued to wear his phones and adjust his amplifiers, but eventually we were compelled to close down."

"What a pity the listeners hadn't television sets," I said. "It would have made one of the most thrilling broadcasts in the history of radio."

"But it would have been regarded as a fake," Mr. Cooper laughed.

"Now to go to the other extreme. What, in your opinion, is the funniest thing that has happened at 5 I T?" I asked.

Mr. Cooper did not require much time to think that over.

"It must have been two or so years ago," he said, "that a member of the B.N.O.C. was singing the Prologue to Pagliacci and as he neared the end of this, a cat that had in some way managed to get into the studio walked across and took up a position immediately in front of the microphone. When the artiste brilliantly sang the final line, 'Ring up the curtain,' there was a brief pause and then:

A Popular "O.B."

"'Mee-ee-yow!' howled the cat. And you can imagine the mingled consternation and laughter it caused," concluded Mr. Cooper.

"I hope the artiste saw the cat," I commented suggestively!

Shortly after this, we went over to examine the transmitter at the Corporation power station. Comparatively speaking, it is quite a small affair, and except for the generators and batteries could be squeezed into an ordinary bath-room. Instead of the series of oscillator and modulator panels employed at most of the stations all the main gear is embodied in one unit, and this is housed in a very poky little room. By the way, it is not only possible but highly probable that by the time these words appear in print this 5 I T apparatus will have been dismantled in view of the fact that the Birmingham studios are now using the 5 G B transmitting outfit at Daventry.

The transmitter was in operation broadcasting an S.B. talk, and I found it most interesting to watch the gear in operation, listening at the same time to a reproduction of the transmission coming through the loud speaker provided for checking purposes.

"5 I T," said Mr. Cooper, apropos one of my leading questions, "was one of the first stations to do 'outside' broadcasting. And our very first 'O.B.' was Lozell's Picture House and we are still transmitting the music from this cinema at regular intervals."

There was not much to see in the transmitter room, and I did not stay there more than a few minutes, but retreated into the open to have another look at the aerial. This is, or perhaps I should say was, erected between two 210-ft. chimneys. And after taking two or three photographs I paid my respects to Mr. Cooper and departed in a rather disappointed mood.

Question of "Atmosphere."

5 I T is one of our leading broadcasting stations but it does not appear to me to have the individuality of some of the smaller ones. It seems to be negative in character. From the listener's point of view, however, it is possibly quite satisfactory, and its programmes may be subject to less criticism than those of other stations. Indeed, I believe 5 I T "on air" is popular and this is all that really matters. However dull and uninteresting it may be behind its microphones, so long as this "atmosphere" does not tend to influence its programmes, no one "outside" has cause to grumble!

* * *

Since the above words were written 5 I T as a broadcasting station has disappeared from our ken, and we now have "The Birmingham Studios" demonstrating daily through "5 G B, the Experimental Station at Daventry."

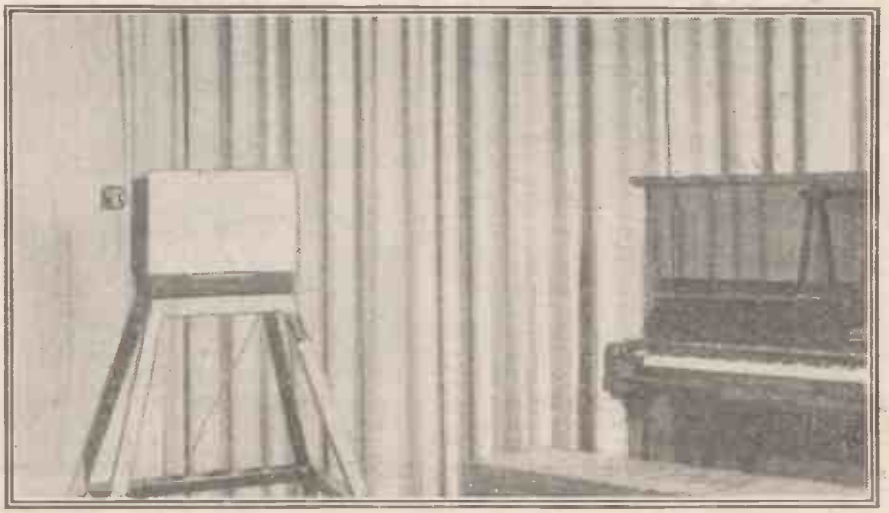
The Birmingham studios are to continue, and with the increase in the size of the service area covered by their new transmitter, I presume that far from becoming a less important arm of the mighty Corporation, the power of the Birmingham broadcasters will be greater than ever. Possibly this will be slightly offset in the distant future by the opening of broadcast studios in several other important towns, but this is purely conjecture on my part.

A "Very Sound Scheme."

I believe the idea has been mooted that there is to be a fairly large number of broadcasting stations dotted about the country, and that these will be divided up into groups, each group mainly to serve one pair of the contemplated "Regional" transmitters. This would appear to be a very sound scheme, and should completely satisfy civic dignity and localised nationalism.

And in view of the fact that Birmingham is the first studio centre in the proposed regional system to come into operation, it may be thought that I have not devoted to it the space that it deserves. But it should be remembered that I have already dealt with the 5 G B transmitter more or less in detail, and there really is not much more to say about the studios and headquarters at Birmingham.

I have no reason at all to doubt that the officials are efficient, and are carrying out their various duties with every possible degree of efficiency. Further, I must admit that the many 5 G B transmissions to which I subsequently listened (with critical attention, be it added!) appeared to be quite up to those of any other station. And that, after all, is, I suppose, all that one can reasonably demand of any of our broadcasters—anyway, these are only *personal impressions.*



The small studio at Birmingham which is generally used for "talks" and for "Children's Hour" broadcasts.

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SAFETY FIRST!

An interesting and informative article, by E. A. ANSON.

MOST of us would expect a glass bottle to crack if we poured boiling water into it. Yet when we give our wireless sets similar drastic treatment somehow we feel annoyed when valves burn out and fine windings break down.

During the course of my experiments the table at which I work becomes festooned with wires. Grid leaks, variable condensers, complete receivers, H.T. batteries, L.T.

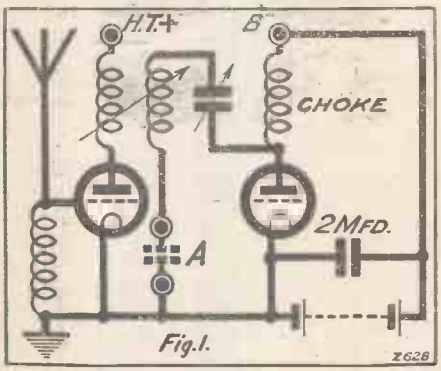


Fig.1. Z628

batteries, valves, jostle one another in an ever-increasing muddle.

