POPULAR WIRELESS, March 23rd, 1929.

REGISTERED AT THE G.P.O. AS A NEWSPAPER.

GREATEST VALUE—HIGHEST CIRCULATION

Popular Wireless

Every Thursday PRICE 3d.

No. 355. Vol. XV.

INCORPORATING "WIRELESS"

March 23rd, 1929.

Other Special Features This Week.

Points About Portables. Programme Poachers

THE "DWARF" THREE

Grid Bias Failures. Which Valve Matters Most?

"P.W." WHITE-PRINT No. 16

AMAZING NEWS!

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RADIO NOTES AND NEWS.

The New Valve Knight—Hint to Highbrows—A Long, Long Listening—More About Dance Music—Guaranteed Noiseless—In a Plain Van—Short-Wave Mysteries.

To-day's the Day.

PEOPLE who cannot line up on the banks and bridges of the Thames should try not to miss the running commentary on the 'Varsity Boat Race, which is to be given again by Mr. G. O. Nickalls and Mr. J. C. Squire. I can promise them, given luck, with a thrilling half hour, or noon to 12.35 p.m. At 3 p.m. on the same day (Sat.) there is the commentary on the F.A. Cup Semi-Final.

The New Valve Knight.

I UNDERSTAND that Dr. J. A. Fleming, F.R.S., who has been inundated with congratulatory letters about his knighthood, desires to be known not as Sir John but as Sir Ambrose Fleming, as there is already a Sir John in the family. So much interest has been created by this knighthood, that I take the opportunity to suggest that Sir A. Fleming has been honoured not because he invented the valve but for his long service to science. Nor does Sir O. Lodge owe his title to his radio work alone, which is relatively a small part of his achievements as a scientist.

Death of Sir John Pender.

DEATH removed on March 6th, at the age of 74, the head of the Eastern Telegraph Company and potential head of the great communications merger which is now in process of formation. Sir John Pender, who was the son of the founder of the Eastern, was taking an active part in the work of combining the Empire's cable and radio interests and died, one may say, "in harness." He was a "big" man in the best figurative sense of the word, and he earned the title of empire-builder.

Is This Right?

NEWS from the U.S.A. is to the effect that the Rum Squad is to use radio in the work of preventing the smuggling of liquor on the coast of Florida. When a suspected vessel is sighted the preventive cutters are to be called along by wireless. That radio should be used for such "dry" purposes almost tempts one to give it up. (Now some "old sobersides" will write and accuse me of conspiring to kill babies with rum.)

Talking and Terror.

I HAVE seen in the Press that the Rector of Sherringham is "terrified" lest in twenty years' time all children should talk like little "announcers." If that report is correct, one is tempted to reply, without intending disrespect to "the cloth," that it would be better for them to talk like the average announcer than like the average rector. I refer to tone and clarity, not to grammar.

Pity the Poor B.B.C.

I SEE that Mr. Cochran has been letting off squibs, nay, thunderbolts, about the quality of the entertainers engaged by the B.B.C. He does not disguise his contempt for those unfortunate "guinea-a-timers." Well, Mr. Cochran has probably forgotten all the B.B.C. knows about the art of entertaining, but I think he ought to bear in mind that the B.B.C. is not the manager of a music-hall; it has wider and far more important functions, and wields a much greater power for good or ill. Nevertheless, when the B.B.C. *does* profess to supply common or garden "vaudeville" it might do it royally and well.

Hint to Highbrows.

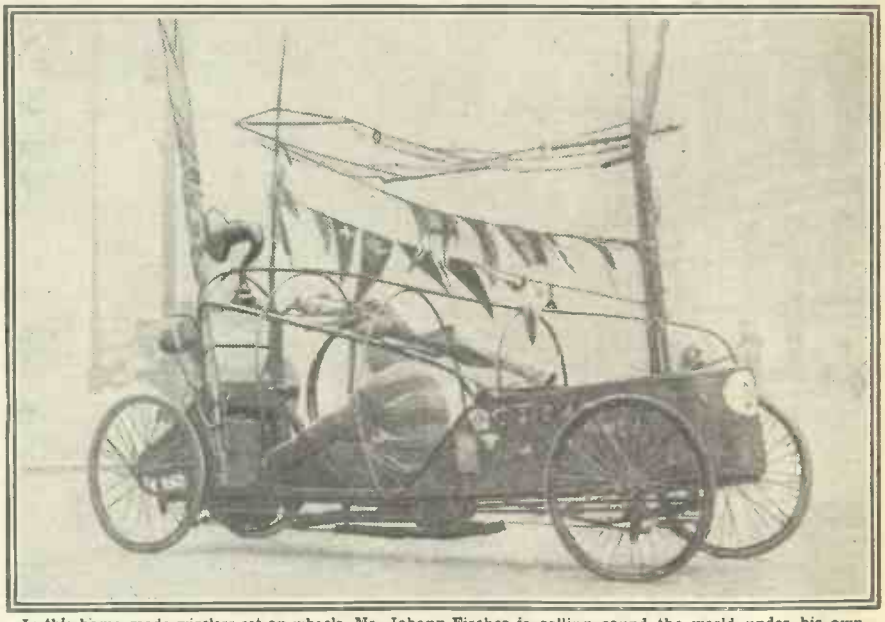
IT is announced that a new station is to be opened at Turin. It is to be 6 kw. in power, and will radiate on 275·2 metres. A specially interesting fact about this station, and one which should appeal to lovers of opera, is that it is to be connected with all the theatres in Turin, including the Theatre Regio at which the first performances of Italian operas are given. So when you hear a tenor sobbing and a soprano shrieking down an orchestra—you may have added Turin to your bag.

A Long, Long Listening.

MR. B. WALTON O'DONNELL was not long ago the hero of a performance from which even the most hardened listener might shrink. In a soft

(*Continued on next page.*)

ROUND THE WORLD ON A RADIO RUDDERSKIFF!



In this home-made wireless set on wheels, Mr. Johann Fischer is rolling round the world under his own aerial. He calls the vehicle a "rudder skiff," and is shown in Berlin on his way to Australia and America.

NOTES AND NEWS.

(Continued from previous page.)

moment he consented to act as judge of a band contest at the Newcastle Station. Only 28 bands took part—and Mr. O'Donnell was, to his horror, the only judge. He stuck to his post for six hours, listening to the same old piece being played, "placed" the first ten competitors, and then withdrew in order to save his mental balance, much to the disgust of the remaining 18 bands who had bets on all the "Places."

Burndept the Phoenix.

AMATEURS, especially of 1921 vintage or earlier, will always be interested in the history of Burndept's because they owe so much to the founder of its predecessor. Mr. W. W. Burnham, who kept the flame of broadcasting alive till it was ready to flare up in the shape of the B.B.C., started the original Burndept firm. It may interest readers of "Modern Wireless" to learn that Burndept's Chief Engineer, Mr. Marcus G. Scroggie, is touring the States, studying American radio methods. His articles in that magazine were excellent.

More About Dance Music.

E. R. E. (Frome) is wroth about the disappearance of the Savoy Band and has exchanged repartee with the B.B.C., with the usual negative result. Of course, E. R. E. is right in his view that the B.B.C. ought not to "vanish" admittedly popular items without so much as an explanation—but there you are! One grain of comfort is that he wrote to Mr. Fred Elizalde, who was good enough to say that he thinks we shall hear his band again before long, and that some well-known people will be added to it. Hooroo!

Appeal to Amateurs.

THE appeal which is being made for £50,000 to endow the Wheatstone Chair of Physics in commemoration of the centenary of King's College has special reference to listeners—although they may not realise it. The Chair is occupied at present by Dr. E. V. Appleton, F.R.S., who is well-known as a research worker in radio matters. He is now investigating the wave form of "atmospherics" and the action of the Heaviside layer in causing "fading" and "echoes," and the properties of short waves.

Radio and Musical Instruments.

THE results of a census taken in the U.S.A. include some figures which may possibly reflect the influence of radio upon the sale of musical instruments and gramophone records. During 1928 the sale of all instruments, except the organ, showed a 45 per cent decrease; the sale of organs showed an increase of 31 per cent over 1925. Pianos slumped 29 per cent. But the sale of gramophone records had increased 28 per cent; 100,000,000 were made and £10,000,000 worth were sold.

The Burning Question.

C. E. (Aberystwyth) tells me that having a radio equipment in his place of business he has collected the opinions of his audiences as to the programmes. The most popular kind of item was Music—"marches, waltzes, and works by the old masters, brimful of harmony." Modern music was not at all popular. This seems to be a very common view, and it is a pity the B.B.C. insist upon trying out unknown composers—a process for which it was not instituted and has no charter.

A Shuffle Suggested.

C. E. expresses the opinion that the programmes from 2 L O and 5 X X have deteriorated since 5 G B was built and that 5 G B gives much more satisfaction but is spoiled by fading. (*Hadn't noticed it!*) He suggests, therefore, that 2 L O and 5 G B join hands and that 5 X X should broadcast what is now sent out by 5 G B. He also declares that gramophone records are superior to "direct" rendition because they are neither hurried by the announcer nor "controlled" by the control room. What say readers on these points?

SHORT WAVES.

We understand that an attempt is being made to popularise the saw as a musical instrument for broadcasting. But why return to the original when so many life-like substitutes have been devised?

* * *

One blow on a brass gong marks the beginning of a transmission from the Hamburg station. Two strokes during a concert indicates a two-minute interval. At the close of the night session there must be a regular gong recital.—"Popular Radio Weekly."

* * *

Customer: "You told me that set I bought would bring in the coast. I can't even get local stuff."

Salesman: That set isn't old enough to talk. Just wait till you've had it two or three years."—"Life."

* * *

"And when I turned the dial, I tuned-in a man singing 'The Vulgar Boatmen' at terrific strength," says a reader's letter. Probably the singer was enjoying rude health!

* * *

Dear Heart, the message that I send
Is from no high aerial hurled;
Your modesty it would offend
Should I broadcast it to the world.
From "yon blue Heaven above us bent"
It comes to you, and you alone,
Having been most discreetly sent
Upon a wave-length of our own.

Four little words are all I need
My simple meaning to convey;
For I express myself, indeed,
In quite the most old-fashioned way.
Yet these are they you joy to hear
In all their sweet simplicity;
So when I breathe: "I love you, dear!"
My darling, listen in for me!

A Letter About a Letter.

IN reference to Mr. Hetherington's letter ("P.W." February 16th), R. V. H. (Pewsham) says that he has received 3 L O most Sundays since June, and has never heard that the wave-length is to change to 43 metres. I don't see that this proves that Mr. H. did not hear it. Perhaps he heard it on a week-day. Anyhow, both of them ought to know by now if there has been a change. R. V. H. says also that it is wonderful that Mr. H. gets 2 X A F so well on Sundays—as that station does not transmit on Sunday. My dear fellow, Mr. H. distinctly wrote "Saturday." Are you spoiling for a bicker or do your glasses need alteration? Never mind, you both love the "Sydney" Two.

Oscillator Wanted.

APROPOS my note of February 23rd about the Thornton Heath man who says he gets 100 stations on loud speaker, a number of listeners in the same district have pricked up their ears and generally behaved in a suspicious way because, says H. H. G. D., Thornton Heath is cursed with a demon "oscillator," "who oscillates, pulls plugs in and out, and fades and blots us out by excessive reaction all day long." These victims wonder whether—but no! clever as my correspondent is in getting 100 stations he cannot be the culprit. Besides, only a conjuror could *pull* a plug in and then *pull* it out.

Guaranteed Noiseless Circuit.

STRUCK with compassion for "our Gladys," who complained of the "parriots chirping" in the one-valver installed in the kitchen, L. M. (Dinas Powis) sends me a clipping from the "Evening Express," showing the diagram of a "double-tuned" crystal circuit they recommend, with the remark that Gladys will find it very quiet. She will, for though the condensers look bonny and the coils full of inductance, there is no crystal shown. Evidently crystal practice has "growed out of all knowledge."

New Use for Zero.

MR. G. WENDT, who arranged special broadcasts for K D K A to the polar regions, says that radio users in the Arctic cannot employ accumulators, and therefore operate entirely from dry-cell batteries. But it was found that the "life" of these batteries in store was not long enough to last the season, and after experiment it was proved that by freezing them they are made quite inoperative. So when they want to put a new one in circuit they have to thaw it, when all the little watts bob up again as fresh as paint.

In a Plain Van.

A FRIEND who has just returned from the U.S.A. tells me that he learned that thousands of people there have combined radio and gramophone sets costing sums fantastically beyond their means. It's all done by the instalment system which bulks so largely in American home trading. The only reason many families do not possess an elephant is that they have not been offered an elephant for a dollar down and small weekly payments.

Short-Wave Mysteries.

I HAVE several times pointed out what a large field for experiment is open in the realm of very short waves, and have hinted that perhaps somewhere down among the wee waves there may be a "band" containing frequencies of healing, or capable of transmuting metals. As an example of the peculiar properties of short waves I may mention that by means of a special valve capable of radiating from 10 to 15 kw. on 6 metres it is possible to raise the temperature of the blood to 100° F. in 16 minutes. This beats malaria hollow.

Does the Weather Help?

J. C. A. (Malta), who has been watching the weather, asserts that when sirocco weather is abroad reception is extra special good. This kind of weather is damp and misty, and I seem to remember that years ago, when a distance of several hundred miles was something to boast about, we were convinced that our signals did better during foggy weather, especially when it was cold.

ARIEL

MY NEW "RADIOSCOPE"

BY G.V. DOWDING

GRAD. I.E.E.

In this article the inventor begins a full description of his new Radio and Home-Talkie scheme, and describes some of the difficulties he has had to overcome before the several problems concerned were successfully solved.

WHEN I light-heartedly tackled the problem of radio home-talkies, I had not the slightest idea that there could be so many snags to be dealt with before a real start could be made. But happily, as I have already said, these have, one by one, been ironed out.

By the time this issue of "P.W." reaches you, all sorts of people will have seen the gear in operation, so it is now possible for me to start telling you something definite about it.

Five Patents Involved.

The system involves about five patents, although you would not think so to look at the simple mechanism. The essential part of it is a small cinema projector capable of holding twenty-minute reels. These reels can, of course, very easily be changed, so that long dramas can be handled if desired.

I expect there are still a large number of people who know little or nothing of these little projectors, notwithstanding that between fifty or sixty thousand are definitely known to be in use in this country.

The first important point to note is that the film used is of a non-inflammable character, and that the outfit handles no more current than many radio sets. You insert a plug in a lighting socket and you can then proceed to give the performance. The projector is easier than a radio receiver to handle and quite if not more fascinating. It can be fitted up in a minute in any room, however small, and it does not necessitate any special fittings; it can be stood on any convenient table, the little screen being hung up on the wall.

Excellent home projectors, working entirely from the electric mains (you do not have to wind a handle), are obtainable from about nine guineas. The operation of the device is quite automatic, and once started it does not require any attention whatever.

So much for the home cinematograph projector as at present in use in thousands of homes.

You will see right away that anything added to such a straightforward little proposition must itself be simple and free from complications, or it would be of little value.

Not So Simple . . . !

And when I tell you that tens of years of experimenting have gone to the production of huge outfits costing up to twenty thousand pounds in order to achieve nearly perfect ordinary talkies, you will see I was up against something when I set out to produce a home-talkie that would cost only a few pounds.

The big talkie machines in use in some of the London cinemas are masses of intricate mechanism. There are valve bridges, compensating devices, fade units, and all sorts of most complicated material.

You might think that all that one needs to do is to couple a sound reproducer with a film projector by mechanical means; drive the whole apparatus from one prime mover as it were. And, in fact, this is all that you need do, only it is not so simple a matter as you might think.

Hand Control Impossible.

Anyway, in due course I learnt that although the pictures shown by the little projectors are clear and distinct, the speeds at which the mechanism runs varies to a very considerable degree. It is a fact that you can keep on varying the speed of a projector within a few pictures or so without any appreciable effect on the screen.

The Radioscope does not necessitate the use of photo-electric cells such as this, or any other similar pieces of apparatus.

The makers of home-projectors have not worried much about constancy of speed. it isn't in the usual way necessary. And I found the variations quite tragic. They entirely washed out two or three of my first ideas, and it is a good job that that happened, as otherwise I should never have hit upon the system now in use.

I remember one of the members of the staff suggesting that a Radio Cinema would be possible merely by controlling the speed of the projector by hand, watching the screen and listening to the speech and music and balancing them up together.

A Variable Load.

Lest any reader of "P.W." also should think this, let me warn him not to waste his time experimenting. He will get a nervous breakdown trying to do it. I say with deep feeling, having tried it with some four on five different projectors, that it is quite impossible. You could just as easily hand-synchronise a television outfit. And I have heard that it is in trying to do this that so many U.S. television experimenters go into asylums.

There are a lot of little working parts in a projector which have eccentric movements. The film goes through in jerks as every picture stops awhile in front of the lens before passing on. The driving mechanism is, of course, small and you couldn't fit a home-projector with a half horse-power motor. In consequence of this there is little reserve of power, so that every tiny variation in the load is immediately reflected back to the motor.

20,000 Pictures!

You cannot fit large fly-wheels and like gadgets, and their use would quickly become a frightening mass of complications. More particularly, you cannot run the projector against constant braking, a scheme which figures in so many ideas regarding synchronisation, as there cannot be a sufficient margin of this to absorb all the speed and load discrepancies without also absorbing all the driving power available. Also small motors themselves are temperamental and react immediately to every variation in the supply.

On top of all this one has to bear in mind that the radio-cinema entails complete synchronisation of the control projector and all its "slaves," as one might term the

(Continued on next page.)

MY NEW "RADIOSCOPE."

(Continued from previous page.)

home outfits. In twenty minutes some twenty thousand pictures will have flashed through the control projector, at the home-cinema rate of sixteen pictures per second.

If you are more than four pictures out of synchronisation the fault may be apparent to the eyes and the ear. Therefore the individual twenty thousand pictures must keep in step as they flash through the control and slave projectors.

Schemes Which Fail.

Any scheme that merely involves constant running checked by ear and eye or by any other means to the same end must fail, because the most minute error completely undiscernible over a period of a minute might prove cumulative. Supposing you lost one picture per thousand at one of the slaves, then at the end of a twenty minute run you would be twenty pictures out of synchronisation. Your screen hero would then be able to say "Yes" one and a quarter seconds before his lips moved.

No, the synchronisation needed must make it impossible for cumulative errors to occur. And my Radioscope does this, I am happily able to say. Moreover, you could switch it on and leave it alone in the room for an hour—providing the control projector was working as long as this, and at the end of that time you would still be in synchronisation.

Entirely Automatic.

I do not see any future for any device that sets out to provide entertainment in the home that needs an operator at the knobs or levers or dials while it is working.

Rather tricky and complicated apparatus is needed for even the simplest of Television outfits. Readers will note a striking difference in the simplicity of the Radioscope, photos of which will very shortly be published in "P.W."

It is generally the purchaser of such a device that becomes the operator, and it is because he was sufficiently interested in it to buy it that he is as keed or keener than anyone else to enjoy the entertainment it provides.

Once the apparatus has been switched on it wants to be forgotten until such time as the cessation of its efforts brings you to earth and tells you that that is the end of the show.

I wonder how popular the gramophone would be to-day if, while it was working, someone had to hold the sound-box lightly in contact with the record with one hand the while he adjusted the mechanism with the other in order to keep it operating properly?

The amenities of the modern home demand devices of the press-the-button-and leave-it variety, and I for one have the greatest sympathy with this desirable state of affairs. But in striving to make my Radioscope conform with these requirements, I have had a most strenuous time, and don't mind admitting that I have faced failure dozens of times.

Developments.

But having synchronised the Radioscope it soon was seen that its scope was immensely widened. One of the latest developments is that any gramophone can be coupled to the apparatus to make a complete home-talkie. The gramophone then acts as the broadcasting station and keeps the projector exactly in step with its own sound-producing mechanism. You place the cinema screen in front of the gramophone, run a lead from the simple attachment on this (it can be fitted to any type of gramophone, even a cheap, portable type), and then place on your talkie record and film. The result is startling.

You have never seen a talkie-film in your own drawing-room, have you? I can assure you that it makes a most fascinating entertainment. All this week of writing I have been showing such to various people, and one and all they have been somewhat amazed by the realism. That the screen is small and the figures correspondingly diminutive does not seem at all incongruous.

This development makes the Radioscope much more valuable, as you can see, for the user can arrange his own programmes by hiring or buying the necessary films and records.

The cost of the Radioscope projector (as assessed by a manufacturer) should be somewhere round about £12. That of the gramophone attachment will be in the neighbourhood of £2, or perhaps very much less. The B.B.C. attachment to make Radio movies possible should be available at two or three pounds.

Including an admittedly cheap gramophone you will see that the whole Radio and Home Talkie complete will run into only twenty or less pounds. Soon you will also see that these figures are not optimistic ones, they are indeed rather conservative and may be very much less, although, of course, they may be a few shillings more if the demand is small, and this is not anticipated. I said you will see this, and by that I mean that in a future article I will describe all the apparatus in minute detail.

I have not told you as much in this article as I set out to do—there is so much ground to cover and space in "P.W." is valuable!

A scene from "A Dash for Liberty," which will doubtless go down in scientific history as the very first Radioscopic film.

FOR YOUR NOTEBOOK.

In the case of a tuned-anode circuit the "earthed" end of the condenser is that which is connected to the H.T. positive terminal.

* * *

When your aerial is not in use it should be connected to earth via a switch outside the house.

* * *

If you are often fiddling with a terminal in a rather inaccessible place, do not forget that it may be an advantage to cut a slot across the top of it with a hack saw, afterwards using a screwdriver to tighten the terminal. (Many manufacturers have adopted this plan as standard.)

* * *

Leads from the plate should not be placed close to or parallel with leads from the grid.

* * *

Where transformers are marked OS and IS and OP and IP it is usual to connect the OS to grid and IP to plate. If your L.F. transformer is not clearly marked to indicate the correct connections, try changing over the leads which go to the primary or to the secondary as they may make a marked difference to strength of reception.

* * *

One advantage of non-microphonic valve holders is that there is less chance of damaging the base of a valve when pulling it out of the holder.

PROGRAMME POACHERS.

Politicians at the Microphone — Our Technical Editor's Invention — Simplified Control.

By **THE EDITOR.**

THERE has been a good deal said lately in the House of Commons about the use of broadcasting for the General Election. Mr. Lloyd George, for example, has had quite a lot to say in connection with the idea of broadcasting political speeches.

Recently Mr. Lloyd George said that, with the General Election in sight, the broadcasting of politics was vital. It had worked well in America during the recent Presidential Election campaign, and he felt sure that in the new circumstances in this country it was almost the only means of reaching the vast electorate.

Political meetings were all well and good when the electorate reached 4,000, but were totally inadequate methods with an electorate of 40,000.

No Embargo.

Mr. Lloyd George went on to urge that a select number of political speakers from each Party should be allowed to address the electors. Or, in any case, such permission should be given to them during the final three weeks of the Election campaign. But it seems to be quite obvious that Mr. Lloyd George's fervour did not inspire the Postmaster-General, for he obviously does not feel much enthusiasm over the part broadcasting can play in the political struggle shortly to begin.

Nevertheless, the Postmaster-General has made it clear that the B.B.C. would place no arbitrary embargo on Mr. Lloyd George's ideas provided a mutual agreement could be reached between the political parties.

Would Make It a Farce.

The Postmaster-General suggested that the idea put forward by Commander Kenworthy, that each of the candidates in the General Election of each Party should be allowed to address the already congested ether, presented a vision that filled him with horror. In this we quite agree with the Postmaster-General; nobody wants to hear 600 members of Parliament broadcasting their views on politics.

That sort of thing would make political broadcasting a farce in this country; but if, as the Postmaster-General suggested, the three political parties could agree upon the respective amount of time they would appropriate for Election propaganda work by broadcasting, he was of the opinion that an arrangement could be made.

But there may be a snag yet, and our readers should not be too confident of hearing the party leaders broadcast in the Election because, as the Postmaster-General pointed out, he thought it was unreasonable for the Government to say that for every single attack made on it by either of the Opposition parties, it must be given an opportunity for an individual reply.

"Talkies" May Be Used.

Now whether the other parties will agree to this remains to be seen. At the moment it does not look as though they will. Nevertheless, whether broadcasting is utilised in the forthcoming Election or not, there is no doubt that the relaying of speeches by means of broadcasting loud speakers with amplifiers will undoubtedly be a feature of this Election, and even the "talkies" are likely to be enlisted in the forthcoming political fight.

And while on the subject of "talkies" readers will no doubt be pleased to find in this issue a further article by the Technical Editor describing his new "Radioscope." This invention consists essentially of a simple system by which a home projector—such as the Pathé home cinematograph—can be utilised to provide perfectly synchronised "talkie" shows in the home.

The scheme devised by Mr. Dowding includes not only the possibility of broadcast talkies, the sounds being provided by the listener's loud speaker and radio set, and the pictures by his home cinema, but also a simple method of providing a complete talking or musical cinema show within everybody's home.

Must Be Simple.

The apparatus employed is neither elaborate nor will it be expensive, while a child will be able to operate it with perfect success. There is no room on the market to-day for elaborate mechanisms and tricky gadgets, everything must be simple to install and simple to operate, and Mr. Dowding has borne these points well in mind while he has been devising the "Radioscope," which is sure to be in great demand as soon as it is placed on the market.

Simplified Control.

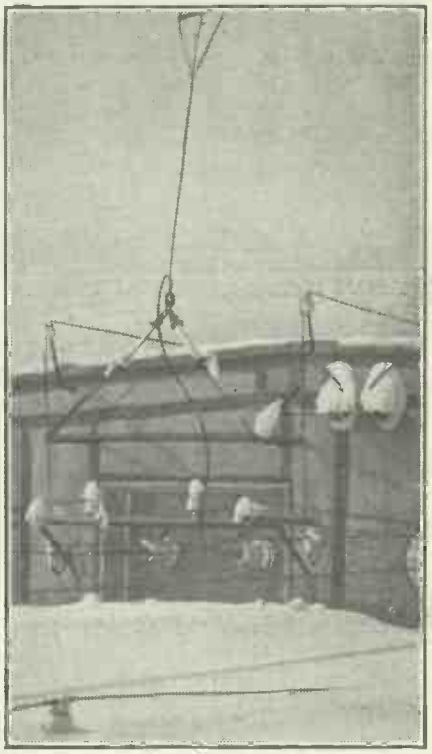
It is not so very long ago that a large array of knobs and dials on the panel of a set were considered an indication of efficiency and the power of distant reception.

The greater the number of controls the greater the difficulty in operating the set, and the trend of affairs to-day is all towards the simplification of design and of making efficient sets which, however, shall be as simple as possible to operate, so that they may be used by the average non-technical or practically non-technical user.

So far from a large number of knobs being thought desirable, the smaller the number of controls the more praiseworthy the design to-day, and some of the best sets upon the market, with all the "capability" that can ordinarily be required, are controlled by no more than two or three knobs.

A very good example of this tendency is illustrated by the "Titan" Three, where there is only one tuning dial, and this set has proved enormously popular.

SNOWED UP!



The new Berlin wireless station (Boxhagener Strasse) which is to be opened very shortly. As will be seen, the aerial and earth leads-in are covered with snow.

POINTS ABOUT PORTABLES.

Here are some further notes about the "Fireside" Two, described in last week's "P.W.," and readers should note that much of the information given applies to other sets of similar nature.

By J. ENGLISH.

WITH regard to the valves to use in the "Fireside" Two, almost any ordinary valves, excepting R.C., will work; but if you are to get the best out of the set, you need to use those types which are most suitable.

For the detector you should use an H.F. type valve with an impedance not exceeding 25,000 ohms and the highest amplification factor obtainable.

If you use the set only for DX reception, when quality is not such a primary consideration, you may use a detector valve with an impedance up to 40,000 ohms. You are probably familiar with examples of the 25,000-ohm impedance class, so that I need not give a full list; but among those which I have tried myself and found to be most suitable are such valves as the Dario Super H.F., S.P. 16-G., etc.

The L.F. Valve.

For the second stage any of the usual L.F. valves will be quite satisfactory, although you should bear in mind that for the local station a medium power valve with an amplification factor up to 10 gives good quality, while for distant reception another H.F. type valve will give higher amplification.

As a matter of fact, I have not troubled to use an H.F. valve here, as a small power-valve in the second stage, with an H.F. type in the first, gave me all the amplification I wanted.

You can also use tetrode valves in this receiver when quite low anode voltages can be employed. I can recommend the Ancloy Products 412 H.F. and 412 L.F. for the detector and amplifier stages respectively, these valves having worked very well on a maximum of 40 volts H.T., the detector taking up to 24 to 30 volts and giving very smooth reaction control. This smooth control is particularly easy to obtain with a tetrode detector.

H.T. Voltages.

You will not require more than 24 to 30 volts H.T. for the detector, and 80 volts H.T. for the amplifier will be ample for loud-speaker reception. Personally, I prefer to use a large-capacity 60-volt dry battery giving the second valve the full voltage, with 24 to 30 volts on the detector.

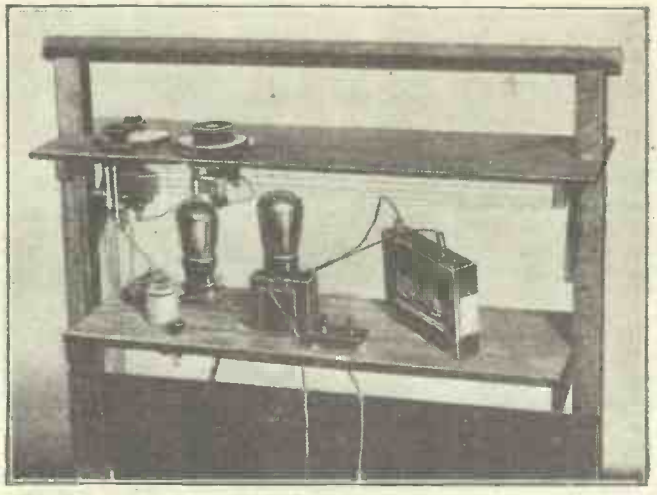
To proceed with the operation of the set, having inserted two valves of the types already mentioned and applied the proper battery voltages, you switch on and first test the reaction control. Reaction is at a maximum with the reaction condenser at zero (the reverse to the Reinartz type of receiver), and, with the proper valves and battery voltages, control should be very smooth indeed, so that as reaction is decreased the very slight breathing sound of oscillation ceases without a plop or sudden thud.

Unless you have had some previous experience of tuning, it would be advisable to start first with the local station. Place the set so that the handle-bar is more or less pointing in its direction and, with the reaction condenser near zero, you should very quickly pick up a strong whistle.

Then slacken off reaction until the transmission can be tuned in without a trace of this whistle. Proper tuning, especially with weak signals, requires a careful manipulation of both dials together, but after some little practice you will quickly pick up the knack of tuning.

Tuning is quite sharp, so that the slow-motion dial is no luxury. This results in very good selectivity, 2 L O, for example, occupying only a few degrees of the dial at a distance of 10 miles. Selectivity is a notable feature of frame-aerial sets, and it is quite a pleasing change from the poor selectivity of many small sets working on an outdoor aerial.

When searching for the local station you will have heard several strong carrier-waves,



Here is a further photograph of the "Fireside" Two which was described in last week's "P.W."

and these can be resolved into good, readable signals by careful manipulation of both dials, the best results as regards volume being obtained when reaction is adjusted close to oscillation point, but not actually oscillating.

If a whistle is heard when the tuning condenser is turned either side of the "silent point," then too much reaction is being used. Provided the detector valve is only just oscillating, you can search for carrier-waves without fear of causing interference, because the frame aerial is a poor radiator compared with the outdoor aerial. However, once you know where to find your local station on the dial, there is no need to oscillate near this point.

Once you are familiar with the controls you will be able to manipulate them with one hand, and, to make this easier, they have purposely been placed close together near one end of the panel. The first finger and thumb rotates the tuning knob, while the little finger moves the reaction dial.

As you probably know, a frame aerial receives best when pointing towards the station you wish to hear. This does not mean that you must carefully adjust its position for every station.

For instance, near London, you would have the handle pointing N.E.–S.W. to receive the majority of European stations, and N.W.–S.E. for French and South European stations. Actually, the N.E.–S.W. position brings in nearly all the stations worth listening to, which, for comfortable listening, is all that is required.

Accurate Calibration.

One very attractive feature of this receiver is that it is possible to obtain an accurate calibration of the tuning dial, which will be approximately correct for any other receiver which is a close copy of the original, using, of course, the same pattern tuning condenser.

This is not possible with an ordinary set, owing to the disturbing effect on tuning of different outside aerials. In Fig. 7 I showed a tuning curve obtained with the receiver illustrated here.

To obtain the condenser reading for a wave-length of, say, 300 metres, make a dot on the curve where a horizontal line from 300 on the vertical scale would cut the curve, and the desired reading is given where a vertical line from the dot cuts the degree scale.

The readings for 2 L O and 5 G B are marked on the scale for easy reference. The actual wave-band covered by the receiver is roughly 200 to 600 metres, which is wide enough to include most of the broadcasting stations in the British Isles and Europe.

There are a few other interesting points about the receiver to which I should like to draw your attention before I conclude. First of all, you will notice that the components occupy only two-thirds of the baseboard. This leaves room for the addition of a third valve, transformer-coupled, should you wish to increase the volume obtainable.

Loud-speaker Reception.

This extra valve will give you very good loud-speaker strength on the local station, and several Continentals at medium loud-speaker volume.

The ingenious constructor will also be able to find room for a small cone loud speaker, so that, with this addition, the receiver will be entirely self-contained, and extremely useful as a family receiver for the local station's programmes on the two valves. When not in use the 'phones which you require for DX work can be hung on a hook from the middle strut.

WHICH VALVE MATTERS MOST?

A thoroughly practical article which tells you in an interesting way exactly how to arrange and use your valves to get the best results.

By C. E. FIELD. B.Sc.

NOW that loud speakers are available which are capable of providing excellent quality of reproduction combined with great volume, the question of the correct selection of valves for use in a receiving set is one of paramount importance, and particular attention has been paid lately to the choice and operation of the last valve of a receiver.

This is because it is generally assumed that, since the last valve handles the strongest signals, it runs the greatest risk of being overloaded, and also because, being a relatively costly valve to buy and maintain, false economy is often exercised in this direction by the purchase of an unsuitable valve.

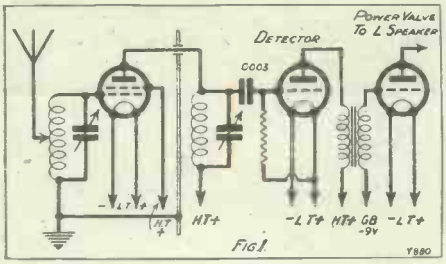


FIG. 1.

Whether the last valve is really the most important in a set, however, is probably largely a matter of opinion, if we understand by the "most important valve" that which requires the most careful selection.

The long-range listener, perhaps, thinks in terms of screen-grids and anti-oscillation measures, and is apt to regard the low-frequency side of a receiving set as a mere adjunct to bring up the volume, if necessary.