Then suddenly I want to rig up some special circuit—unless I remember a few "Safety First" rules things happen. Valves light up with 100 volts across their filaments, but not for long! Sparks fly from the H.T. batteries and the L.T. leads start to melt in an effort to pass 500 amps. or so from a shorted accumulator.

Unnecessary Strain.

It is extraordinary what a mess of wires is required for even a simple rig-up. Hard experience has taught me the wisdom of checking connections before inserting valves, and then testing with a voltmeter. I have now quite a few unwritten Safety First rules. Many of these may be of use to listeners who do not attempt to construct their own sets, whilst others may help constructors to avoid spending money at the rate of 10s. 6d. a second (for I find this to be the life of a valve when it gets its filament mixed up with the H.T. battery).

I suppose the commonest thing in wireless is switching on and off. Probably 2,000,000 sets get switched on and off daily. Now, there is a good and a bad way of switching on. If you switch on the L.T. and then plug in the H.T., the wireless set is being strained. For with the filament alight the act of plugging in the H.T. will cause a sudden rush of current. This rush of current, partly due to charging up condensers, etc., will cause electrical surges in transformer and loud-speaker or 'phone winding.

When the surge stops and starts, high voltages will occur across these L.F. windings (several thousand volts). Well, if you do this sort of thing often enough something is bound to happen—generally costly. When switching off these surges will occur if you disconnect the H.T. with the filaments alight. In fact, it is a good Safety First rule to remember never to break the H.T. circuits if the filaments are switched on.

So when starting up switch on the filaments last and when switching off, turn them off first. It takes an appreciable time for the filaments to heat up, only a fraction of a second of course, but a fraction of a second is a long time electrically. This slow heating of the filaments prevents surges and allows the plate current to build up slowly.

Faulty Condensers.

In addition, in a receiver with 2 mfd. across the H.T., when plugging in the H.T. lead look for a small spark. That spark should occur once. If you unplug the H.T. again, count five slowly, and still get a spark when connecting up, your reservoir condenser is faulty. Of course, this test only applies when the filaments are OFF. It is, however, a good habit to make this test each time the set is put into use. Condensers smaller than about ·25 mfd. do not give a noticeable spark and a 2 mfd. condenser will not spark under about 80 volts or so.

Incidentally, a good 2 mfd. condenser, if charged to 100 volts by connecting it across the H.T. battery, should retain its charge for several minutes when disconnected from the H.T. After, say, two minutes short its terminals with a pointed piece of wire. As the point makes contact with the condenser terminal there should be a spark as the condenser discharges.

In the interest of Safety First, suspect

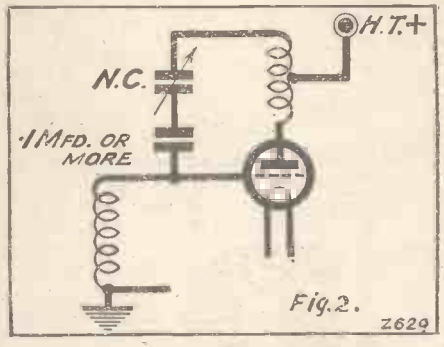


Fig.2. Z629

2 mfd. condensers that fail under this test. For they leak away their charge on account of internal faults.

Another wise Safety Rule is—Never insert or remove a valve without disconnecting the H.T. This is a rule I am always breaking; nevertheless, it is a very good rule, particularly if you are not familiar with the legs of valves. Valve legs are specially spaced to prevent plugging them in wrongly, but—well, disconnect the H.T. Looking down on a valve you will see its four pins like this • : • A. The lonely one marked A is the anode pin. Put your finger on it. Then be sure which way to insert the valve. If you do this the filament and grid legs may be fitted safely into their sockets before the anode. If they fit, take your finger away from under the anode pin and slip the valve gently into position. This Safety First method helps to avoid attempts to insert the valve the wrong way round.

(*Continued on next page.*)

The spacing of components in a multi-valve set is of supreme importance.

SAFETY FIRST!

(Continued from previous page.)

When connecting up the H.T. for the first time to the receiver terminals, remove all valves and make very sure that the H.T. leads really do go to H.T.+ and —, not to L.T.+ and —.

There has been more wholesale valve butchery through this than from any other reason. It is quite possible in a multi-valve set to blow a fiver in under one second!

Connecting the H.T. battery the wrong way round does no harm—that is, connecting H.T.+ to the H.T— terminal of the set and H.T.— to the H.T.+ terminal. But you won't hear anything. It sounds stupid, but I spent an entire evening wondering just why I couldn't get a set to work. This was the reason!

Avoiding H.T. "Shorts."

Remember that in many cases merely removing a reaction or tuned anode coil breaks the H.T., and should not be done with the filament alight.

Set constructors will find a few Safety First rules will really save them money, too. It is so easy to connect up wrongly and produce unwanted fireworks. First of all it is useful to remember that H.F. currents are not stopped by condensers if the con-

Make sure that fixed condensers are all O.K. and that they do not leak.

densers are made large enough. For instance, when using condenser reaction the usual circuit looks like the one shown above. (Fig. 1.)

Notice the reaction circuit, from the plate through a variable condenser through reaction coil to earth. If the vanes of the condenser happen to touch one another, the H.T. battery is shorted. A condenser of anything above .1 mfd. connected at A would not interfere with this circuit, but would insure the absence of fireworks if the variable condenser did let you down.

Better still, make use of the existing 2 mfd. condenser across the H.T. and connect the reaction coil to B instead of at the earth. In this case a faulty variable reaction condenser cannot short the H.T.

Carefully Test Everything.

It is the same with neutralising condensers. A large condenser connected in series with them will prevent shorting the H.T. (See Fig. 2.) The effect of putting condensers in series is to reduce the capacity of the variable condenser used. However, if the added series capacity is very large compared with the variable condenser, the reduction is very small.

After a receiver has been constructed there is one Safety First rule that should never be omitted. After inserting all coils, batteries, and 'phones, connect the L.T. battery to the H.T. terminals. If the valves light, sit down and congratulate yourself that you made the test. If the valves don't light, probably the circuit is all right as regards L.T.

Generally, before inserting any valves it is safe practice to go over the valve sockets with a voltmeter. All coils, 'phones, etc., must be in place. Also H.T. and L.T. batteries.

Then if you get a 100-volt reading from the L.T. sockets it is obvious that something needs checking. Whilst this test is being made get someone to turn all variable condenser knobs. If the voltmeter waggles have another look inside the set; it shouldn't waggle. A condenser vane may be touching a wire or shorting. Don't forget to turn the neutralising condenser, too.

None of these tests will ensure that the set will work, but they will most certainly tell you whether the H.T. and L.T. are keeping to their proper wires.