H.F. Distortion.

Conversely, the up-to-date loud-speaker enthusiast devotes his attention to obtaining a combination of quantity and quality from his set, and possibly sometimes regards his high-frequency brothers simply as "knob-twiddlers."

We may say, however, that on the high-frequency side of a receiver, it is relatively easy to select the most suitable valve, and to operate it under its correct conditions, provided that oscillation is avoided.

The only serious distortion likely to be introduced is that due to the cutting off of high frequencies on account of excessively sharp tuning, or the use of too much reaction.

Consequently, the valves which require the most careful choice, and are to be suspected of causing distorted reproduction, are usually to be found in the low-frequency portion of the circuit, the detector, of course, not being overlooked.

As already stated, however, there is a tendency to jump to the conclusion that the last valve is necessarily the weak spot in the circuit, but this by no means follows with modern valves.

On the L.F. Side.

Let us, then, try to get an idea of what is happening on the low-frequency side of our receiver by considering briefly two or three typical circuits.

Firstly, let us assume that we have a receiver comprising a good high-frequency amplifier (one screen-grid, or two neutralised normal H.F. stages, for instance), followed by a leaky-grid detector. In order to operate a loud speaker we have added a small power valve, such as an Edison P.V. 215, with the grid biased to about 9 volts, the circuit being something like that shown in Fig. 1.

Overloaded Output Valves.

Let us presume, further, that we are situated within 10 miles of a main B.B.C. station, and that we belong to that large class of listeners who receive the local station most of the time, but occasionally try to reach out during dull items.

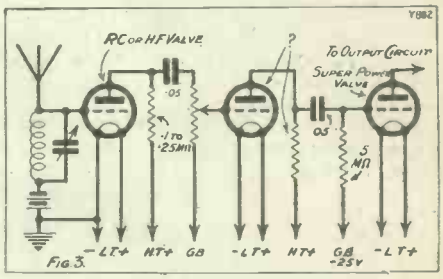


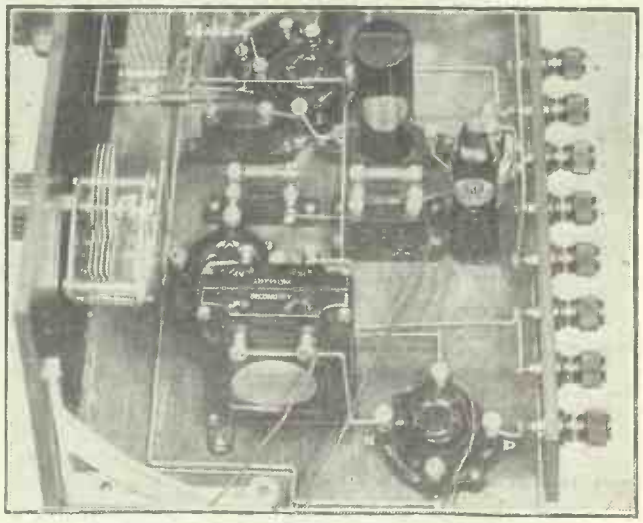
FIG. 3.

When receiving distant signals, all would be well, but if the circuit were used for reception from the local station, with an outside aerial, the last valve would be seriously overrun, and distortion would also probably be introduced in the detector.

There are many ways of putting matters right, perhaps the wisest being to cut out the H.F. stage for local reception. Even then, the last valve would probably be overrun, and could well be replaced by one of the small super-power class, biased with about 15 volts.

It would have been better in the first place, however, to have

(*Continued on next page.*)



A very important end of a powerful set from the point of view of choosing and using valves. Here are the detector and L.F. stages.

WHICH VALVE MATTERS MOST?

(Continued from previous page.)

employed an anode-bend detector, followed by resistance coupling, in which case the smaller power valve would probably have been just able to cope with signals from the local station.

Let us suppose, now, that although this circuit proves fairly satisfactory, i.e. we have reason to believe that there is no overloading and though the last valve is about fully loaded, the volume is still not quite sufficient.

Transformer Coupling.

If we wished to retain resistance-capacity coupling after the detector it would be no use replacing the last valve by a larger one. This would reduce rather than increase our volume by reason of its lower amplification factor.

We would have to add another valve, and here we should need to be very careful. The additional valve would have to be transformer coupled, resistance coupling between power valves being a poor proposition unless excessive high-tension voltage is available.

Now, if we followed our small power valve by a transformer with a transformation ratio of, say, four-to-one, we should at once find ourselves in difficulties due to overloading. We are applying a signal strength of about 9 volts to our existing valve grid. The amplification factor of such a valve is about 6, so that there will be a voltage change in the plate circuit of $9 \times 6 = 54$ volts, and even if only 50 per cent of the voltage were utilised, the transformer would hand on $4 \times 27 = 108$ volts to the grid of the last valve.

Potentiometer Volume Control.

The best way out of the trouble would probably be to reduce the input to the first low-frequency valve by means of a potentiometer across the grid and filament, the circuit being then as shown in Fig. 2. Thus, any risk of this valve being overloaded would be avoided, and the input to the last valve could be reduced until it was within the grid swing catered for by the bias voltage applied.

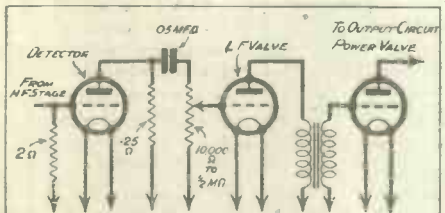


FIG. 2

We will imagine, now, that we wish to start afresh, and make a set to give results of a high standard of quality at very loud volume, and we decide to adopt a super-power valve such as P. 625A in the last stage, biased with 25 to 30 volts, and supplied with a high-tension voltage of, say, 180 volts.

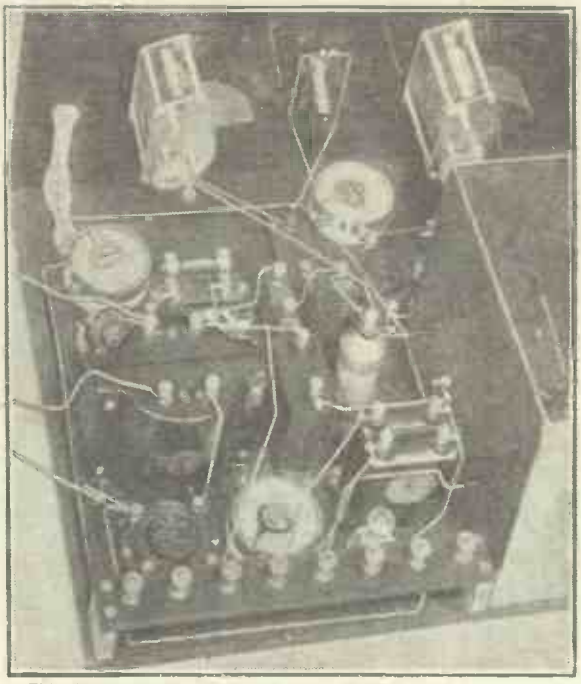
In order to get the highest possible quality of reproduction, we propose to use resistance coupling throughout, giving us a circuit similar to that shown in Fig. 3.

The last valve is decided upon, and the detector, being followed by resistance coupling, presents little difficulty. It may be of the H.F. type working into a resistance of, say 100,000 ohms, or of the R.C. type followed by about a quarter of a megohm, the former being preferable if leaky-grid rectification is employed, and the latter for anode-bend detection.

The Intermediate Valve.

The intermediate valve remains to be selected, and, its duties being such that very few valves are fitted for the position, it may be regarded as the most important valve in this circuit.

Consider first the use of an ordinary L.F. valve in this position. Such a valve might have an impedance of about 12,000 ohms, and an amplification factor of 10.


This view of a multi-valver again shows the L.F. stages and gives a glimpse of an efficiently screened H.F. amplifying stage.

Followed by the most suitable value of anode resistance (say, 80,000 ohms), this valve would not pass on more than half the voltage change produced in its plate circuit. Thus, if the valve were biased with 3 volts, the voltage swing received by the last valve would amount to $\frac{10 \times 3}{2}$ = 15 volts. This probably represents about the maximum voltage that can be obtained from a general-purpose valve used in this way.

A similar voltage could be obtained by using a small power valve with a very low coupling resistance, but the high plate current taken by the valve, and its relatively high filament consumption, render this arrangement still more inefficient.

The Final Choice.

To get the best results we shall have to employ a high-amplification valve, preferably a 6-volter, as this will have a lower impedance than the corresponding 2-volt valve. A valve of this type will take a grid bias of 1½ volts, and pass on between ·4 and ·5 of the voltage changes in its plate circuit, if followed by an anode resistance of half a megohm and fed from a 180-volt high-tension battery. Allowing an amplification factor of 40, the last valve will receive a grid swing of $1\frac{1}{2} \times 40 \times \cdot 4 = 24$ volts, which just about meets our requirements.

These examples may serve to show how different are the requirements of different circuits, and to indicate that in any receiver each valve requires careful attention.

TECHNICAL TIPS.

Recent experiments with anti-motor-boating devices suggest that a 4-mfd. fixed condenser is greatly preferable to the 2-mfd. usually employed.

* * *

An L.F. choke for a filter output unit should have an inductance value of about 20 henries, and a low D.C. resistance—say of 300 or 350 ohms.

* * *

When winding solenoid coils over a ribbed former it is a good stunt to cut little grooves for the first and the last wires to fit into, and there will then be no tendency for the windings to shift along the former, as they will be anchored securely in place by the end turns.

* * *

One of the advantages of using a good solid coil tube instead of a flimsy cardboard is that the terminals can be securely mounted upon the former for the purpose of connection.

* * *

Never attempt to drive a long thin screw into a three- or five-ply baseboard without drilling a hole for it, or the head is sure to break off just when you are screwing the last few turns.

* * *

Wood screws are easily driven into soft wood, but it is always advisable to drill a hole for them if the wood is of the type that is liable to split, or the baseboard is of plywood.

* * *

When a new set is being assembled have a piece of soap at hand and push the screws into this before attempting to drive them, as this makes a surprising difference to ease of working.

* * *

UNWANTED H.F.

If you are suffering from a thin and "reedy" distortion for which you are unable to account, remember that this is often caused by H.F. getting into the L.F. side.

* * *

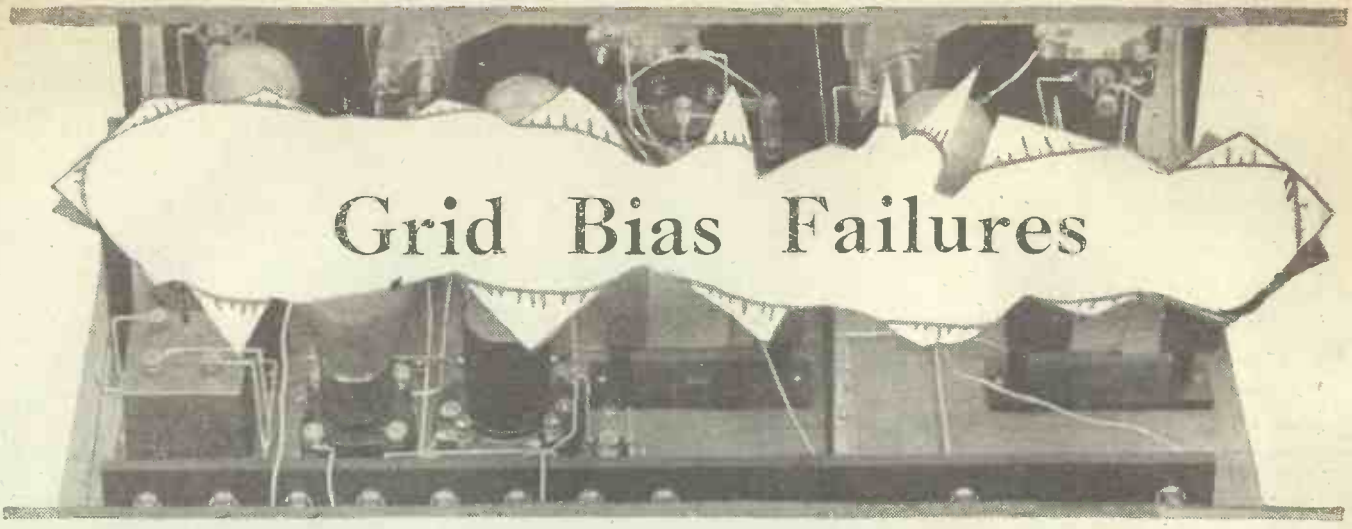
One of the best preventatives of threshold howl in a short-wave set is to use an output filter of the L.F. choke-condenser type.

* * *

As smooth reaction is absolutely essential to successful short-wave reception it is no earthly use buying short-wave coils for a set which is troubled with ploppy or fierce reaction.

* * *

If you are taking H.T. from the mains and are troubled with a slight hum, it is a good plan to insert the primary or secondary of an old L.F. transformer in series with the H.T. to the detector lead, as this very frequently effects a complete cure.



Grid Bias Failures

Some timely reminders upon a subject that is too often overlooked.

By P. R. BIRD.

IT often happens that the grid-bias battery, being small and seldom adjusted, comes in for a certain amount of neglect, and so gives rise to faults for which other components are blamed. As a matter of fact grid bias is always important, and a great many failures to get good reproduction arise from carelessness with the grid-bias battery and its leads.

One common fault is to expect the G.B. battery to last for ever. As a matter of fact a grid-bias battery is doing well if it lasts six months, and any battery which has lasted longer than this should be suspected until tests with a voltmeter prove it to be O.K. Another fault—which is perfectly obvious to old hands at the radio game but is worth mentioning because it is so common—is bad contact at the plug and socket.

Whiskers and Wobble.

Unless the grid-bias plugs fit snugly and cleanly into their sockets trouble is sure to develop, and this is particularly true if the leads to the plugs have been carelessly prepared and left with long whiskers of flex sticking out. All sorts of crackling noises originate in this way, and there is absolutely no need to have ill-fitting plugs when a few minutes' work with a file will make a perfectly satisfactory job of it.

If the leads tend to wobble or to pull unduly upon the plugs, the old trick of slipping an elastic band round the battery and the leads to hold these in place firmly, should be tried.

Apart from the obvious faults there are several less conspicuous but more important considerations to bear in mind. Do not forget, for instance, that if you are using a grid-bias battery of 18 volts or more, such as is required by a super-power valve, you may with careless handling burn out one or more of your filaments.

Look Out for Long Leads.

Another point which is well worth mentioning is the danger of adjusting grid bias on a powerful set without switching off the L.T. This practice involves a great strain upon the filament of the valve concerned, as can easily be understood when it is remembered that current drawn by a power valve when it has no grid bias may be twenty milliamps or so more than when the valve is correctly biased. It is obvious that if the plug is pulled out suddenly the circuit has to bear the strain of that extra current, which is certainly rather hard upon the filament of the valve in question.

It sometimes happens that the grid-bias leads are rather longer than they need be owing to the desire to make one grid-bias battery serve for more than one valve. This is quite an economical practice provided it is remembered that such long leads are liable to pick up unwanted impulses and may easily give rise to distortion if carried close to H.F. chokes or L.F. transformer.

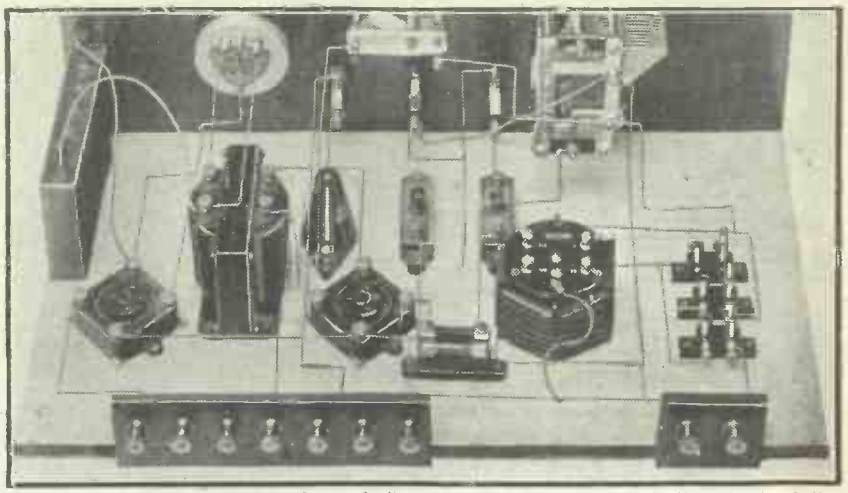
The spacing of such flexible leads should be just as carefully carried out as the spacing of the permanent wiring of the receiver, and in many cases which have come under the writer's notice the re-adjustment of a long grid-bias lead has removed a peculiar type of distortion due to H.F. being super-imposed upon the L.F. currents. Where long leads are unavoidable it is possible to overcome this source of distortion by fitting a high-frequency choke in the leads to the grid-bias battery, preferably at a point close up to the grid leak.

In cases where an H.F. choke cannot be mounted owing to considerations of space, etc., it often proves advantageous to insert a resistance of a quarter megohm or so.

The danger of pick-up in grid-bias leads is particularly applicable to the case of an anode-bend detector which is notoriously sensitive to all sorts of external influences. For this reason it will be found a good plan to provide a separate bias battery for an anode-bend detector, placed as close to the grid connections as possible, so that the leads to and from this may be as short as possible. Where a screened-grid valve is biased to 1½ or so negative, a special battery for the purpose is really advisable, particularly as this will last for a very, very long time without renewal.

The Separate Battery.

Several of the battery makers have placed upon the market little robust cells for this purpose, and one, or two if necessary, can very easily be mounted among the H.F. wiring without the slightest danger of stray capacity from long leads, etc. It is, of course, essential that grid bias applied to the "front" of a set like this should be absolutely stable and trustworthy, and this is one reason why it is not always advisable to try and take anode bias for H.F. or detector valves from a battery which is supplying the L.F. end of the set.



"A great many failures to get good reproduction arise from carelessness with the grid-bias battery and its leads."

LATEST BROADCASTING NEWS.

ALBERT DE COURVILLE AND CHARLOT AGAIN.

AN APRIL FOOL PROGRAMME—A REAL FATHER CHRISTMAS!—BRITISH v. FRENCH ARMIES AT RUGGER—SALVATION ARMY SERVICE—CARDIFF CHOOSES YOUR CAREER.

Albert de Courville and Charlot Again.

A NEW series of weekly programmes for listeners throughout the country, arranged by Albert de Courville, is due to start on Tuesday, April 2nd. Generally speaking, these shows will be similar to those put on by Mr. de Courville last year, and before him by André Charlot. The B.B.C. is paying an inclusive fee to Mr. de Courville, leaving him to arrange his own artistes, so that at the moment little or nothing is decided about those to take part.

A special dance band will be engaged for these entertainments, of which there will be six (with the possibility of more), the reason being that Jack Payne and the B.B.C. Dance Orchestra are now called upon to take a part in the regular programmes so much that they can hardly be expected to play for these extra shows, which must necessarily entail a good deal of rehearsal work.

It is appropriate at this stage to mention that Mr. André Charlot is providing a vaudeville programme for London and other listeners on Thursday evening, April 11th, on behalf of the Actors' Orphanage Fund.

An April Fool Programme.

Easter Bank Holiday falling this year on April 1st will be made the occasion of a special April Fool Day programme for 5 G B listeners. The title is "Fool to Make Me Merry," and the cast includes Colleen Clifford and John Rorke. To say more about the programme would give the show away, which is unfair to those who are arranging it, but those who hear it can look out for a little harmless "leg pulling." On the same evening 5 G B is also relaying a concert by the Black Dyke Band, which will be playing that week at the National Trades and Industrial Exhibition at the Bingley Hall, Birmingham, under the conductorship of Arthur O. Pearce.

A Real Father Christmas!

Here is a delightfully pretty story from the postbag of the Birmingham Station. During a children's play broadcast from 5 G B just before last Christmas young listeners were humorously advised to refrain from the old-time method of putting up the chimney letters to Santa Claus containing their requests for seasonable presents, but to send them to him by balloon instead.

Two small listeners remembered this advice a few days later when, after a visit to a London store, they returned home each with a small gas-filled balloon. One of the children attached a label to his balloon asking for a box of paints, and then, when it was dark, opened the window and sent the balloon away on its journey. Recently the boy received a parcel containing a box of paints and a note stating that it came from Father Christmas—really a teacher in the centre of France.

British v. French Armies at Rugger.

A running commentary by Captain H. B. T. Wakelam on the Rugby match between teams representing the British and French Armies, which takes place at Twickenham on Saturday afternoon, April 6th, will be broadcast from London and other stations. Welsh and West Country listeners are notified that as from April the weekly Sports Talk will be given on Wednesday instead of Saturday evenings during the summer months, the reason being that many people are out of doors during the week-end while the days are long and fine.

Salvation Army Service.

A service arranged and conducted by the Salvation Army will be broadcast from the London Studio on Sunday evening, April 7th. The service was originally arranged to take place some weeks ago, but was postponed at the suggestion of well wishers of the Army, who considered the anxiety at that time occasioned by the deliberations of the High Council and the uncertainty of the future leadership of the organisation would receive no benefit by bringing them more vividly into the limelight of publicity.

Cardiff Chooses Your Career.

A new series of talks on the important subject of choosing a career has been arranged by the Cardiff Station. The talks will cover architecture, navigation, engineering, and commerce, and each will be given by an expert, the first being by Principal Coles, of Cardiff Technical College, on Friday, April 12th. Mr. Coles has

HONOURED BY THE KING.

A recent portrait of Frederick Delius, the blind composer, whose name appeared in the last Honours List amongst the Companions of Honour.

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

GRID-LEAK VALUE.

LONG DISTANCE SIGNALS—H.F. UNITS, ETC., ETC.

Grid-Leak Value.

ALTHOUGH the value of the grid leak is often specified very loosely (sometimes stated to be "between 2 and 5 megohms") you should remember that in some circuits, not all, the correct value of the grid leak may make a very important difference to the working of the set.

It is true there are many circuits in which the value of the grid leak is not at all critical, and in some cases even anything between 2 and 10 megohms will work satisfactorily, but you should bear in mind that the grid leak controls the value of the negative charge which can accumulate on the grid.

The higher the resistance of the leak naturally the greater the charge which will accumulate or, perhaps, I should say the higher the potential to which the grid will be raised. In some cases, especially on strong signals, this charging-up of the grid may actually block the valve.

With a low-resistance leak, on the other hand, the charge drains away quickly and the potential of the grid does not rise so high. This has the advantage that there is less liability to distortion in the tone quality, but on the other hand the detector is less sensitive to small inputs.

Long Distance Signals.

It follows that when you are "out for" distant signals it is better to use as high a value of grid leak as possible. It is a good plan to have on hand an assortment of grid leaks of different values and to try these out until best results are obtained. Alternatively, one of the variable grid leaks may be used, but so far as my experience goes, and I think most readers will confirm this, they are rather liable to be unsatisfactory and generally a fixed grid leak gives much quieter results.

H.F. Units.

A set which uses only low-frequency amplification is as a rule much simpler to fit up and operate than one using high-frequency amplification, and one reason

(*Continued on page* 76.)

Use this wonderful NEW Cossor Transformer

It has a marvellous performance on all notes from the highest to the lowest . . . . .

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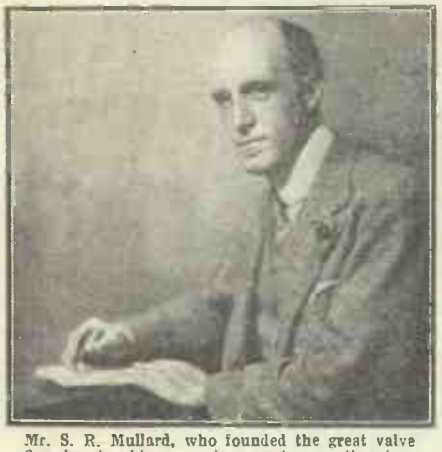
FROM THE TECHNICAL EDITOR'S NOTE BOOK

MULLARD PENTONE VALVE.

THE Mullard people call their five-electrode low-frequency valve a "pentone," whereas the rest of the valve makers refer to their productions of this nature as "pentodes." I find it perplexing that the valve makers should have more or less standardised the outward forms and appearances of these valves while there yet remains this apparently so slight discrepancy in description. However, at the time of writing, at any rate, it would seem that Mullards are the only people to have 6-volt types of these new valves in production.



Mr. S. R. Mullard, who founded the great valve firm bearing his name, is a most energetic scientist. During the war he was head of the Wireless Research Laboratory of the Imperial College of Science. He is still comparatively young, being only forty-five years of age.

The latest Mullard Pentone valve is listed as the P.M.26, and it retails at 25s. It has the following very interesting characteristics; filament voltage 6, filament current ·17 amp., impedance 25,000 ohms, amplification factor 50. Its impedance and amplification factor are taken with its anode volts at 100 and its auxiliary grid volts at a similar figure.

It will be seen that this valve has the very satisfactory mutual conductance of 2, which compares favourably with any ordinary super-power valve. The P.M.26 can accommodate a far greater input than any other pentode I have yet come across. With 150 or so volts H.T., it will be gathered from the fact that between 15 and 20 grid-bias volts are needed, that it does not easily succumb to overloading but, and I now quote from the leaflet accompanying the valve: "It must, however, be borne in mind that the P.M.26 should not merely be substituted for a super-power valve in the output stage of an L.F. amplifier where full loud-speaker volume is already obtainable. In such a case the P.M.26 would undoubtedly be overloaded and the preceding L.F. stage must therefore be omitted. . . ."

In other words, whereas it is now the general practice to have an L.F. stage between the detector valve and the output valve, the use of the P.M.26 as output valve dispenses with the necessity of the first L.F. stage.

Much of a similar nature has been said about other valves of similar types, but it is an important fact that the average 2- or 4-volt pentode is rather too delicate when it comes to handling the local station input required for full loud-speaker operation. Here in the P.M.26 we have the first pentode of the real power class.

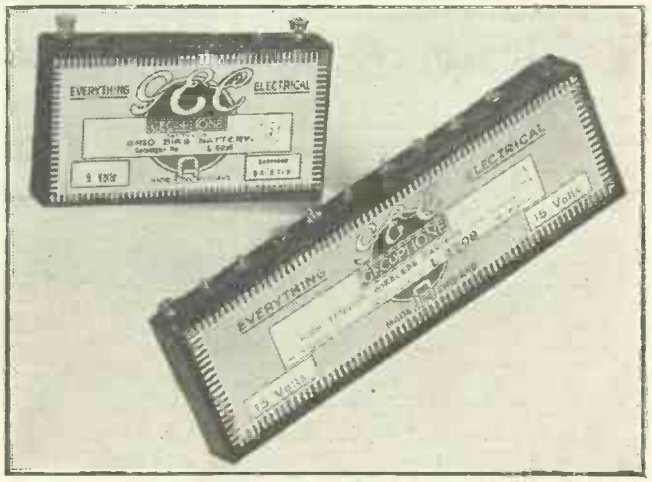
A good 2- or 4-volter will cope with the work encountered in the average small set, but the Mullard 6-volt Pentone can pass through sufficient energy without distress for the working of even moving-coil loud speakers. When you have a valve of this nature an ordinary H.F.-Det.-2 L.F. four-valver can be shrunk to three valves without apparent sacrifice. A very fine combination is the "Titan" Three (which, as you all know, uses a screened-grid valve in the first stage) having 6-volters for the H.F. and Det., and including this 6-volt Pentone in its L.F. stage. Quite remarkable results are obtained, and it is illuminating to compare them with those achieved with a last year's five-valver.

GECOPHONE G.B. BATTERIES.

The General Electric people have produced, as a useful adjunct to their range of Gecophone H.T. batteries, three Gecophone grid-bias batteries. These are available in three sizes, viz., a 6-volter at 1s. 6d., a 9-volter at 1s. 9d., and a 15-volter at 3s. 6d. The largest is tapped at every 1½ volts and an unusual and useful feature is that it is provided with terminals instead of the more conventional plug sockets.

Thus, once a correct point has been located the connection can be permanently clamped down under the terminal. This should make the battery very popular among portable-set enthusiasts. This 15-volter (list L4908) is classified as a "high-tension wireless battery" on its label, and of course, several can be joined up and used for this purpose. The 6- and 9-volters, unlike the 15-volt battery have small screw-plug terminals which are carried in sockets and can be shifted about.

As with the Gecophone high-tension batteries, these grid-bias varieties are well made and should be capable of giving long and reliable service.



Two of the Gecophone Grid-Bias Batteries.

THE "TONATUNA."

When the Tonex Company, of Water Street, Blackpool, sell you one of their latest Tonatunas at the very reasonable price of 21s., they provide you with full instructions, including a large chart, for building a specially designed three-valve set, a very sensible way of ensuring that their component is used in the way for which it was designed.

Traders and manufacturers are invited to submit radio sets, components and accessories to the "P. W." Technical Department for test. All tests are carried out with strict impartiality, under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

The Tonatuna is an aerial reaction arrangement covering the ranges of 240 to 520 and 1,100 to 2,000 metres. This is when a ·0005 mfd. variable tuning condenser is used.

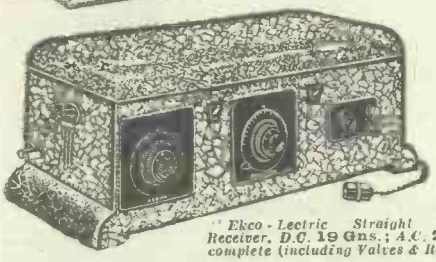
The tuner is mounted on the panel by means of one hole, and the reaction adjustment is made by means of a large dial. With a central knob you can then switch from the one wave-length range to the other. The aerial coil, which is provided with a tapping for the aerial, is wound on a ribbed ebonite former.

Five milled terminal screws, with slots enabling them to be screwed down tightly with a screwdriver, all plainly marked, are fitted at the back of the tuner.

It is a well-made article, and the reaction control is smooth through all the normal ranges. In fact, we found on test the general efficiency of the Tonatuna above the average for such devices. On the lower wave-length the selectivity was of the centre-tapped coil order.

Why ACCUMULATOR BATTERISE? Just "Plug in"—That's all!"

"Ekco-Lectric" H.T. Unit 3F.12. D.C. £1-17-6 complete.



'Ekco-Lectric Straight Three' Receiver. D.C. 19 Gns.; A.C. 21 Gns. complete (including Valves & Royalty).

"EKCO"

"EKCO-LECTRIC" RADIO RECEIVERS AND POWER SUPPLY UNITS

H.T. UNITS				PRICE COMPLETE	
Model.	Current Output.	Voltage Tappings	A.C. Rectification.	D.C.	A.C. Inclusive of Valves & Royalty
1F.10	10 MILLIAMPS For 1 to 3 valve sets, or those requiring not more than 10 milliamps. Specified for the "Mullard Master 3," "G.E.C. Victor 3," etc.	60 or 90 or 120		17 6	—
		60 and 120	Valve	£1 9 6	£3 13 6
2F.10			Valve	£1 17 6	£3 18 6
3F.12	12 MILLIAMPS For 1 to 3 valve sets, such as 1929 Cossor. Special tapping for screen-grid valves.	60 "S.G." 60 120/150			
3FA.20	20 MILLIAMPS For 1 to 5 valve sets, or those requiring not more than 20 milliamps.	30 fixed 60 " 120 "	Valve	£2 10 0	£4 18 6
1VA.20		0-120 var. 120 fixed		£2 18 6	£5 8 6
3FB.20		30 fixed 60 " 120 "	Westinghouse Metal Rectifier	—	£6 15 6
1VB.20		0-120 var. 120 fixed		—	£7 5 0
4F.60	60 MILLIAMPS For 1 to 10 valve sets or those requiring not more than 60 milliamps	30 Fixed 60 " 120 " "Power" fixed	Valve	£3 12 6	£7 2 6
1V.60		0-120 var. 120 fixed "Power" fixed		£3 18 6	£7 13 6
2V.60		0-120 var. 0-120 " 120 fixed "Power" fixed		£5 0 0	£8 12 6
FV.120	120 MILLIAMPS Super-Power	0-120 var. 0-120 " 200 fixed	Valve	£7 15 0	£15 10 0
C.1A	"ALL-POWER" UNIT FOR D.C. MAINS. 60 milliamps. H.T. 0-120 var. 120 fixed "Power." L.T. 1 to 6 volt up to 6 amp. G.B. up to 21.			£9 15 0	—
T.500	TRICKLE-CHARGER. Charges 2, 4 or 6 volt accumulators from A.C. Mains at ½ amp. continuously.		Westinghouse Metal Rectifier	—	£2 12 6
R.20	RECTIFIER UNITS. For attaching to D.C. Units.	For 10 and 20 milliamp range.	Valve	—	£3 12 6
R.60	For use on A.C. mains.	For 60 milliamp range.		—	£5 0 0
"EKCO-LECTRIC STRAIGHT THREE" RECEIVER.			Valve	19 Gns complete, inclusive of Valves and Royalty	21 Gns complete, inclusive of Valves and Royalty
ISOLATING TRANSFORMER, for isolating Loud-Speaker or 'Phones from set where a power supply unit is in use.					15/-

OBTAINABLE ON EASY PAYMENTS FROM ALL RADIO DEALERS.

"Ekco-Lectric" H.T. and All-Power Units complete from 17/6 D.C. and 52/6 A.C. Write for free illustrated "Ekco-Lectric" Booklet.

E. K. COLE LTD (Dept. A), "EKCO" WORKS, LEIGH-ON-SEA.

"TUNING THE LOUD SPEAKER."

The Editor, POPULAR WIRELESS.

Dear Sir,—Upon opening my POPULAR WIRELESS of Mar. 2nd I was agreeably surprised to read the article on page 1281, because I had recently completed experiments in coupling up a horn speaker and cone speaker to obtain results exactly as detailed by Mr. Hallows, and I can certainly endorse that the results are very gratifying.

The reason for the experiment was that in my case I had purchased an expensive type of cone speaker, and was not at all pleased with the results. My star set is a four valver, and with all the sets I have built up from specifications from your magazines, I have always used a horn speaker that has given very good results, and although I have had several well-known makes of cone speakers, have always returned to the horn speaker for best results.

Valves of the 4-volt type are used in my set, and with super-power valve in the last stage I have a choke-filter output.

However, as previously mentioned, after buying a well-known cone speaker costing over £5, I was not at all pleased with the tone of this speaker, in fact, the opinion of several enthusiasts was that the horn speaker I possessed was a most excellent one, but there was, as detailed in the article mentioned, a lack of "roundness" or absence of the bass notes.

Not wishing to scrap this expensive cone speaker, I coupled it up in parallel to my old horn speaker and the results were most extraordinary, the volume was magnificent, and in some mysterious way the bass notes from the cone speaker are reproduced in the horn speaker, and the high notes from the horn speaker now appear to be more brilliant and less piercing, but these high notes are not improved on the cone speaker.

I can certainly endorse the concluding paragraphs of your article that the experiment is worth trying, and it would be very interesting to learn why I have formed the opinion that the deep bass notes from the cone speaker appear to be reproduced by the horn.