Generally, before connecting up to an aerial it is good practice to tune all circuits to the same wavelength. The set should oscillate violently. Then adjust the neutralising condenser until oscillation stops. Move the aerial tuning coil slowly a degree or two right and left. Perhaps oscillation will start again at one spot. Readjust the neutralising condenser until it stops.

In this manner it is possible to neutralise the set before putting it into use. For you may be sure that if it won't oscillate when not connected to the aerial it will be further away still when the aerial load is applied. This last Safety First rule will be appreciated by your neighbours. In a large town there are generally scores of new sets being neutralised for the first time on the local station in the approved style—and they do oscillate!

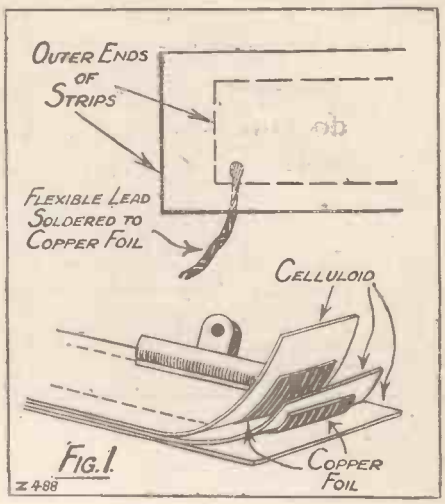
I have left the most important Safety First rule till last. Don't lend components. Either the borrower ignores all Safety First rules or simply builds your components into his set and cherishes them greatly.

MAKING LARGE-CAPACITY FIXED CONDENSERS.

By A. V. D. H.

THE ordinary method of making up fixed condensers by interleaving small slips of copper or tin foil and mica becomes distinctly tedious if the capacity required is anything above about .002 mfd. Larger fixed condensers than this are sometimes wanted for shunting the loud speaker, for example, and these can be made up quickly by the following method.

Obtain a strip of copper foil a few feet long and not less than 2 in. wide, and also a strip of thin celluloid about 6 in. longer



than the copper and not less than 4½ in. wide. From the copper foil cut two strips each 1 in. wide, and from the celluloid three strips, each 1½ in. wide. To one end of each copper strip solder a short length of flexible wire. Now lay the ends of the five strips as shown in Fig. 1, and fix them temporarily in this position with a paper clip. Make sure that the two leads at the far ends of the strips come out on opposite sides. Lay the whole length of the strips out flat and properly interleaved, take off the paper clip, and roll up the strips as tightly as possible, starring the roll on a 1½ in. piece of ebonite tube about ½ in. in diameter. Tape over the completed roll, bringing the ends out neatly at the sides. The ebonite tube is left in place in the centre of the roll, and makes the mounting of the condenser a simple matter.

FILAMENT VOLTS AND AMPLIFICATION.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have read Captain Round's article in our last issue with great interest. I have taken the following emission measurements of a 4-volt Cossor bright emitter), with plate and grid connected :

Anode Volts.	Anode. (A)	Current. (B)	Milliamps. (C)
0	·005	·145	·523
1	·039	·305	·794
2	·129	·545	1·110
3	·279	·830	1·444
4	·508	1·160	1·814
5	·766	1·500	2·203
6	1·078	1·870	2·624

Filament voltage 4·01.

(A) = negative of filament battery to negative of H.T.

(B) = middle of filament battery to negative of H.T.

(C) = positive of filament battery to negative of H.T.

The curves are within reasonable limits the same, but shifted two volts each time. The (B) setting was found to be independent of the way round of the filament battery, an idea which does not seem to have occurred to Capt. Round.

If the emission were dependent simply on the $\frac{3}{2}$ law it can easily be shown that from 4 to 6 volts in (A) the anode current should be $a^*V^{\frac{3}{2}}$, which is clearly not the case :

a	2	3	4	5	6
$a^{\frac{3}{2}}$	5·7	15·6	32·0	140·5	882

* If $I_a = K V^{\frac{3}{2}}$ for given filament without P.D.

then $I_a = \frac{2K}{5v}(V^{\frac{5}{2}} - (V-v)^{\frac{5}{2}})$; where v = filament volts; providing (V—v) not negative.

The question of the emission at low plate voltages is more largely dependent on (1) the initial velocity of the electrons, (2) magnetic field due to filament current. (3) electrostatic field due to P.D. along filament.

Figure 5 should, I presume, be labelled " volts on grid," " milliamps in grid circuit " from the text. Why is a K.L. valve " unfortunately only useful to those with A.C. ?

I have also the emission figures for the Cossor valve with the grid connected to filament as usual, if they should interest you.

Yours faithfully,
ERNEST C. CRAVEN.

Plaistowe, E.13.

TRANSFORMER VERSUS RESISTANCE COUPLING.

The Editor, POPULAR WIRELESS.

Dear Sir,—The frequent appearance of the letters of Mr. J. Baggs in your Correspondence column suggests that this gentleman has a very large bee in his bonnet. His constant dissertations on the merits of transformers—and one make in particular—remind one of the gentlemen of Hyde Park who " orate " every week-end. I am not suggesting that supporters of transformers are revolutionaries, but that the arguments put forward by this gentleman are not dissimilar in many ways to those of the perspiring orators.

Mr. Baggs' weekly oration usually consists of a protest that transformer coupling and output transformers are the be-all and end-all of good reproduction. I would remind Mr. Baggs that the B.B.C. do not seem to think so ; in fact, they avoid transformers in their amplifiers whenever possible.

I was privileged recently to see a curve of a four-stage B.B.C. amplifier. It was dead-straight from 50 cycles to 9,000 cycles, with a very slight drop at 10,000 cycles ! Needless to say, it was resistance-capacity coupled, and the " line " output transformer (which was unavoidable) was choke-coupled from the last valve. Furthermore, the circuit was particularly simple, and the " drop " at 10,000 cycles was caused by the transformer !

The bee in Mr. Baggs' bonnet seems to be taking shape. In fairness to other makers of transformers, would Mr. Baggs assure us that he is entirely a disinterested party, that he has no connection and has had no dealings with the firm which makes the transformer he continually " booms." I say this because I know that there are several other makes which are just as good, and one or two which are better ; yet he fails to mention them. I am not saying that the " Baggs transformer " (shall we call it ?) is bad. It is very good, and adequate for most loud speakers. But I still maintain that for the very best possible results, some form of resistance-capacity coupling is essential.

Yours, etc.,
" MALTESE CROSS."

London, S.W.1.

A TUNING QUERY.

The Editor, POPULAR WIRELESS.

Dear Sir,—As a regular reader of your valuable paper I would like to mention a point concerning square law and S.L.F. condensers which has puzzled me for some time, and which I think may have puzzled others besides.

A ·0005 mfd. variable condenser will tune between, say, 300 and 380 metres, but on the higher wavelengths between, say, 1,400 and 1,800 metres. Thus, the higher the wave-length less capacity is required to raise the wave-length a fixed number.

Now have in mind a square law condenser in parallel with the carial and earth, which I think is

CORRESPONDENCE.

FILAMENT VOLTS AND AMPLIFICATION

A TUNING QUERY— AN EVER-DRY INSULATOR, Etc.

Letters from readers discussing interesting and topical wireless events, or recording unusual experiences, are always welcomed ; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—Editor.

the more usual. Now, when the condenser rotor is turned from all-out position to all-in, the wave-length is increased, and also the first ten degrees make very little difference in the capacity, whilst the last 10 degrees make a big difference, and hence makes a much bigger increase in the wave-length, as the higher the wave-length the less capacity needed for a fixed number of wave-lengths. Could any of your readers please settle this question for me ?

Yours truly,
F. SKINNER.

Kirton-in-Lindsey, Lincs.

RECEIVING 2 X A F.

The Editor, POPULAR WIRELESS.

Dear Sir,—In " P.W.," August 20th, " INQUISITIVE " wishes to know whether other readers receive 2 X A F without an aerial.

I ordinarily receive this station at good loud-speaker strength, and can still hear every word all over the room when I remove aerial lead. Detector valve V.24 (O-v-2).

I should like to know whether readers consider an extra-reaction valve to be worth while, or whether extra inter-electrode capacity nullifies its advantages for short-wave work.

Yours faithfully,
JOHN V. BOLSTER.

BARING COTTON-COVERED WIRE.

The Editor, POPULAR WIRELESS.

Dear Sir,—In a recent " P.W." I note you have an article on " Baring Cotton-covered Wire," but so far I have not seen published the method which I consider the simplest and most satisfactory, viz. : Place the end of wire to be uncovered in the flame of a lighted match, and allow to smoulder until the required uncovering is reached ; then wipe the end with a piece of paper or rag, and the wire will be left quite clean without any further trouble. This method applies also to stranded wire.

Yours faithfully,
ARTHUR H. RUDGE.

Tettenhall.

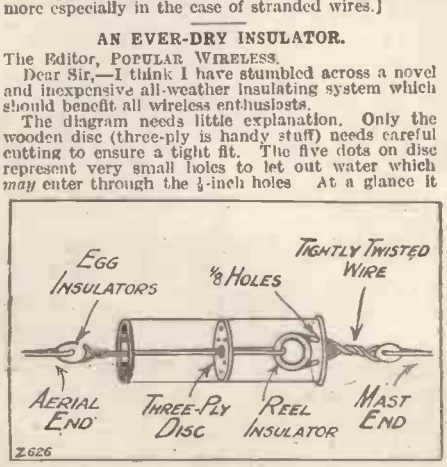
[EDITORIAL NOTE.—We do not recommend this practice, as, when heated, copper will rapidly oxidise, making good electrical connections difficult to obtain, more especially in the case of stranded wires.]

AN EVER-DRY INSULATOR.

The Editor, POPULAR WIRELESS.

Dear Sir,—I think I have stumbled across a novel and inexpensive all-weather insulating system which should benefit all wireless enthusiasts.

The diagram needs little explanation. Only the wooden disc (three-ply is handy stuff) needs careful cutting to ensure a tight fit. The five dots on disc represent very small holes to let out water which *may* enter through the ¼-inch holes At a glance it



will be seen that four of the five holes are unnecessary drilling a number ensures that one will be at the bottom whichever way the device is erected.

The wire at the mast end should be tightly twisted. Even if moisture does reach the inner chamber it will soon be dried by the heat-attracting qualities of the tin.

I'm certain that this will benefit your readers who don't care to clean their aerial systems periodically.

The open end of the tin should be a little lower than the closed end ; this is achieved by putting the closed end to the mast. I have put on the tin two coats of paint.

Hoping I have done a little in the interests of " uniform reception."

Yours truly,
G. MILLER.

Sunderland.

" WIRELESS ON TRAINS."

The Editor, POPULAR WIRELESS.

Dear Sir,—Referring to an article entitled " Are We Wireless Wasters ? " appearing in your issue of July 9th, we would like to draw your attention to an article entitled " Wireless on Trains," which appeared in your issue of April 5th, 1924, in which the entirely successful operation of a Wireless Broadcast Receiver in the Continental Boat Express which brought Sir Davison Dalziel, Chairman of the International Pullman Car Co., from Dover to London, is described. This installation was carried out by the Technical Staff of the Marconiphone Co., Ltd., of which the undersigned was at that time manager, and it has occurred to us that a suitable reference to this article which appeared over three years ago will be a good answer to the suggestion made in the article to which we now refer, which suggests that America and other countries have gone ahead of us in this respect. There is no doubt whatever that had the railway authorities at that time been prepared to go ahead with installations in trains, such installations could have been carried out in an entirely satisfactory manner, and we should not now have to admit that other countries have gone ahead of us in this respect.

Yours faithfully,
H. A. HARDINGE,

Bombay.

5 X X IN GLASGOW.

The Editor, POPULAR WIRELESS.

Dear Sir,—It may be of general interest to you and " P.W." readers to know that in Glasgow I can, with a crystal set followed by a two-stage transformer coupled amplifier, put Daventry on the loud speaker sufficiently loud to be heard at one yard distance from the horn ; this in daylight, during the midday transmission from that station between the hours of 1 p.m. and 2 p.m. at this time of year. Can this be done by any resistance-capacity adherent ? And in view of the controversy at present taking place on this subject, I would state that I am using a Ferranti A.F.3 and A.F.4, and though several other well-known transformers have been substituted, not one could be found to equal them, in fact, in some cases signals could not be heard even on 'phones. In view of the distance and that only a crystal is used as detector, I think this shows the wonderful efficiency of this transformer, and the makers are to be congratulated. Wishing " P.W." every success.

Yours faithfully,
CHAS. M. SINCLAIR.

Govan, Glasgow.

SHORT-WAVE RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—With regard to your comments regarding the reception of S.W. telephony in " P.W." of the 29th July, I trust the following may be of interest from one residing in Egypt. Using a home-made three-valve set (1 H.F., 1 Det., and 1 L.F.) I receive P C J J and 2 X A F at good loud-speaker strength, and on most occasions I have no need of the headphones at all. On the other hand, K D K A, I find, is not so good, and until 2 or 3 a.m. Local Time is not worth listening to. During the 24 hour special broadcast from P C J J I made the following observations.