There is just one little interesting point that has also cropped up—during one evening whilst the two speakers were coupled up, when listening in on Daventry, a French and German station were very noticeable in the background, and a very slight movement of the tuning condensers would bring them in. This feature has not been noticed before when using only one speaker. A wave-trap will probably cure, or rather eliminate, this interference.

Yours faithfully,
E. W. KIRKUP.

Burnley.

THE 7s. 6d. THREE-VALVER.

The Editor, POPULAR WIRELESS.

Dear Sir,—I should like to congratulate you on the above set, which appeared in your issues dated January 5th and 12th.

I know I am rather late, but the remarkable results from such a cheap and simple set, which can be made in an evening, made me suspicious, so I have given it a six weeks' test.

I know nothing about valve sets—the thoughts of drilling panels, cabinets, chokes, transformers, condensers, etc.—in fact, the list of components accompanying a wireless circuit which must be just so, make me tired, as I am only interested in results.

I half-heartedly made the set, using three of the cheapest valves, and the result was surprising—full volume and pure tone without distortion. I made the set on January 11th and it has been used every day since, so, far from being a five-minute novelty, the set is quite practicable.

Several of my friends who own three-valve sets of repute have been astonished when they hear this set, the principle ingredients of which consists of sealing-wax, stove polish, and lead foil!

All this on a makeshift aerial and earth—which will continue to be makeshift, as "I am only interested in results."

Yours faithfully,
S.

Tottenham.

CORRESPONDENCE.

"TUNING THE LOUD SPEAKER."

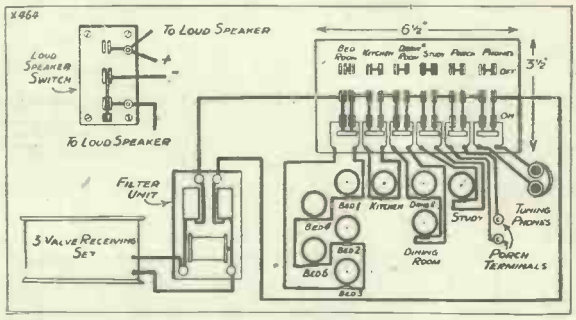
THE 7s. 6d. THREE-VALVER—A LOUD-SPEAKER EXCHANGE—AN L.T. UNIT.

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.

A LOUD-SPEAKER EXCHANGE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have sometimes seen in your paper inquiries for wiring up several rooms in a house for wireless reception, but I haven't seen a diagram of such wiring, so I am enclosing a tracing of the way I have wired up my house.



I regret that the tracing is not better, but I am an old man of nearly seventy and the materials I used were not good; but it may be of interest to your readers.

The receiving set is in my study and the switchboard is near the set, the wires being all led to and from it.

I tried single-pole switches, but found that faint signals could still be heard, even when switched off, so had to put in double-pole switches.

You will see that all the wiring is in series, otherwise if in parallel one loud speaker would take more than its share of signals, as they are of different makes.

There is a loud speaker in every room, with a separate single-pole switch to each.

There is also a filter, which is necessary with such a long length of wire.

There are always at least three loud speakers at work at the same time, and sometimes four or five, which the set can easily manage.

The wire to the porch is so to have a loud speaker in the garden, as I often, in summer, give the Sunday evening service to the village people.

Yours faithfully,
H. W. WILLIAMS.

Norwich.

AN L.T. UNIT.

The Editor, POPULAR WIRELESS.

Dear Sir,—There must be very many users of small valve sets in the country places who have been faced with the difficulty of getting small accumulators charged. As a rule, tradesmen do not care to fuss with these, as they require such a small current, and their men either charge at too high a rate or keep them rather a long time—at least, that has been my experience.

I have solved the difficulty to my own satisfaction, and perhaps these of your readers who have suffered in the same way would like to know the procedure.

It only applies to the small accumulator of about 10 ampere hours. Here, then, is the method.

Get two, pint—or preferably four—Leclanché batteries and, starting with the accumulator charged, connect the two Leclanché batteries in series with the accumulator when switching on the set. The extra two batteries are in reserve, or, if preferred, connected, in parallel to the first two.

When the set is switched off, test the voltage of accumulator, and if below 2 volts, leave the batteries in circuit until it has registered its full charge.

It will not do any harm to leave these on until the next morning, if required. Indeed, I have kept mine on sometimes for 50 or 60 hours.

When they are disconnected, they recuperate, and the only care required is a small time spent weekly scraping the porous pots and zincs if they are corroded. In this way the accumulator is kept "up to scratch" all the time, and I can assure you it has been well tested.

I know some electrical authorities are most emphatic in saying the Leclanché is unsuitable for charging, but used in this way it is quite satisfactory, and costs a mere trifle to run, besides always being available.

The Leclanché batteries can be bought cheaply at Woolworth's 6cores—jar 6d., porous pot 6d., zinc 3d., and also the necessary chemical, sal ammoniac, two ounces to pint—quite sufficient for the two jars.

Trusting you will give these few hints to your readers.

Yours sincerely,
B. FLOWERS.

Essex.

[ED. NOTE.—We should not have expected such a scheme to prove a practical solution to the problem. However, our correspondent seems to be satisfied, and we should be pleased to hear from any other reader employing Leclanché batteries in this way.]

SHORT-WAVE NOTES.

By W. L. S.

I WONDER how many short-wave enthusiasts are, in this enlightened age of slow-motion condensers and slow-motion dials, using one of the good old-fashioned two-plate verniers? I plead guilty myself; I am rather proud of it, and find it a great help when following a signal that is none too steady.

Naturally, one of the verniers that we used to use has far too large a capacity, and is almost big enough for the main control! With about a ¼-in. spacing between the plates, however, these old-stagers are very useful and effective.

Choke Output

Choke-filter output, as a cure for threshold howl, has risen considerably in my estimation. I expect many of you know the annoying effect of a set that does not actually howl, but gives a "hollow" kind of tone to all signals received, as if it is about to burst into a lusty squeal.

In most cases I believe you will find that an old transformer secondary as an output choke, with the 'phones connected from plate to earth in series with a 1 or 2 mfd. condenser, will effect a complete cure.

It is also a good plan to adopt, simply on account of the fact that the 'phones are actually earthed (for one should always put the condenser on the anode side of the 'phones), and therefore one does not come up against the trouble of signals disappearing when one clutches hold of the 'phone cords.

A Mysterious Station

A mysterious station has arrived on about 18 metres which transmits nightly at about 9 p.m. and, after sending what are apparently gramophone records (unannounced) for twenty minutes or half an hour, starts transmitting pictures.

I, personally, haven't the faintest idea of who he is, for there has never been an announcement of any kind when I have been listening, and, for another point, he seems to come in at a time of day when all the usual distant parts are absent. Can anyone enlighten me?

Anode-Bend on Short-Waves

Also, has anyone met with any great success using anode-bend rectification on short waves? I have had several shots at it, and had all the sets working passably well, but cannot succeed in getting anything like the silky reaction control to which I am accustomed. I have always used resistance-coupling from the detector to the first note-mag., using a very high-mag. valve as detector.

The advantages of anode rectification, as regards purity of reproduction, are very apparent even on short waves. 5 S W and W 2 X A D, brought up to real loud-speaker volume, are both a treat to listen to.

The "DW

Built and Described

"EXCELLENT quality and more than sufficient volume, but wherever could I find room to keep it? You see I live in one of those furnished cupboards commonly known as 'flats.'"

The above remarks were passed on a recent three-valver the writer had constructed. I fully agreed with my friend's remarks when he proceeded to explain that it was not just the set but the "bits," as he would repeatedly call them, which took up the space.

These few outspoken words started a train of thought, for I realised his position and saw that there must be thousands of others like him. Considering the question in detail my conclusions were that the space taken by the "bits" could not be easily reduced, but a suitable set could be built within limits which appear at first sight absurd.

When I constructed this set it was christened the "Dwarf" Three, and it had solved a rather interesting little problem. The receiver may be packed into a cabinet 10 in. by 7 in. by 6 in., but more however, will be said later regarding an alternative cabinet. The circuit of the set is quite normal and consists of a detector and two stages of low-frequency. The first low-frequency stage is resistance-capacity coupled, whilst the second stage employs transformer coupling.

If you examine the tuning circuit you will see that there are two condensers joined in parallel across the grid coil. The first condenser is of the normal variable type with a maximum capacity of ·0005, whilst the second condenser is of the semi-variable type with a maximum capacity of ·0003. One side of this second condenser is joined via a switch to the bottom of the secondary coil instead of direct, as in the case of the main tuning condenser.

If we open this switch any adjustment of the second condenser will have no effect on the tuning of the circuit, so that the tuning circuit merely consists of a primary and secondary tuning with a centre-tapped coil in the secondary position, arranged so as to give a Hartley reaction scheme.

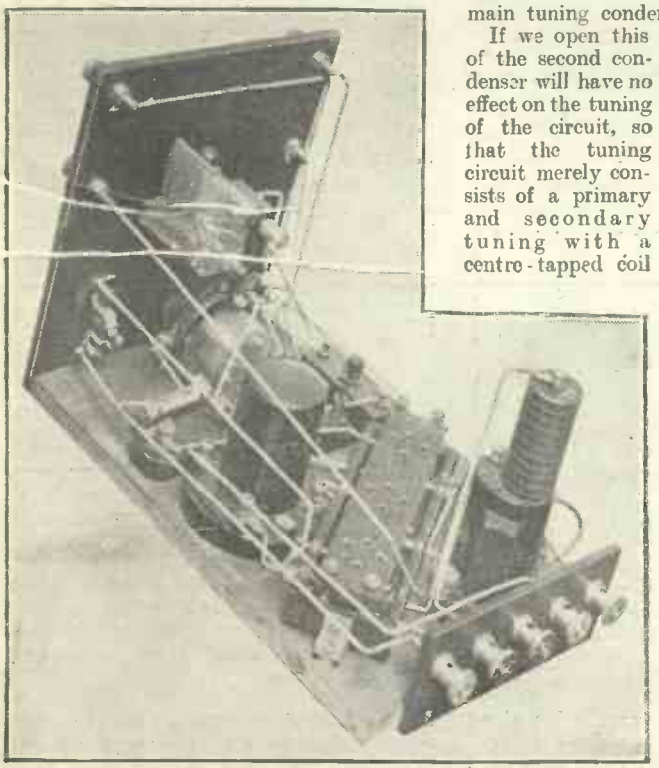
The primary coil gives sufficient selectivity when situated at 10 to 15 miles from a local station to enable one to eliminate this in a few degrees of the tuning dial. If, however, you are quite close to the local station only a mile or so away, it is advisable to use some additional eliminating device such as a wave-trap, but more will be said regarding this point in the operating details.

Now we will assume that the switch in series with the second condenser is closed. If we now rotate the operating knob of this

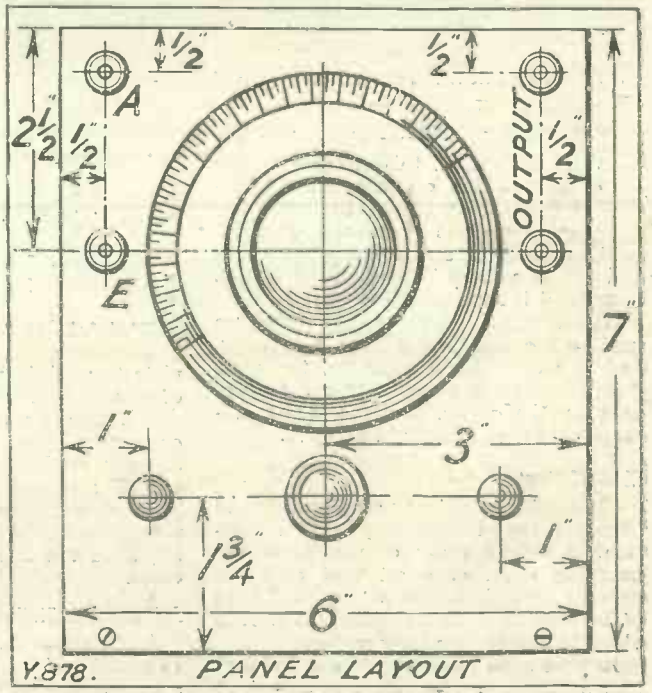
Here is a remarkably effective three-valve set contained within a case of the size usually specified for a crystal or one-valve set.

THE PARTS REQUIRED.

1 Panel, 6 in. × 7 in. × ¼ in. or ³⁄₁₆ in. (Becol, "Kay-Ray," Trolite, Radion, etc.).
1 Cabinet to fit (see text), with baseboard 10 in. deep (Camco, Raymond, Bond, Lock, Arteraft, Gilbert, Caxton, Pickett, etc.).
1 ·0005 Variable condenser (Formo, Lotus, Raymond, Lissen, Cyldon, J.B., Igranic, Dubilier, Colvern, Ormond, etc.).
1 ·00005 Reaction condenser (Igranic micro).
1 ·0003 Fixed condenser, with grid-leak clips (Dubilier, Mullard, Lissen, T.C.C., Clarke, Goltone, Magnum, Igranic).
1 ·0003 max. Semi-variable condenser (Formo type J or equivalent in Igranic "Pre-set" range).
1 H.F. choke (Wearite, R.I.-Varley, Lissen, Lewcos, Bowyer-Lowe, Cosmos, Burne-Jones, Colvern, Dubilier, etc.).
NOTE.—If a large type is used here a different method of mounting may be needed.
1 L.F. Transformer (Philips, Mullard, Igranic type J, or other very compact type).
1 R.C.C. Unit (Mullard, R.I.-Varley, or other good make of similar shape).
1 2-Megohm leak (Lissen, Dubilier, Pye, Ediswan, Igranic, Mullard, etc.).
2 Baseboard coil holders (Lotus).
2 On-off switches (Lotus, Lissen, Benjamin, Raymond, Burne-Jones, Pioneer, Burton, Wearite, etc.).
1 Valve holder block (Ready Radio).
9 Terminals (Eelex, Burton, Belling & Lee, Igranic, etc.).
1 Terminal strip, 2 in. × 5 in.



Doesn't look as though there are enough components to make a really efficient three-valve set in such small compass, does it? Yet the instrument has considerable sensitivity and power.



by J. R. WHEATLEY.

condenser the effect will be as though we are rotating the main tuning control, for the two condensers are in parallel. If, therefore, we set the main tuning control to receive the local station with the switch open, then close the switch and rotate the second condenser, so as to increase its

The " Dwarf " is one of the simplest, cheapest, smallest, and yet most effective " Det., 2 L.F.'s " that has ever been designed.

capacity, a point will be reached where we come into tune with another station. In the writer's case 5 G B was chosen. If the switch is again opened the local station will be received without any readjustment whatsoever, unless it is a slight adjustment of the reaction condenser.

We can now consider the construction of the set. One point must, however, be borne in mind. Unless the identical makes of components are used, as in the original set, sufficient extra space must be allowed to accommodate these components.

The components on the baseboard should first be arranged, taking care to space the components accurately. The wiring diagram as well as the photos will assist you to do this.

Choosing Components.

You will see that instead of three separate valve holders a block unit has been used; this has the desired effect of not only reducing the resultant wiring, but allowing more space for the other components. For a similar reason one of the excellent R.C. units, now available, was employed in place of separate components, which would have taken up two or three times the space occupied by the complete unit.

The transformer may appear rather diminutive, but it is remarkably efficient. It is one of the newer types now in fairly common use, which by the use of special wire and core have been reduced to exceptionally small limits and yet have proved to be quite as efficient as the larger types.

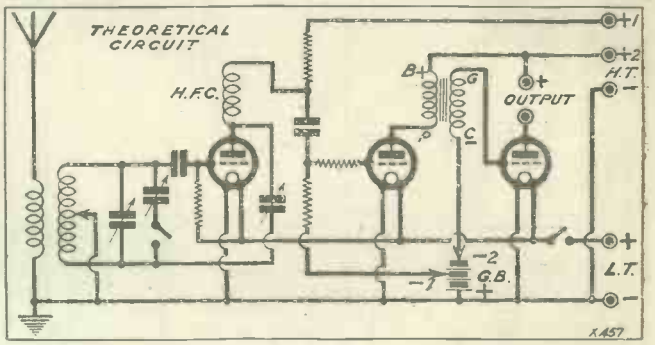
When mounting the valve holder block place two small nuts or a thick washer under the holding down brackets, so that wiring may be easily passed under the valve block. The H.F. choke, it will be seen, is mounted on top of the L.F. transformer, and to hold this in place a small quantity of Chatterton's compound is needed; use just sufficient to do the trick, and not to besmear the whole of the transformer and set with it.

On completing the baseboard assembly it is advisable to wire as much of same as is practicable, for it is rather an awkward job getting the soldering iron down into the " works " with the panel in place. Insulated wire is used throughout to carry out the wiring, for unless this is used, trouble may be experienced in spacing the wires sufficiently to prevent shorting. An alternative is to cover the wire with Systoflex, which will be found equally efficient but rather more difficult to handle in so small a compass.

The panel carries three components and four terminals, the main tuning control (a ·0005 variable condenser), the reaction condenser, which must have a fairly low minimum capacity, and two on-off switches. The left-hand switch has already been referred to, for this controls the wave-change scheme, the remaining switch is the on-off switch for the filament circuits.

When mounting these components on the panel the measurements given in the panel layout should be strictly adhered to, or it will be found that the tuning condenser fouls the coils.

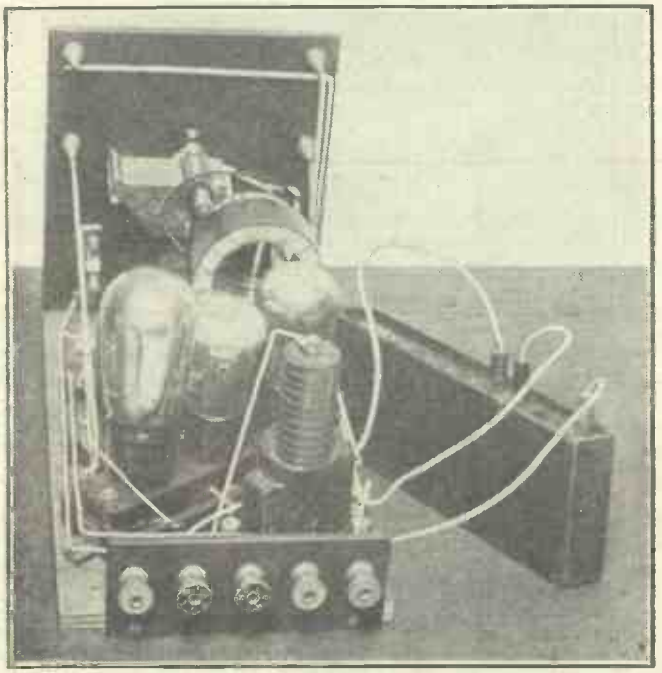
Having assembled the panel components proceed with the wiring of the panel as far as possible, then fix the panel to the baseboard. Before continuing, make sure that your panel and baseboard will fit into the cabinet designed for it. If all is O.K. finish the wiring between the baseboard and the panel.

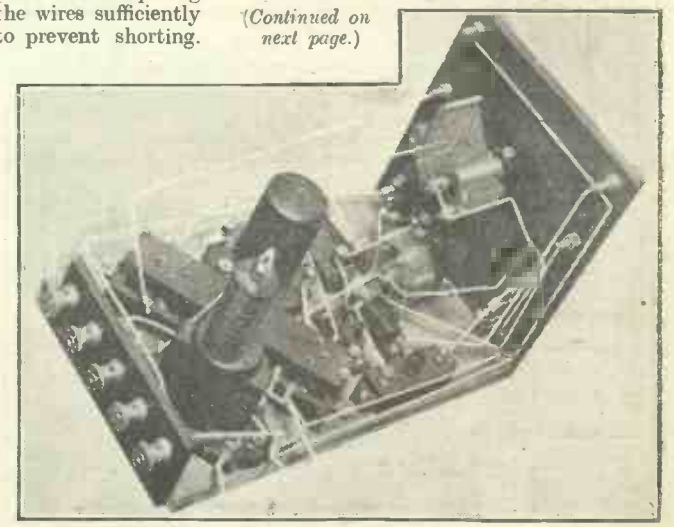


Having completed the wiring we are now in a position to discuss the question of accessories. Valves may be either of the 2-, 4-, or 6-volt class, in any of the well-known makes. In the first position an R.C. is recommended, in the second an H.F. valve, and in the third the best power valve you are able to use, bearing in mind the source of your high-tension supply. Quite a hefty super-power valve is not out of place, for this little set gives remarkable punch for its size.

If you are in doubt as to the most suitable valves to obtain get in touch with your

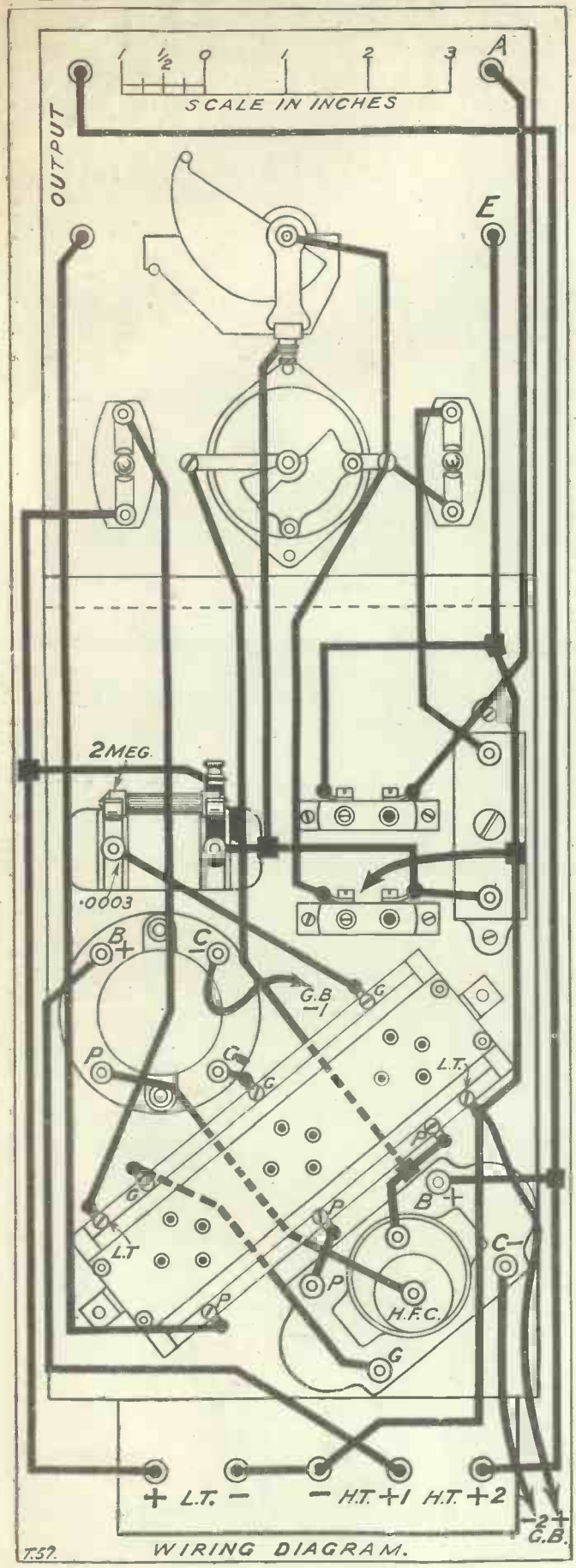
(Continued on next page.)





On the left you see the set complete with coils and valves in position, and on the right with them all removed.

THE "DWARF" 3 *(Continued from previous page.)*



favourite valve manufacturer, who will only be too happy to assist you with your choice.

Only two coils are required, and the sizes will depend on the wave-band it is desired to cover. Assuming that it is to be 2 L O and 5 G B a 35 primary coil and a 60 centre-tapped coil should give the desired results.

The cabinet is really the only remaining part of the "Dwarf" Three which really requires some special mention.

The set, as previously stated, is designed to go into a cabinet 6 in. by 7 in. by 10 in. deep. By using a cabinet, say 14 in. wide and 10 in. deep you have sufficent room for both the low-tension and high-tension batteries, whilst the loud speaker can stand on top, making a compact and well-finished outfit.

The spaces at the side of the panel may be fitted with small dummy panels to fill the space which would otherwise be left vacant.

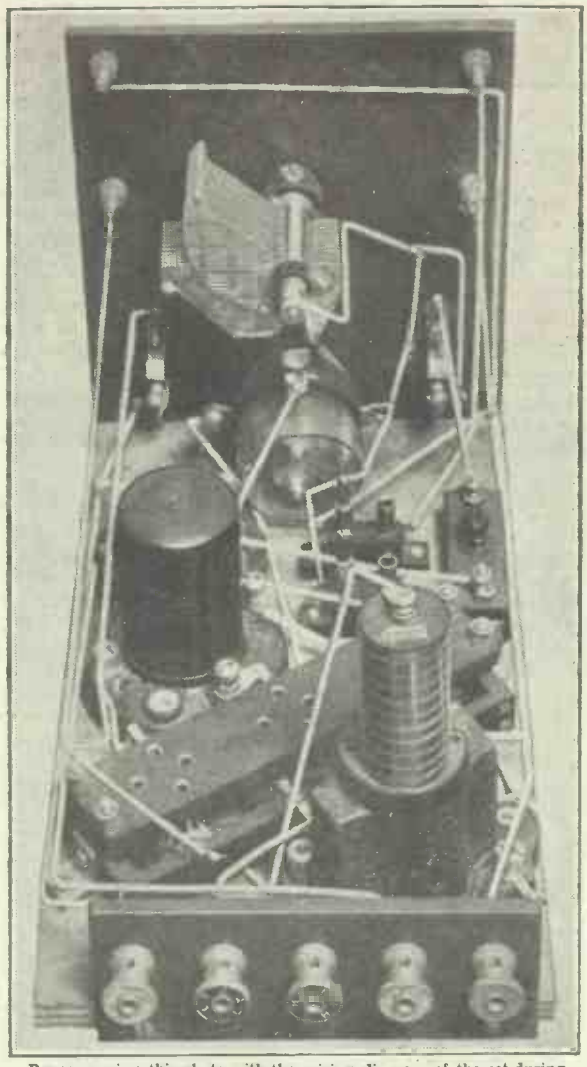
The Set's Selectivity.

Regarding the selectivity of the set, it was found that by the addition of a "Standard wave-trap" 2 L O could be entirely eliminated in a degree or so of the main tuning control, and a second station received when only a few metres separated the two stations.

When adjusting the set, it is advisable to arrange for the loudest station to be slightly detuned, so that on switching to the other by means of the wave-change switch, one does not appear to have been suddenly transferred from the stalls to the furthest heights of the gallery.

Between 2 L O and 5 G B it was possible to receive several other stations at really good loud-speaker strength. On the night of the final test Hamburg and Madrid came in particularly well.

Using a mains H.T. unit in place of batteries, excellent results were obtainable, and there was not the slightest tendency for the set to develop motor-boating.



By comparing this photo with the wiring diagram of the set during the wiring-up, the constructor's work will be greatly facilitated.

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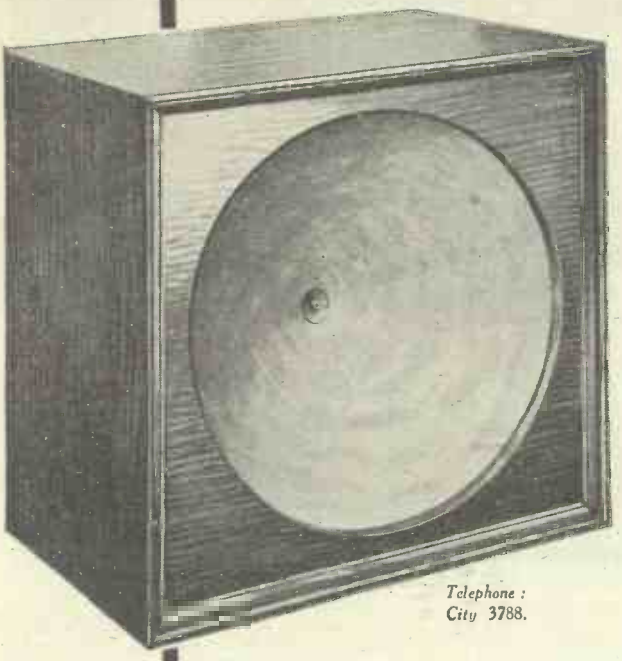

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LIST OF DULL EMITTERS

Type	Fil. Volts	Amp.	Imp. Ohms	Amp. Fac.	
PR 2	2	·095	28,000	13	H.F. Det.
PR 3	2	·095	15,000	8	L.F.
PR 4	2	·095	120,000	32	R.C.
PR 9	3.5-4	·063	18,000	14	H.F. Det.
PR10	3.5-4	·063	10,000	8·7	L.F.
PR11	3.5-4	·063	88,000	40	R.C.
PR17	5-6	·1	18,000	17	H.F. Det.
PR18	5-6	·1	9,500	9	L.F.
PR19	5-6	·1	80,000	40	R.C.
PR20	2	·15	7,000	6	Power
PR40	4	·15	7,000	6	"
PR60	6	·1	5,000	6	"
PR120	2	·3	2,750	4	S.P.
PR140	4	·2	2,500	4	S.P.

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RADIOTORIAL

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QUESTIONS AND ANSWERS.

R.C. IN PLACE OF L.F.T.

B. A. (Nr. Hinkley, Leicestershire).—"Although it was very powerful the set was never very satisfactory because of jarring on certain notes which was really very unpleasant to listen to, although, as I say, it was very loud. A friend of mine knows a chap who had the same sort of trouble, and who cured it by taking out the first L.F. transformer and putting in a resistance-capacity unit in its place.

"I should like to do this, and I can borrow a unit if I like, to try it out, so if it would not involve too much trouble in the alteration to wiring, etc., I should very much like to have a go at it. What would be the connections and do you think I should be able to manage it all right?"

It is very easy to alter a set from L.F. transformer coupling to R.C. coupling, provided you have the unit complete with the necessary anode resistance and grid leak in it. (Most units are of this type, although some have detachable resistances, in which case it is necessary to insert correct values).

To make the change-over disconnect all the batteries from the set, take it out of its cabinet and proceed carefully to alter, as follows. First of all undo the two wires which go to the primary side of the L.F. transformer, carefully bending them back a little out of the way, if necessary, but taking great care not to pull any soldered joints adrift, or to make any other bare wires anywhere in the set touch each other which, of course, might result in burning out your valves when you connect up again.

If you are not certain of remembering exactly where a wire went, it is a good plan to tie a little label round to show exactly to which part of the transformer it was connected. Next undo the two wires which go to the secondary in the same way, taking care not to mix them up and to see that each one is marked with its correct label. Now unscrew the L.F. transformer and take it right out of the set, fitting the R.C. unit into its place if this is possible or, if not, mounting it as near as may be to the original position.

You will find that the R.C. unit has one terminal marked H.T. positive. This terminal must be connected to the wire which previously went to one of the primary terminals, and if you examine these primary wires you will find that one of them is connected to the H.T. positive terminal on the set (and possibly to other places as well. It is likely that it is connected to the other L.F. transformer's primary terminal as well). It does not matter much which other point it goes to so long as you are sure that it goes to the H.T. positive terminal, and having connected this turn your attention to the terminal on the R.C. coupling unit which is marked P.

CONNECTING THE UNIT.

To this point you must affix the remaining wire which formerly went to the *primary* terminal of the L.F. transformer. In all probability the other end of this wire connects up to the H.F. choke, and the other side of this choke will be found to be connected to the plate of the valve, but here again it does not matter much exactly where it goes so long as you are sure it is the remaining primary terminal.

Having screwed these down tightly turn your attention to the two wires which formerly went to the secondary of the transformer. If you follow these out you will find that one of them was connected to the grid of one of the valve holders. Take this wire and affix it to the G terminal on the R.C. unit. This leaves you with only one wire free, and an inspection of this will show that previously it was taken to a terminal which was connected to the grid-bias battery. Consequently, all you have to do is to connect this lead up to the G.B. terminal on the R.C. unit.

If any of the wires are not quite long enough it is understood, of course, that you will have to replace them by other wires, but if this is carefully done there is no reason why you should interfere with any other part of the wiring, or why it should be unsafe for you to make the alterations, even though you are not skilled in set building. Having fixed all the leads in place give the set a careful look over, and make

(*Continued on page* 66.)

THE BURNDEPT CABINET CONE LOUD SPEAKER

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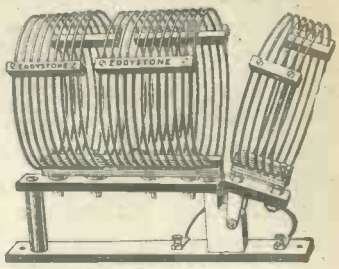

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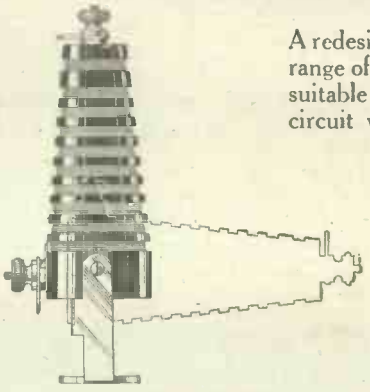

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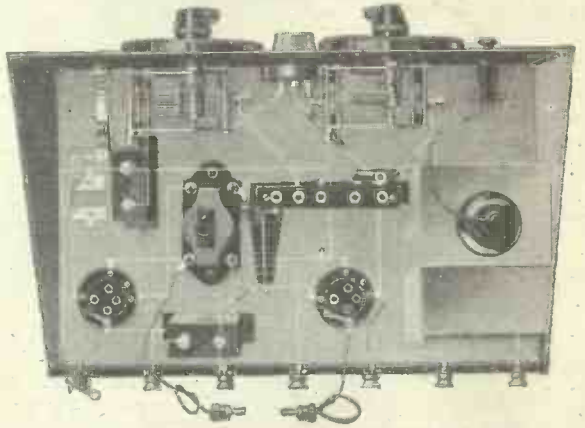

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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 64.)

sure that nothing has been knocked loose, or anything of that kind.

Pay particular attention to bare wires which may have been bent and accidentally come in contact with one another for, as has already been stated, if this is done it is possible you will burn out a valve or something of the kind, although it should not be necessary to have any fears under this head provided you have exercised care in carrying out the alterations.

When all is O.K., carefully replace the set in the cabinet, connect up the batteries as formerly, plug in the valves, etc., and try out the results. Do not forget that in order to get the maximum results out of the set it may be necessary to adjust the H.T. positive voltages to a different value from that previously allocated to the various terminals on account of the fact that you now have a high resistance in circuit instead of a comparatively low one.

By the way, it is not advisable to alter high-tension voltages, whilst the set is actually running, so switch off the L.T. every time before a plug is pulled out and then switch on again to see the effect. In this manner you will protect the filaments of your valves from being unduly strained by sudden changes of grid bias.