Tuesday, July 26th, 12 noon, G.M.T.	reception R 1.
Do.	2 p.m. G.M.T., R.2, no fading.
Do.	5–8 p.m. G.M.T., R.6 do.
Do.	8.15–10.40 G.M.T. R.3. Fading rather bad.
Wednesday, July 27th, 4 a.m. G.M.T.	R 5. Slight fading.

I myself being a recruit in the ranks of wireless cannot read Morse, but I should imagine anyone that does has always something interesting to listen to, for without exaggeration I can pick up 40 to 50 stations at any time during the day or night.

Remarkable as it may seem, I never get interference from Morse when receiving any of the above three stations.

Reception on the long waves in Egypt, with the exception of during the months of November, December, January, February and March, is very poor, owing to X's, in fact, sounds issuing from the loud speaker consist of approximately 50 per cent programme and 50 per cent X's.

On reading some back numbers of " P.W." I came across one dated July 3rd, 1926, containing a paragraph entitled, " Radio for Egypt," in which it is stated that an agreement has been reached between the Egyptian Government on the one hand and the Marconi Co. on the other for a period of 30 years. This, to myself and many other Britishers here, who, unfortunate in having no broadcast station of our own, have to depend on outsiders for our programmes, the nearest of which is " Stamboul," approximately 750 miles away, comes like a " Bass " in the Sahara on a day in August. Any news of further developments would be greatly appreciated.

Wishing the " P.W.," of which I have just become a regular subscriber, continued success.

Yours faithfully,
W. G. BEDINGTON.

Abbassia, Cairo, Egypt.

Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Department for test. All tests are carried out with strict impartiality in the "P.W." test-room, under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiassed guide as to what to buy and what to avoid.—EDITOR.

"ATLAS" RESISTANCE-CAPACITY COUPLER.

MESSRS. H. CLARKE & CO. (M/c), Ltd., recently sent us one of their new "Atlas" Resistance-Capacity Couplers. This is a neat little unit consisting of a bakelite panel, measuring 3⅛ in. by 2¼ in., upon which is mounted two resistances, a mica condenser, and four terminals. The grid leak has a value of 1 megohm and the plate resistance ½ megohm. The fixed condenser has a capacity of ·01 mfd. By the way, as one cannot take the presence of an "·01" in a unit of this nature for granted, although this value is more or less standard, it would be advantageous if the makers of such would mark their coupling condensers plainly with their values. The "Atlas" people are better than some makers in this respect, for they do clearly mark their resistances—each in two places, in fact—while one can unmount the fixed condenser and refer to its value, which is marked underneath. In these days amateurs do like to be able to know the ohms and mfds. of their gear.

And the fact that the condenser of this "Atlas" unit can be fairly easily removed is a feature which appeals to us, inasmuch as it can be easily changed for another fixed condenser of the same make but of a different capacity. And the resistances are held in clips and can quickly be removed. All this should appeal strongly to the experimenting amateur.

The unit is well made, and its terminals are provided with legible lettering. And on test we found the coupler perfectly satisfactory. It should, of course, be employed with one of the special R.C. valves having a high amplification factor. The price, 7s. 6d., is, in our opinion, perfectly reasonable.

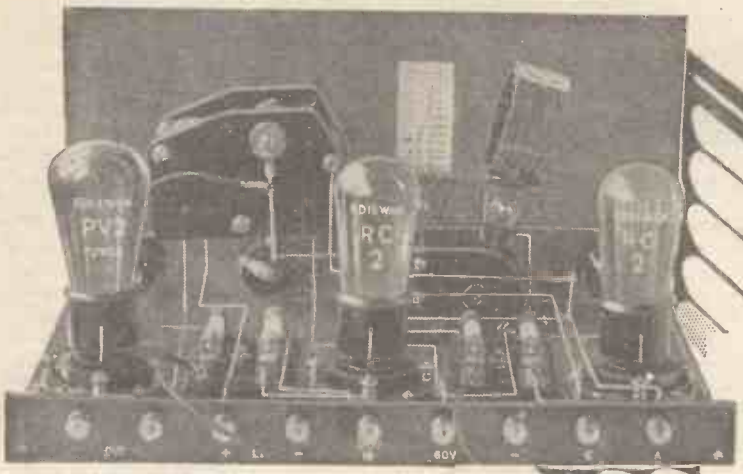
A NOVEL RHEOSTAT.

Although resistors are tending to displa panel-mounting filament rheostats in mode radio receivers, the rheostat is by no mea obsolete, in fact, in some sets it is more less an essential component. And in an case, a rheostat on the panel makes a ve convenient master control with which switch the set on and off and to make tho adjustments necessary from time to tim to compensate for falling battery voltage And for such purposes particularly, a rhe stat having an adjustable stop which ca be set to any position so that any desire proportion of the resistance is left circuit when the contact is moved to i "minimum" position, is a very attracti proposition. Such a "master control" ca be safely left in the hands of untechni operators.

And an adjustable stop of this nature a feature of a new filament rheostat du to Messrs. Rooke Bros, Ltd., which fo this reason alone should achieve conside able popularity. But additionally, it appea to be quite well made and it operate smoothly and positively. It is provided wit a dial and pointer and is designed fo single-hole panel mounting. We understan that various types are to be available including one that has two ranges of re sistances corresponding with the once popular "dull emitter"-"bright emitter" sections.

The stop arrangement is a very simple mechanical scheme, and can be locked by means of one small and accessible screw But it is most efficient. If a tenth o the resistance wire is to be left in circuit

(*Continued on page* 110.)



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IF YOU are still looking for a circuit which will give you perfect loudspeaker reception—why not build the R.C. Threesome?

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V.55.

APPARATUS TESTED.

(*Continued from page* 108.)

according to the position of the stop, then that tenth will be a permanent minimum until the stop is altered, despite the roughest handling of the component.

FERRANTI LOUD-SPEAKER UNIT.

The Ferranti loud-speaker unit is, we are informed, being withdrawn from the market because it has been found that in some instances it is being used with trumpets that lamentably fail to do the unit justice. Rather than that this should occur, Messrs. Ferranti have completely withdrawn the unit, and intend shortly to market a speaker embodying their unit with a scientifically designed horn of an exponential character.

HYDRA CONDENSERS.

The Hydra fixed condenser is very well known in America, where, it is stated, over two millions are sold every year, but it has not hitherto been exploited to any great extent in this country. It now appears that Hydras are to come on to the British market and at attractive prices. The Hydra condenser employs a paper dielectric, but has separate aluminium foils and claims a power loss of under one degree and an insulation resistance of at least 200 megohms per microfarad. It is contained within an aluminium casing, and, all things considered, can be said to be remarkably compact. An ordinary range is available running from ·0001 mfd. to ·009 mfd. at 1s. 6d. each and from ·01 mfd. right up to 10 mfd. at equally low figures. This range is tested on 500 volts D.C., but five other ranges are available, embodying long lists of values up to one that is tested at 6,000 volts D.C. This last would prove suitable for small transmitters, and the two intermediate ranges, viz., 1,000 and 2,000 volts D.C., would be quite safe for mains unit eliminator work and provide very satisfactory margins into the bargain.