THE VOLTAGE ON THE LAST VALVE.

T. C. R. (Nr. Swindon, Wilts).—"I haven't got a good high-resistance voltmeter, and therefore I am not quite certain of the voltage which my last valve is getting, and I should like to know this as I am very keen on getting the maximum purity from the set. I know it cannot be getting its full 120 volts if the battery plug is in 120, because I have in circuit a low-frequency output choke, the resistance of which I am told is 500 ohms. Is it possible to calculate out how much extra voltage I shall need?"

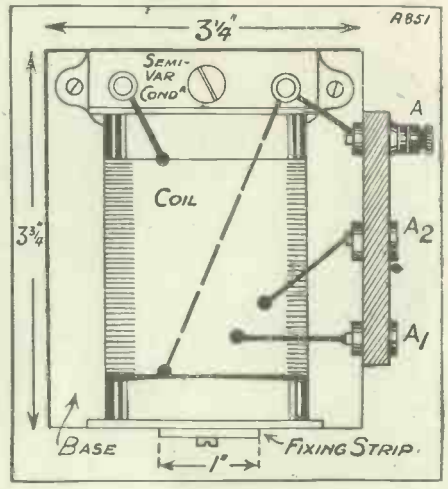
The actual voltage drop across a resistance of this kind can be calculated quite easily if the anode current is known. To ascertain the voltage drop multiply the anode current in milliamps by the resistance of the choke and divide this total by 1,000. Thus if the anode current is ten milliamps and the resistance is 500 ohms, the voltage drop will be found to be 5 volts. This means that if you have an H.T. battery adjusted at 120 and the battery is up to standard you are only getting 115 volts on, and in order actually to obtain the necessary 120 volts you will need to replace the H.T. positive plug at 125. You can easily work out the voltage drop for other conditions in the same way.

It will be noted that in the case of a power valve of this type the alteration in voltage is not very severe and in all probability it will not make an appreciable difference to the quality obtainable, although theoretically, of course, it is far better to give the exactly correct voltage in order to ensure that the valve is being worked under the conditions laid down by the makers.

THE "P.W." STANDARD WAVE-TRAP.

G.M. (Leeds).—"So as to get the distant stations I've got to cut out the local somehow, and I have heard this 'P.W.' Standard Wave-trap 'puts the kybosh' on even the strongest signals. How is it made?"

The "P.W." Standard Wave-trap, a plan of which is shown herewith, is assembled upon a small wooden baseboard measuring 3¾ in. by 3¼ in., and about



¼ in. thick, the intention being that this baseboard shall be screwed down directly upon the wooden base on the receiver.

The coil is mounted on this in a horizontal position, with its centre at a height of 2 in. above the bottom of the small baseboard. This point of the height of the coil is of importance in cases where the trap is

(Continued on page 68.)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 66.)

screened, the position of the trap inside whatever screen is used naturally being a matter which must be watched.

The coil is wound upon a piece of ebonite, Paxolin, Pirtoid, or similar good material, 2 in. in diameter and 3 in. long, and this can be mounted in any convenient fashion which does not entail the use of large pieces of metal. One method is to fix an ebonite end disc into the tube and attach this by means of a screw to an upright strip of 3-ply wood, whose lower extremity is similarly secured by means of screws to the edge of the little baseboard.

The coil consists of 64 turns in a single layer of 28 D.C.C. wire. As the coil is wound, tappings are made in the 16th and 24th turns, these being the alternative positions for the aerial tap the ends of the winding being secured by the simple procedure of passing them through two small holes drilled in the tube at the correct points, while the two tappings may be made in a variety of ways.

For example, the whole coil can be wound without making any tappings whatever and then the 16th and 24th turns can be prised up slightly with the blade of a pocket knife, and two short pieces of matchstick about ¼ in. long slipped under them. The wires thus lifted up can be scraped bare of cotton covering by means of a knife, and the appropriate ends soldered on to them.

Mounted upon the baseboard immediately beneath the end of the coil is a small variable condenser of the compression type, which is now becoming so popular for work of this sort, the capacity of this component depending upon the wave-length of the station it is desired to eliminate.

If the wave of your local station is below 400 metres, a ·00025 mfd. or ·0003 mfd. will be required, while if it is 400 metres or over, one of ·0005 mfd. should be chosen. The alternative capacities of ·00025 or ·0003 mfd. have just been given because in some makes only a ·00025 mfd. is available, whereas in others ·0003 mfd. is produced and, as a matter of fact, either will serve.

These components have a screw-down adjustment, which can be performed by means of a screwdriver, and, of course, the condenser can be left permanently set to the correct capacity once this has been found.

Screwed to the edge of the baseboard of the trap is a small piece of ¼ in. thick ebonite, 2½ in. by 1½ in., carrying a terminal and two sockets, such as the Clix or Eelex types, these being for the external connections to the trap.

In use, the lead from the set to the trap will be connected to the terminal, while the aerial lead will terminate in a plug which will be inserted in one or other of the sockets, according to the number of turns on the coil which it is desired to use for coupling purposes.

IMPROVING SELECTIVITY.

S.G.W. (Liverpool).—"In order to improve the selectivity of the set I am told I ought to use aperiodic aerial coupling. How is this fitted and what extra parts shall I require?"

The use of what is generally termed "Aperiodic Aerial Coupling" is often beneficial in increasing selectivity, cutting out unwanted noises, etc., and old sets can be converted as follows:

Mount another coil socket by the side of the existing aerial coil, so that the coupling between the new coil and the existing one will be as tight as possible. From one of the terminals on the new socket take a wire to a new terminal on the panel or terminal strip; this will be the new aerial terminal. Connect the other terminal on this new socket to earth.

The coil sizes used will now be slightly different and, in general, will be as follows:

In the old aerial socket, which now becomes the *secondary* coil, for the broadcast band a No. 60 or 75 coil. For Daventry, a No. 200 or 250.

In the new socket, for the broadcast band, a No. 25, 35 or 50 will be needed, and for Daventry a No. 75 or 100.

In the case of sets employing a stage of H.F. amplification, this improvement may sometimes have the effect of rendering the set a little unstable, in which case a potentiometer should be added.

LENGTH AND HEIGHT OF AERIAL.

H.T.A. (Hertfordshire).—"Previously I had to put up with an indoor aerial, but now we are out in the country where I can have plenty of room for it. What are the chief considerations to bear in mind?"

The P.M.G. regulations stipulate that no listener shall have an aerial greater in total length than 100 ft. This length is taken from the aerial terminal of the set along the aerial wire to its far end, i.e. to the farthest insulator. 100 ft. is *more* than ample for all ordinary purposes. Generally, 75 ft. of single wire is about the best possible length, an excellent arrangement being a lead-in 40 ft. high and a 35 ft. flat top.

Height of aerial is the really desirable factor and the greater height that is obtainable the better (theoretically a vertical wire running straight up for the whole of its length would be the ideal arrangement but, of course, this is not practicable). Remember that the effective height of an aerial is the height from the wire to the nearest large earthed object or flat surface below it, and consequently the roof, bushes, walls, etc., will lower the effective height of the aerial or, in effect, will "bring the earth up" to their own height.

FITTING A CHOKE FILTER OUTPUT.

S.M.W. (Huddersfield).—"My last loud speaker was ruined through having the high tension through it the wrong way round. In order to prevent anything of the kind occurring again I have made up my mind to use an output choke or filter circuit and should be glad if you can give me the full connections for this. I have a large output choke which has marked on it '20 henries.' Is this O.K.?"

A 20-henry choke is perfectly suitable for an ordinary output-filter circuit, and in addition to this you will require two large fixed condensers of 2 mfd. each. The alterations to the connections are quite simple and should be carried out as follows:

First of all arrange the L.F. choke in some position conveniently near to the loud-speaker terminals, and then connect one side of this to one loud-speaker terminal and the other side to the other loud-speaker terminal. You will need two new loud-speaker terminals. Mount these in some convenient position on the panel and close to them mount the two fixed condensers, calling one "Condenser 1," and the

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RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 68.*)

other "Condenser 2." The connections will then be as follows. Take a lead from the Condenser 1 (C1) to the nearest point on the L.T. negative wiring. (This may be the L.T. negative terminal itself, the H.T. negative, or any part of the lead which is in direct metallic connection with these points, the idea being to obtain a lead as short as possible and to interfere with the rest of the wiring of the set as little as possible.).

The other side of C1 is then connected to one of the new loud-speaker terminals. The remaining new loud-speaker terminal is now connected to one side of the other condenser which we have called C2.

The final connection is from the remaining side of the condenser C2 to the L.F. choke, at that end of the choke which is connected internally to the plate socket of the last valve holder. It does not matter whether the wire actually goes to the choke terminal itself or to the plate terminal of the valve holder itself or to any intermediate point on the wire which is joining these two, the whole idea being to get a good metallic connection to this part of the circuit.

One place is just as good as another provided that the correct end of the L.F. choke is chosen, for it is essential to make the connection at that end which is *joined to the plate* of the valve, and not at the end which is now joined on to the H.T. positive terminal. This completes the arrangement for a choke filter-output system.

You will find that it is capable not only of giving extremely good reproduction but it is of advantage in stopping the effects of battery coupling, it protects the loud-speaker windings, it insulates the loud speaker from the high-tension supply, and finally if you are in the habit of using long loud-speaker leads it reduces the possibility of losing high-tension voltage by leakage between the two leads. It will thus be seen the many advantages that make it really well worth the time and trouble taken and the expense involved.

THE "HUNDRED-PER-CENT" CRYSTAL SET.

E. J. W. (Bedfordshire).—"I am always experimenting with crystal sets and I have tried scores of circuits, but think that the one I like best of all is the 'Hundred Per Cent.' I still have the panel and baseboard for this, but should like to know details for making the coil again as my original coil was altered time and again in order to see if I could get better results with different circuits. I couldn't, so that if you can tell me how to make the coil again, I shall stick to the 'Hundred Per Cent' as being the best of them all."

The former for the "Hundred Per Cent" coil is made on a piece of insulating tubing of any good material, such as Paxolin, Pirtold, Radiou, etc. The dimensions are 3 in. diameter and 3½ in. long. The former can be secured to the baseboard in any convenient manner, one of the easiest ways being to fit into one end a little wooden crosspiece secured by two screws passing through the walls of the tube, finally fixing this crosspiece by means of a large screw going through it into the baseboard.

It is essential to get the windings correct. First of all there is a plain winding of 60 turns of No. 24 D.S.C. wire, this being called L1. Interwoven with the first 40 turns of this coil there is another winding of 40 turns of No. 32 D.S.C. wire which is put on turn by turn along with the other winding.

You will find it is quite easy to put the two windings on together if you arrange the two wire bobbins in a convenient position on the table, take the two ends of the wire and twist them tightly together for an inch or so, then pass it through a couple of small holes in the tube.

Wind these two wires on together side by side, one turn of each wire straight alongside the corresponding turn of the other wire, and proceed in this way by putting on a double winding pushed up quite close just like any other ordinary single-layer winding until you have completed the 40 turns of each. Then cut the finer wire and secure the finishing turn of this wire with a small blob of Chatterton's compound or sealing-wax, but carry on with the winding of the thicker wire until you have completed the required number of turns.

Then secure the end of this coil, too, either by a blob of sealing-wax or by a couple of little holes in the tube, similar to those made for commencing the windings. This is how you carry out the main operation, but it should be particularly noticed as you do so you must make tappings in the thick wire winding only, at the following turn numbers: ten, fifteen, twenty, twenty-five, thirty, thirty-five and forty.

This is quite easy to do if you twist up a small loop of the thick wire as you come to each of the turns on which the tapping is to be made, and then carry on as before with the winding. Note carefully that no tappings whatever are needed in the thin wire winding.

When the coil is finished you can scrape this loop bare with a knife, and then it is ready for the attachment of the tapping clips.

IMPROVING A MAINS UNIT.

D. J. (Wembley).—"Since I went over to the H.T. mains there has been a great improvement in reception, and in fact the volume is far beyond what it used to be with a battery. The only trouble is that when there is nothing doing, and no one speaking in the loud speaker, I can hear a slight hum.

"I should like to get rid of this, if possible. Can you tell me if any simple alteration to the unit would be likely to cure this?"

The presence of a slight hum in conjunction with the use of a mains unit of this type usually indicates unusually "rough" mains, or that inadequate smoothing is employed, and this can be remedied by the use of larger shunting condensers or better choking.

A tip worth noting, however, is that it is generally the detector valve supply which is the guilty party, so that before alterations to the unit are tried it is a good plan to connect in the external H.T positive lead to the detector an extra L.F. choke. Nothing elaborate in the way of L.F. chokes is needed, and even the secondary of a burnt-out transformer will often cure the trouble, as the current carried by the detector valve is quite small.

We should certainly try this in preference to altering the unit, the probability being that this alone will be quite sufficient to cure the trouble, and will obviate the necessity of altering the internal wiring of the unit.

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RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 70.*)

WINDING YOUR OWN COILS.

W. F. B. (Bideford).—"What is the proper method of finding out the correct lengths of a former on which a coil is to be wound? I find it very difficult to cut a former if it is too long, and very inconvenient if, when winding on a big coil, say 250 turns, the former is found to be just a little too short to get the last few turns on. How can it be ascertained accurately what length the former should be?"

Any electrician's handbook or table will tell you the exact diameter of the various types of wire. When the diameter of the wire is known it can be multiplied by the number of turns you are putting on and the resultant length is that which will be occupied by the completed winding.

You should, however, allow a small margin for fixing off, and also because you will not be able to wind on the wire so exactly that each turn will lie perfectly side by side. Consequently, you must allow a small margin, and when this has been added to the theoretical calculation of the length of the winding you can tell exactly how long your former should be to accommodate this.

For instance, the diameter of No. 30 enamelled wire is given in the table as 0·017 in., which is the thickness of one turn of the wire. Consequently, 250 turns of this wire would be 0·017 × 250, which is equal to 4·25 in.

This is the exact size which would be occupied if the 250 turns were laid out perfectly close to one another. As stated previously it is almost impossible to wind wire so perfectly, so it is necessary to allow just a little extra to cover small accidental spacings. The theoretical length of the winding above would be 4·25 in., so we would allow, say 4½ in., or just a little more than that.

This small margin will enable you to begin and finish the wire, and leave just sufficient to allow for any little unevenness or imperfection of the winding, at the same time ensuring that the former will not be too long nor be not quite long enough for the coil in question.

LOUD SPEAKERS IN DIFFERENT ROOMS.

"MARRIED" (Edgbaston).—"I want to wire up the house so that different kinds of loud speakers can be used not only in the different rooms downstairs, but upstairs in the bedroom as well. What is the best way to go about it?"

You must connect the speakers "in series" with one another, and one of the first things to decide is the actual method of connecting your loud speakers to the house wiring. Even if you anticipate using the loud speakers continuously we should certainly have them arranged so that they can be cut out of circuit, as this almost invariably is desirable at some time.

One good method is to use a plug and jack, the jack being of the type that is arranged so that the circuit is closed when the loud speaker plug is withdrawn. (Note.—This is essential as the loud speakers will be connected in series.)

Alternatively, quite a good connection can be made with the ordinary single-coil plugs and sockets, the sockets being mounted upon the skirting board and the coil plug attached to the leads of the loud speaker. Where this method is employed all that is necessary is a shorting device or another "plug" in which the plug and socket are joined together by a short wire, i.e. a "shorting-plug."

Whatever method is employed for plugging in the loud speaker, it can very easily be arranged to short this by means of an ordinary on-off filament switch. If such a switch is placed across the particular point in question, or across the loud-speaker leads, the speaker will be working when the switch is in the "off" position, but will immediately be shorted out of circuit when the switch is pushed "on."

The loud-speaker extensions will be practically invisible if bell wire or No. 16 D.C.C. is used, but it is not advisable to use very thin wire for this or the losses will be comparatively high. Do not use twisted wire for the long leads which run round the house, as undesirable capacity is introduced by this method and theoretically the "come" and "go" wires should be separated as far as possible.

One method which is perfectly satisfactory in practice is to run one wire to all the points via the top of the door, picture rail, etc., and to take the return wire from the most distant point along the floor, skirting boards, under carpets, etc. When done carefully in this way the wiring of the whole house can be made practically invisible.

A GOOD H.F. AMPLIFIER.

T. N. E. (Manchester).—"It was an H.F. amplifier of 'P.W.' design, the chief components being an H.F. choke, a neutralising condenser, a ·0005 variable condenser, ·001 fixed condenser, on-off switch and valve socket mounted on a panel, 7 in. x 7 in., with a 9-in.

(*Continued on next page.*)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

deep baseboard. Can you tell me what the circuit was for an H.F. unit to put in front of the 'Master' Three?"

In addition to the components named the circuit will require two single-coil sockets, one for the aerial and one for the grid coil. The connections will be from the aerial terminal to one side of the aerial coil holder, the other side of this going to earth to L.T. negative; to one of the filament sockets on the valve holder, and to a flexible lead which connects to the centre tapping on the grid coil.

The grid socket of the valve holder is connected to one side of the ·0005 mfd. condenser and one end of the grid coil. The other ends of this coil and condenser are joined together and taken to the neutralising condenser, the other end of which is joined to the plate socket of the valve holder, to the ·001 fixed condenser and to the H.F. choke.

The remaining side of the ·001 fixed condenser goes to the A terminal on the set and the remaining side of the H.F. choke goes to the H.T. positive terminal of the unit. The only remaining connections are from the remaining filament terminal of the valve holder to the L.T. switch, the other side of which joins the L.T. positive terminal on the unit to which the battery leads are taken.