We very carefully tested the samples forwarded to us for that purpose, and found them all to be quite efficient and well within their stated margins of errors. They are certainly high-class products, and their low prices and the comprehensive ranges of values available should help to make them serious rivals to our home products of similar natures.

AN ANTI-CORROSION "DOPE."

All users of accumulators will have been annoyed at one time or another by the corrosive action of the sulphuric acid solution used in these. The spraying of the acid during charging, together with the inevitable "creeping," brings the awkward fluid not only into contact with the terminals of the cells, but with connecting leads as well, and "green rot" subsequently sets in unless very special precautions are taken. British Electric, of Strand House, Willesden Lane, Park Royal, London, N.W., recently sent us a sample of their "Antysulph," a substance which is claimed to both remove and prevent corrosion. It is a thickish fluid, and a small brush is provided with which it can be applied to the affected parts.

On test we have found "Antysulph" remarkably efficacious. Containing a strong neutralising agent, it rapidly "kills" the acid, and the oily content allows the "dope" to remain in the form of a thin, colourless film to prevent further attacks. We were able to clean up almost to their original brightness the brass terminals of an old cell that were very badly corroded, and this by merely applying one dressing of "Antysulph," and after a short period wiping this off with a piece of rag. And for preservative purposes we have found it vastly superior to any form of grease or oil, owing to its containing a strong alkaline substance.

"Antysulph" costs 1s. 3d. for quite a small bottle, but as only a small quantity is required for each application, and as it is a most effective "dope," it cannot be said to be espensive. And it should prove a boon to all users of accumulators either for radio or other purposes.

Miss Marie Bremner, one of the favourite artistes at 3 L O, the Melbourne broadcasting station.
Photo: C. J. Fraser, Melbourne.

RADIOTORIAL

All Editorial Communications to be addressed to The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, 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 receivers. As much of the information given in the columns of this paper concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

Questions and Answers

TESTING A CONDENSER.

S. D. C. (Stony Stratford).—"I have been trying to test a ·5 mfd. fixed condenser by connecting a 99-volt H.T. battery across it, as described in 'P.W.' recently. I find that, if carefully done, it gives a good, smart spark on discharge, after 1 or 2 minutes. If left much more than this the spark gets less robust but it is not at all a bad spark after 5 or 6 minutes. Does this indicate that the condenser is in fairly good condition? (It is one of the paper Mansbridge types.)"

Your condenser is evidently in fairly good condition if it will spark noticeably five minutes after it has been charged.

NUMBER OF COILS IN ¼ LB. OF WIRE.

B. L. (Salisbury, Wilts).—"How many 50-turn basket coils should I be able to make from a ¼ lb. of No. 24 enamelled wire?"

Four or five, according to the size of the former employed, and the actual tightness of the winding, etc.

If the former has a mean turn-circumference of 7 or 8 inches, each coil would take 10 or 11 yards of wire. There are approximately 55 yds of this wire in 4 oz. so there should be no difficulty in making five coils from it.

"DEAD SPOT" ON SHORT WAVES.

A. P. S. (Hitchin, Herts).—"I have been amusing myself by winding low-wave coils to take my set down below 100 metres. It is a Reinartz and 1 L.F., and I can get it to oscillate well on short waves with smooth reaction, except at one blank place on the dial. Here, for some reason, it will not oscillate at all with the proper reaction coil that gives good results on readings 5 degrees above, or 5 degrees below. I am told that this is known as a short wave 'dead spot.' How can it be cured?"

The cure will readily be applied when it is realised that the "dead spot" is simply due to the fact that the grid circuit is at that point coming into tune with the aerial circuit.

At most condenser positions there is but little tendency for energy transfer between these circuits, owing to the coupling being loose. But, when the grid circuit tunes to the aerial's own natural frequency, or to a harmonic, the reaction effect which should strengthen signals is nullified by the aerial circuit radiation losses.

(*Continued on page* 114.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 112.)

A very simple way of overcoming the trouble is to arrange a small condenser in series with the aerial lead, with a shorting switch to cut it out when necessary.

Using such an arrangement the dead spot can be shifted at will by simply throwing over the switch. This will either short or insert the small fixed condenser (·0001 mfd. is suitable) which will alter the aerial's wave-length and allow the grid circuit to react smoothly over that part of the condenser dial which was formerly the dead spot.

Naturally, with such a condenser altering the aerial's wave-length, there is a possibility of introducing another unwanted dead-spot at a different wave-length; but when it is required to search at that point the switch is thrown over again, and thus the dead spot is once more shifted to a part of the dial not in use.

NEW FRENCH STATION.

W. H. C. (Marlborough, Wilts).—"Is there a new French station on about 275 metres? I have picked up signals twice and heard something about Marseilles and Alps, but cannot catch the full announcement."

THE TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

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

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

Full details, including a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: On receipt of this an Application Form will be sent to you, free and post free, immediately. This application will place you under no obligation whatever, but having the form you will know exactly what information we require to have before us in order to solve your problems.

Probably you heard the new Grenoble station, which has been testing on 278 metres. Some of the transmissions have been relayed from Marseilles.

AM I OSCILLATING?

L. T. M. G. (Basingstoke, Hants).—"I have built a 1-valve set from the 'P.W.' Blue Print No. 1 (Detector Valve with Reaction), but I cannot handle the reaction properly. Where should the moving coil be put? Once I heard foreign voices speaking, but when I tried to get them clearer the set whistled. Am I oscillating by doing that? How do I get foreign stations on a 1-valve set?"

The whole secret is to control the reaction properly, so that you are getting neither too much nor too little for the station that is being received. Just as turning the condenser alters the tuning, so adjusting the moving coil's position alters the reaction.

To understand how reaction increases the strength and range of the set, proceed as follows:

Choose a time when there is no broadcasting on, say, early in the morning, put on the 'phones, and listen carefully to the effect of moving the reaction coil.

First listen in with the coils wide apart. You will hear a very faint "background" when the valve is alight and the H.T. plugged in, and the set can then be said to sound "alive." Now bring the reaction coil *slowly* towards the fixed coil, and carefully listen to the result in the 'phones. Just at first, perhaps, you will hardly notice any difference. But as the coils are brought closer together, the faint whispering in the 'phones gets a little louder. You are now getting reaction effects, and the set is much more sensitive than when the coils were right apart.

Now if you wet your finger and tap the aerial terminal with it, you will hear corresponding clicks in the 'phones, and these clicks will become quite loud as the coils get nearer and nearer. Listen carefully to these clicks, and keep on slowly moving the coils closer and closer together. You will find that quite suddenly the clicks get very loud indeed, and a kind of hissing or breathing sound begins, or else the set starts to howl. This means that now you are using too much reaction, and the set is oscillating. So open the coils apart again, for you must never let the set oscillate, as this spoils your own reception and other people's too.

Practise a little while in this way, until you can tell the difference between the proper reaction effect (which will strengthen weak signals), and too much reaction. This latter not only spoils your neighbours' programmes, but it actually prevents you from picking up the weak broadcasting from distant stations. You will find that the set is most sensitive when it is nearly, *but not quite*, up to the oscillation point. When you have learned the knack, and when you can alter the tuning without making the set oscillate you have learned the secret of long-distance reception and you will probably be astounded at what your set can do in the way of picking up distant stations.

BEWARE OF BATTERY LEADS.

W. M. Y. (Church Stretton).—"My brother wanted me to wait for him, but I couldn't. And when I was joining the set up I had three of the wires in my hands at once, and I noticed a little spark, but didn't pay much attention to it at the time. But when I got the set all fixed up I couldn't hear a sound with it.

"We tried it on my brother's aerial, across the road, and he couldn't get a sound either until we put his valve in. Then it went fine, so I took the valve I bought back to the dealer and he said he would try and get it changed for me.

But now the firm have written and told him its filament is destroyed by 'too much voltage,' and they won't change it. Can I do anything about it?"

Rough luck, W. M. Y.! We are afraid you cannot do anything about it, because it wasn't the valve people's fault, was it?

They say on the box they packed it in (and probably on the valve, too) "Filament Volts, 2" (or 4, or 6, as the case may be). But when you crossed up those leads in your hand you probably gave the poor filament about 60 volts! Naturally it couldn't stand up to that, even for a moment.

But although you have paid dearly, you have learnt the priceless lesson that high-tension leads must never, under any circumstances, be allowed to touch the low-tension leads. Fortunately you had only one valve in the set, but if there had been half a dozen they might all have been burnt out just as easily.

Accidents of this kind can *easily* be prevented, by always removing one or both of the leads of the high-tension battery when disconnecting, connecting up, changing over wires, or altering valves, etc.—in fact, whenever any alterations to the set are being carried out. Once the habit of taking out the plug is formed it is never forgotten.

METRES AND KILOCYCLES.

S. C. L. (Enfield Town, Middlesex).—"How can metres be changed into kilocycles, and kilocycles into metres?"

By dividing either of these into 300,000. If the wave-length is the known quantity, the answer will then be in frequency (kilocycles). Or if the frequency in kilocycles is known, this when divided into 300,000 will give the corresponding wave-length in metres.

5 X X, for instance, has a frequency of 187 kilocycles, and dividing 300,000 by this number we find its wave-length is 1,604·27 metres. Similarly Aberdeen, with a wave-length of 500 metres, has a frequency of $\frac{300,000}{500}$ = 600 kilocycles.

(*Continued on page* 116.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 114.)

MICA OR MANSBRIDGE TYPE?

A. G. Y. (Blackpool).—"I am making up an H.T. battery eliminator (for D.C. mains), and I am uncertain as to which of my fixed condensors should be used in it for by-passing H.F. currents. I have the following condensers on hand, and should like to know which kind should be used, for H.F. and Det. valves: One 2 mfd., two 1 mfd., and two ·5 mfd., all "Manbridge" types; two ·01 mfd., and one ·006 mfd. mica type."

For your purpose the mica type is much likelier to give good results. Very often the use of the "Mansbridge" type condensers in eliminators leads to humming noises or instability. So despite their smaller capacity we should use the ·01's and the ·006, all of the *mica* type.

A SIMPLE METHOD OF NEUTRALISING

P. D. (Belfast).—"Some month or so ago I saw in 'P.W.' a description of the method of neutralising a stage of H.F. amplification, the set being fitted with a condenser to control reaction. Can you tell me in which number this appeared, or give the details again?"

For the benefit of other readers also we are reproducing the description below:

"The following method of neutralising is recommended for use in sets employing one stage of H.F. and provided with a reaction control.

"Set the reaction control at minimum, and likewise the neutralising condenser. Now, on setting the tuning condensers so that the two tuned circuits are in step with each other, it will probably be found that the set is oscillating. To test for oscillation, touch one or other of the sets of plates of the tuning condensers (this may be either the fixed or moving, according to the particular set). You will probably find that the set will only oscillate under the above conditions when the two circuits are in tune with each other, and this can be used as an indication. It is convenient to perform the operation at some point near the middle of the tuning range. Now increase the capacity of the neutralising condenser.

"Test at intervals for oscillation as this is done, and you will presently find that the set has ceased to oscillate, and will not recommence even when the tuning dials are slightly readjusted. Now increase the reaction a little, until the set once more oscillates, and again increase the neutralising condenser setting until oscillation ceases. Slightly readjust the tuning condensers again to make sure that the set is completely stable once more.

"Proceed in this way until it is found that the correct adjustment of the neutrodyne condenser has been over-shot. Once this point has been passed it will be observed that further increases of the neutrodyne condenser no longer stop oscillation, but cause it to become stronger.

"The object is to find such an adjustment of the neutralising condenser as will permit the greatest setting of the reaction condenser to be used without producing oscillation. It will then be observed that when the two tuned circuits are in step and the set is brought to the verge of oscillation a slight movement in either direction of the neutrodyne condenser will cause the receiver to break into oscillation.

CLICKS FROM THE HOUSE-LIGHTING SWITCHES.

H. M. (Battersea, London, S.W.).—"Every time a light is switched on or off, there is a big click in the loud speaker. (This used not to happen when I used H.T. batteries, but now I get H.T. from the mains.) Is there a fault somewhere, or don't the clicks matter?"

It is quite usual for switches to be "heard" in this way, when H.T. is taken from the mains, and there is not the slightest harm done either to the set, or to the loud speaker.

IMPORTANT NOTICE

Next week's issue of "P.W" will be A SPECIAL EXHIBITION NUMBER

TECHNICAL NOTES.

(Continued from page 92.)

panels instead of ebonite: ply-wood which has been thoroughly dried and then properly shellac-varnished so as to exclude moisture has been used by the writer with excellent results.

I notice that the Lignole Corporation (U.S.) now supplies a special form of 5-ply wood for the making of wireless panels, baseboards, and so on. The wood has the usual mechanical properties of ply-wood (that is, it has no tendency to warp or break although it is comparatively thin) and, further, it has been baked in vacuum ovens at a fairly high temperature, long enough to dry it completely, after which a special insulating material has been forced into the pores of the wood under very high pressure. The standard thickness of the panel is 3-16th of an inch, the five laminations being cemented together so tightly that they appear to form a single wood board.

It is claimed that a panel of this material is for all practical purposes equivalent to an ebonite panel, whereas, on the other hand, it is much cheaper and more readily worked, and it can be supplied in a variety of finishes which are not ordinarily available with hard rubber; it can, for instance, be surfaced with a veneer to match any style of cabinet work.

NEXT WEEK

A SPECIAL
EXHIBITION NUMBER
ORDER *YOUR* "P.W." NOW

Aluminium Panels.

In this connection, the Aluminium Company of Pittsburg has now produced a range of aluminium panels, which combine shielding with a beautiful finish for the front of the cabinet. By using aluminium for the top, base, sides and centre inter-stage shield an effective combination has been created. The aluminium panels carry a photographic reproduction (presumably by means of a "transfer") of walnut, mahogany or any other type of wood. The components mounted upon the panel of this material are, of course, set into ebonite bushes.

The same company manufactures aluminium for special radio purposes such as for Alcoa shields, box shields, cabinets, panels, variable condensers, foil for fixed condensers, and so on.

Valve Voltmeter.

One of my readers asked me recently to describe how a valve might be used as a voltmeter. A simple arrangement of this sort is quite easy to make, and some interesting measurements may be made with it. An ordinary 3-electrode valve is used, with the negative terminal of the H.T. battery connected to the negative terminal of the L.T. battery, using an H.T. voltage of perhaps 30 volts. In the plate circuit should be introduced a milliammeter with a maximum reading of 1½ milliamps.

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TECHNICAL NOTES.

(*Continued from page* 118.)

A grid battery should be introduced, with its positive terminal connected to the negative terminal of the L.T. battery, whilst its negative terminal forms one of the input terminals of the vacuum tube voltmeter as a whole. The other input terminal of the system is connected direct to the grid of the valve. The grid battery voltage should be adjusted until the milliammeter reads about 1-10th of a milliampere, when the input terminals of the system are short-circuited, the valve now being operated on the lower bend of its characteristic curve.

If a voltage, whether direct or alternating, be impressed upon the input terminals, the plate current will suffer a change. The system should be calibrated by impressing various known voltages across the input terminals and reading the corresponding deflections of the milliammeter, which is in the plate circuit. When the arrangement has thus been calibrated, it may be used for determining accurately the value of any unknown voltage which is applied to the input terminals.

R.F. Amplification.

A paper appears in the June number of the "Proceedings of the Institute of Radio Engineers" entitled "A Mathematical Study of Radio Frequency Amplification," by a member of the University of Toronto. This paper is probably much too mathematical for the majority of readers of this journal, but at the same time there are parts which may be read and understood without any particular mathematical knowledge, and the paper deals with several important aspects of H.F. amplification.

The air-core transformer is fully considered, as also the question of the energy relations in the primary and secondary. The important question of the capacity between primary and secondary is also discussed, as well as the effect of valve output capacity. It is found, as a result of this mathematical investigation, that the output capacity is the same as though the valve had a complex amplification factor and a complex plate impedance.

The Crystal Valve.

I recently received some samples of a crystal detector entirely enclosed in a vacuum. This detector is described by the inventor as a "crystal valve" since it has all the outward appearance of a valve: the glass bulb is actually the same as those used for valves and the device is fitted with a standard valve base or cap. The base, however, is provided with only two pins instead of the usual four.

The "crystal valve" may be plugged into an ordinary valve-holder, its two pins engaging with two of the sockets of the valve-holder, the remaining two sockets being, of course, idle. When thus plugged-in, it presents exactly the appearance of a valve, although, of course, on closer inspection it is seen that the interior economy is somewhat different.

Adjusting.

The cat's-whisker is made adjustable in a very ingenious way. It is mounted upon a tiny ring which slides loosely upon a short horizontal bar, and the whole of this cat's-whisker system is counterbalanced by means of a small weight. Thus it is only necessary to tilt the valve in various directions so as to obtain any desired adjustment of the cat's-whisker against the crystal.

Oxidation.

It is claimed for this arrangement that, owing to the complete exhaustion of air, it is impossible for oxidation (or any other reaction which might take place in a crystal under ordinary conditions) to happen in the present case. Moreover, owing to the fact that the crystal detector is completely enclosed, dust and other extraneous effects are excluded.

According to reports of extended tests on the device, it has been found to give a remarkably uniform performance and to be free from the caprices of the ordinary type of crystal detector. I have not had the opportunity of testing it over any lengthy period as yet, but in the preliminary tests to which it has been submitted it certainly seems to give excellent results.

Of course, its principal attraction is its novelty and the fact that it turns a crystal set into a valve set, at any rate so far as the outward appearance is concerned.

A CORRECTION.

The London Electric Wire Co. & Smiths, Ltd., manufacturers of the Lewcos Six-pin Coils, advise us that in their advertisement on September 3rd incorrect prices were inadvertently inserted. The prices of the following styles should be:—

SPA 12	W/L 600-1200	6/-
SPT 12	W/L 600-1200	10/-
RTA 20	W/L 1000-2000	14/-
MRT 20	W/L 1000-2000	14/-
SSTP 15	W/L 1000-2000	14/-

R/R

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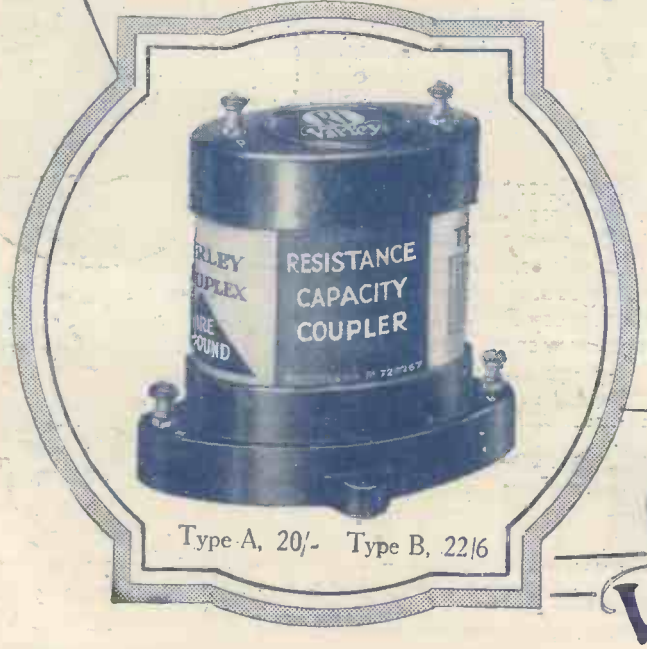

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