FOUR USEFUL HINTS

A SIMPLE and efficient earth connection can be obtained by forcing into the ground several pieces of iron or other metallic tubing. The lead to the set can be fixed into the top of the pipe by means of solder. This contracts on cooling, and causes a bad connection, so metal which expands on setting, such as "type" metal, should be used, if possible.

Shunt the H.T. Battery.

THE absence of a large condenser across each H.T. plus tapping and H.T. negative is not very noticeable in some circumstances, for instance, when the H.T. battery is new and giving its full-rated voltage. With an older battery, however, absence may be shown by cracking or "frying" noises, or if low-frequency amplifiers are used, perhaps a tendency to howl when the set is just on the oscillation point.

Grid Leak Troubles.

A FAULTY grid leak is, as a rule, fairly easy to detect, simple methods being satisfactory in nearly every case. A loud howl or ticking noise when the reaction coupling is fairly tight is a sign that the grid leak is either cut right out of circuit or of much too high a value.

Serious distortion also results sometimes from a defective or unsuitable grid leak.

Directional Aerials.

AN AERIAL of the inverted L-type is directional towards stations which lie in a direct line with it, looking from the free end of the aerial towards the lead-in end. Imagine the aerial wire to be an arrow with its head at the lead-in end, then the arrow will point towards the point of the compass to which the aerial is directional. An aerial of the inverted T-type where the lead-in is taken from the centre, is directional anywhere in a straight line with the aerial. Thus, with this type of aerial there are two maximum directional positions.

FADING?

SQUEALING from a receiver is in many cases a sort of high-frequency motor-boating, but it rarely happens in well-designed circuits—at least, not when reasonably large by-pass condensers are connected across the high-tension battery or eliminator. With modern amplifiers capable of reproducing the very lowest notes, the fault may take the form of a slow but periodic swelling and waning of signals, not unlike that experienced with slow fading.

In certain cases the amplitude of the slow oscillations may be such as to completely modulate the incoming signals—i.e. it may completely cut out the signal at its lowest amplitude and more than double its intensity at the crest.

If the trouble is only slight, it is not annoying, and can, in fact, only be detected if special attention is given to the output.

The variations may be increased so as to constitute quite a large amplitude, but, again, if this is slow, the effect is not in every case noticeable. It is interesting how one may be misled into thinking that the trouble experienced is due to the station fading, whereas it is really due to this slow kind of motor-boating.

Slow Motor-Boating.

The frequency and strength of this effect depends to a certain extent on the H.F. amplifiers, but to a far greater degree on the L.F. amplifiers, the greater the amplification employed the greater is its effect.

It is this point which causes slow motor-boating to be mistaken for fading on distant stations and many times a DX fiend has been puzzled by a fellow-listener not being troubled with fading, whereas he himself is constantly troubled with this fault. This only applies to feeble motor-boating, for violent motor-boating will take place all the time, whether the set is tuned or not.

In most cases, however, true fading is not so regular as motor-boating, and its successive periods are of equal duration. If, therefore, you are troubled with an apparently unexplainable variation in signal strength, try some large fixed condensers across the high-tension battery or eliminator. If this should fail to remedy the fault, try one of the excellent anti-mobo units now available in the plate circuit of your detector valve.

It may in some cases be necessary to add such units in the plate circuits of the L.F. stages also.

WIRELESS ECHOES.

ATTENTION has recently been drawn to the existence of mysterious "echoes" due to the reflection of short-wave signals from some distant point in inter-stellar space, far beyond the confines of the Heaviside layer.

The extraordinary features in this particular instance are (a) the length of time elapsing between the outgoing signal and the return of the echo; (b) the fact that the

(Continued on next page.)

WIRELESS ECHOES.

(Continued from previous page.)

signal must have penetrated through the Heaviside layer, and (c) the nature and location of the reflecting medium.

In itself the echo effect due to reflection is of course a well-known occurrence and has already been utilised in various ingenious ways.

It is clear, for instance, that if one can measure the time-interval between the transmission of an outgoing signal and the return of its echo, one has the necessary data to measure the distance away of the reflecting surface or medium. Electric waves travel at the speed of light, so that by multiplying this velocity by the total time taken by the signal to reach the reflecting surface and return as an echo, we can measure the total distance travelled. Half of this calculated figure will be the distance separating the transmitter from the reflector.

Calculating Distance.

The same method was of course employed by Fizeau in measuring the speed of light. In this case, however, the distance between the source of light and the distant mirror was known, and the time interval was measured by means of a rapidly rotating obturator disc. A simple sum in division then gave the required velocity of the light-ray.

The long-distance wireless echoes observed by Professor Stormer occurred after intervals varying from 3 to 15 seconds, which according to the previous argument would place the reflecting media at distances varying roughly from 300,000 to 1,500,000 miles away.

Similar "echo" effects have already been used to measure the height of the Heaviside layer. Here of course it becomes a troublesome problem to measure the time interval between the outgoing and reflected signal, the interval in question being of the order of the one-ten-thousandth part of a second.

The outgoing signal is modulated at a frequency of 1,000 cycles and the return echo note is applied to a sensitive oscillograph, after suitable corrections have been made to distinguish the "reflected" wave from the direct or earth-bound component.

Most of the suggestions that have been put forward from time to time for "prospecting" the earth's surface for hidden minerals are based upon the same principle. Again the distances are relatively so short that very special apparatus must be designed in order to separate the outgoing signal from the returning echo.

An Ingenious Valve.

Dr. Heinrich Lowy, an Austrian physicist, has devised an ingenious form of valve for this purpose. It consists of a single filament and a number of separate anodes arranged around the filament in the form of a circle.

The stream of electrons coming from the filament is controlled by an external magnetic field so as to sweep to and fro over the circle of anodes in rapid succession. Certain of the anodes energise the transmitter, whilst others cut it out of action and simultaneously bring the receiver into action.

The whole device constitutes an extremely rapid make-and-break switch by means of which the signal and echo can be separately recorded and the corresponding time interval measured.

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for this is that arrangements for switching in and out of circuit is a comparatively straightforward matter with L.F. parts of the circuit, whereas with H.F. units switching arrangements frequently introduce considerable losses and therefore they have, at any rate until comparatively recently, been avoided as far as possible.

In view, however, of the great convenience of being able to switch H.F. coils, experiments have for a long time been conducted with a view to finding means for doing this without the above-mentioned losses, which were previously inseparable from it, and much better switching methods have now been devised.

At the same time, although it is now possible without any serious losses to switch in and out tuning-coils and so on, the problem of the efficient switching of a complete high-frequency stage cannot be said to have been properly solved.

Chokes.

Talking of high-frequency coils brings me also to the question of H.F. *chokes* which, as you know, are now often employed in eliminators or mains-supply units. Hitherto it has been almost the invariable rule to employ only L.F. chokes in units of this type, and it is only comparatively recently that the H.F. choke has also been used for this purpose.

The smoothing properties of the mains unit are, of course, dependent upon the inductive properties of the usual low-frequency chokes, but it must be remembered that the mains unit is often connected up to H.F. parts of the circuit as well and, in order to prevent H.F. leakage, the H.F. chokes are introduced. This is more particularly the case when the unit is used to supply a multi-valve set. Incidentally, if H.F. chokes are used in this way they should be of low capacity.

Screened-Grid Voltages.

Talking about screen-grid valves, there is one point with regard to the H.T. values which I think is not always quite clear, especially to beginners. This is the question of keeping up the H.T. voltages to their proper values, and where H.T. dry batteries are used there is sometimes a danger of the applied H.T. voltage falling far short of the intended rating.

In this respect the screen-grid valve, when supplied with a waning H.T. voltage, behaves quite differently from an ordinary three-electrode valve. With the latter, if the voltage falls off there is usually nothing more serious than a gradual—or in some cases a fairly rapid—diminution in the volume of the reproduction. This is particularly the case where a fairly critical adjustment of the H.T. is used on the detector, and quite a small reduction in the H.T. voltage will make a very considerable difference to the regeneration.

Erratic Behaviour.

With the screen-grid valve, however, if the proper voltages are not used, or if they are allowed to fall away from their proper values, the valve begins to misbehave itself in various peculiar ways which it is not always possible to prophesy. Usually the

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TECHNICAL NOTES.

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effect is to set the valve into oscillation and to cause generally unsatisfactory and erratic results.

With H.T. accumulators, or with a mains-supply unit, this trouble is not so likely to happen, but where a dry battery is used—and I suppose even in these days dry batteries are still used more largely than any other form of H.T. supply—there is always the danger, especially if the battery is getting on in years (or months) that one or more of the cells may have ceased to function; such a cell simply acts as a comparatively high resistance and I have known of cases where a defect of this sort occurred between the screen tapping and the anode tapping with the result that the voltage applied to the anode was practically no higher (when a current was actually flowing) than that applied to the screen.

High Sensitivity.

The screen-grid valve is, of course, an extraordinary sensitive device especially for high-frequency work or for the high amplification of very weak signals, but in order to get the best possible results and to obtain the full advantage of its extraordinary sensitivity it is very important to take every precaution that the specified voltages are used, and that all the adjustments are carefully attended to.

Safety H.T. Units.

The new Ferranti metal case for H.T. supply units is a simple and excellent achievement. It is adequately ventilated, and at the same time the internal components are suitably shielded so as to prevent interference emanating from the unit and a particular claim is made for the fact that the container is of the safety-first variety.

The novel and advantageous feature of the case is the automatic switch-and-fuse arrangement by which the latter are automatically operated upon the opening and closing of the lid. I recommend all experimenters who contemplate making up H.T. supply units to take an opportunity of examining the Ferranti "safety case" before commencing operations.

Quite a large percentage of home-made H.T. supply units are built up simply upon a wooden baseboard, with the various components exposed to dust and danger, and it is undoubtedly very desirable to enclose the H.T. unit in some type of covering. Having decided upon an enclosed unit, the claims of the Ferranti safety box, and more especially in view of the automatic switch and fuse devices, need no further emphasis.

Talkies.

One of the latest systems of talking films is the Photophone (not to be confused with Phototone). In the Photophone system, which is being developed by the Radio Corporation of America, the sound record is optically impressed upon the edge of the ordinary picture film and, apart from other refinements, the chief feature which differentiates this Photophone film from others in which the sound is "on the film" is the fact that the sound part of the film does not encroach upon the picture part.

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TECHNICAL NOTES.

(Continued from previous page.)

There seems to be some confusion about the word "Photophone." So far as I am aware, this name was originally used by a well-known British scientist, Dr. Rankine, many years ago in connection with a method of recording sounds upon films and it is possible that the word has become common usage for this kind of recording.

On the other hand, it is possible that the Radio Corporation's Photophone system may be an elaboration of the Rankine system and based upon the latter's patents, although I am not aware that this is so.

Excellent Results.

The latest R.C.A. Photophone gives excellent results, possibly superior to those of any of the other talking picture systems. The reproduction is excellent throughout the whole of the range, except possibly in the highest part where there is a peculiar "thin" quality which is noticeable also in other talking pictures. I must say, however, that it is not nearly so pronounced with the Photophone as with some of the other apparatus which I have heard.

This new outfit employs eight moving-coil loud speakers and an excellent amplifier, the loud speakers being arranged more or less around the picture screen; in this way it is considered that a more natural effect is obtained than by placing the loud speakers behind the screen and allowing the sound to pass through. Incidentally, this latter arrangement necessitates the use of a very coarse open-work material for the screen which tends to mar the fineness of the picture reproduction.

I have seen screens used for this purpose which were so coarse in texture (to allow the sound to pass through from the back) that it seemed a wonder that the pictures could be satisfactorily shown upon the screen at all.

THE "P.W." "WHITE PRINTS."

A UNIQUE SERVICE FOR OUR READERS.

White Print No. 16 :: :: An H.F. and Detector Set.

This week we publish the sixteenth of our White Prints. This page may be easily and safely torn out—along the dotted line overleaf—and the "White Print" filed. In due course you will thus have available an encyclopædic collection of the best circuits used in modern radio practice. A "White Print" will be published on the last page every week in "P.W." until further notice.—THE EDITOR.

WHEN one is limited to a fairly small set, there is a great deal to be said in favour of a sensitive long range headphone instrument. For one thing, it is very economical to equip and run. The valves themselves are of the cheaper types (H.F. as a rule), they do not require a very high voltage H.T battery, and consume very little H.T. current.

Again, there is no loud speaker to be bought, and quite good headphones are very cheap nowadays. Notwithstanding these factors, one can derive lots of entertainment from such a receiver. It will bring in a long string of foreigners just like one of the big and elaborate sets, but on the 'phones instead of the speaker, and its selectivity can be very good.

Altogether, a set like this makes a very good second step for anyone who has made a start with a one-valver, and intends to take the wise course of progressing gradually instead of taking the plunge with a big set before getting some experience with medium-sized ones.

It is particularly good from this point of view, because it actually forms an excellent basis for a bigger outfit. If at a later date you were to add one of the L.F. amplifiers from this series you would have a loud-speaker receiver of a very good type and without any scrapping or rebuilding.

Economical and Efficient.

The example of this type which we have chosen for the "White Print" series was designed with the idea of extreme simplicity and reasonable economy, without actual cheese-paring over any important detail. It incorporates two valves (H.F. amplifier and detector), and although a fair number of components are needed they are all of standard types, and you will quite likely have a good number of them at hand (the design was worked out with some care to use such parts as constructors generally have among their spares).

The aerial circuit is composed of a very standard type of tuned secondary with auto-coupling for the aerial itself, a 6-pin type of coil being used for the purpose. These coils are very simple and convenient, and give very satisfactory results provided that you (1) buy a good make, (2) keep the pins clean, and well opened out with a knife blade, at intervals, and (3) are very careful to use the right type.

The correct coil for this design is the one described as a "split-primary type aerial coil," and although others could be used almost equally well the wiring would need to be altered to suit most of them. You want two of these coils, one for the ordinary wave-band and one for the long waves.

The high-frequency amplifying valve operates in a circuit usually described as a "split tuned anode." In this there is a tuned anode circuit with a centre tap, which latter is wired to H.T. positive. One side of the circuit goes to the anode of the H.F. valve, while the other side is left free to provide the "equal and opposite" voltages which are fed back through the neutralising condenser on to the grid of the valve to stabilise it.

Hartley Reaction.

This free side of the tuned anode is also made use of to enable reaction to be obtained in a very simple way. Remembering that this tuned-anode circuit constitutes also the grid circuit of the detector valve, it is evident that since we have a centre tap and a "free" side we can easily get reaction as it is done in the Hartley circuit, and you will see from the diagram below that it has been done, for there is no separate reaction winding.

COMPONENTS.

- 1 Panel, 14 in. × 7 in. × $\frac{3}{16}$ in. or $\frac{1}{4}$ in.
- 1 Cabinet to fit, with baseboard, 9 in. or 10 in. deep.
- 2 ·0005 mfd. variable condensers.
- 1 ·00005 or ·0001 mfd. reaction condenser.
- 1 L.T. switch.
- 2 Sprung valve holders.
- 1 Neutralising condenser.
- 1 6-pin coil socket.
- 1 Ordinary plug-in coil socket.
- 1 "P.W." standard screen, 6 in. × 7 in. or 6 in × 10 in. (see text), or suitable home-made screen of sheet copper.
- 1 ·0003 mfd. fixed condenser.
- 1 ·001 and 1 ·0002 mfd. fixed condenser
- 1 2-meg. grid leak and holder.
- 1 H.F. choke.
- 1 Terminal strip, 12 in. × 2 in. × $\frac{1}{4}$ in.
- 10 Terminals.
- Wire, screws, flex, etc.

In this circuit you want an ordinary centre-tapped plug-in coil. For the lower wave-band (250 to 550 metres, say) you require a No. 60 and for the 5XX range of wave-lengths a No. 250.

Just one constructional point must be mentioned: a standard "P.W." screen is called for, and the one shown is 6 in. high and 7 in. wide. This is adequate, but if you chance to use a cabinet with a 10-in. baseboard you may as well use a 10-in. screen also (they are supplied in standard sizes of 7 in. and 10 in. wide).

Note carefully in connection with this screen where connection is made actually to the metal and where wires are insulated and pass through one or other of the perforations along the lower edge. In the former case a small screw and nut, or small terminal, is put through one of the perforations and connection is made thereto.

Now about operating adjustments. Neutralising is the main point, and this calls for a little care. With valves and coils inserted, everything connected up and the set switched on, put the neutralising and reaction condensers to minimum and see if the set oscillates when the dials are brought into step (put one to a point at the middle of the scale and swing the other). Probably it will, but if not, increase reaction carefully until it JUST does.

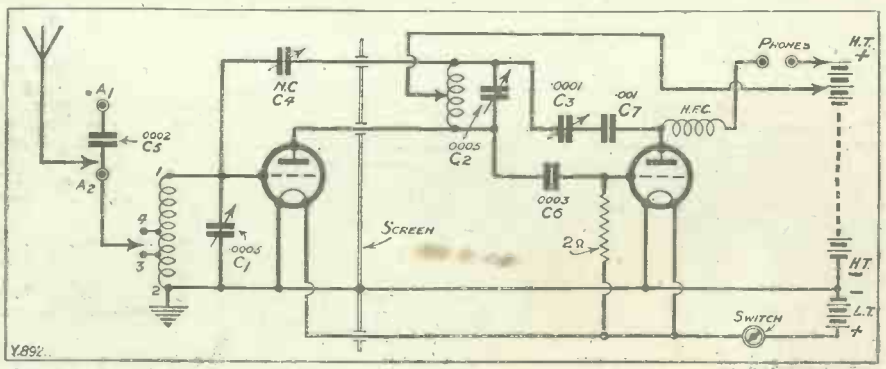
How to Neutralise.

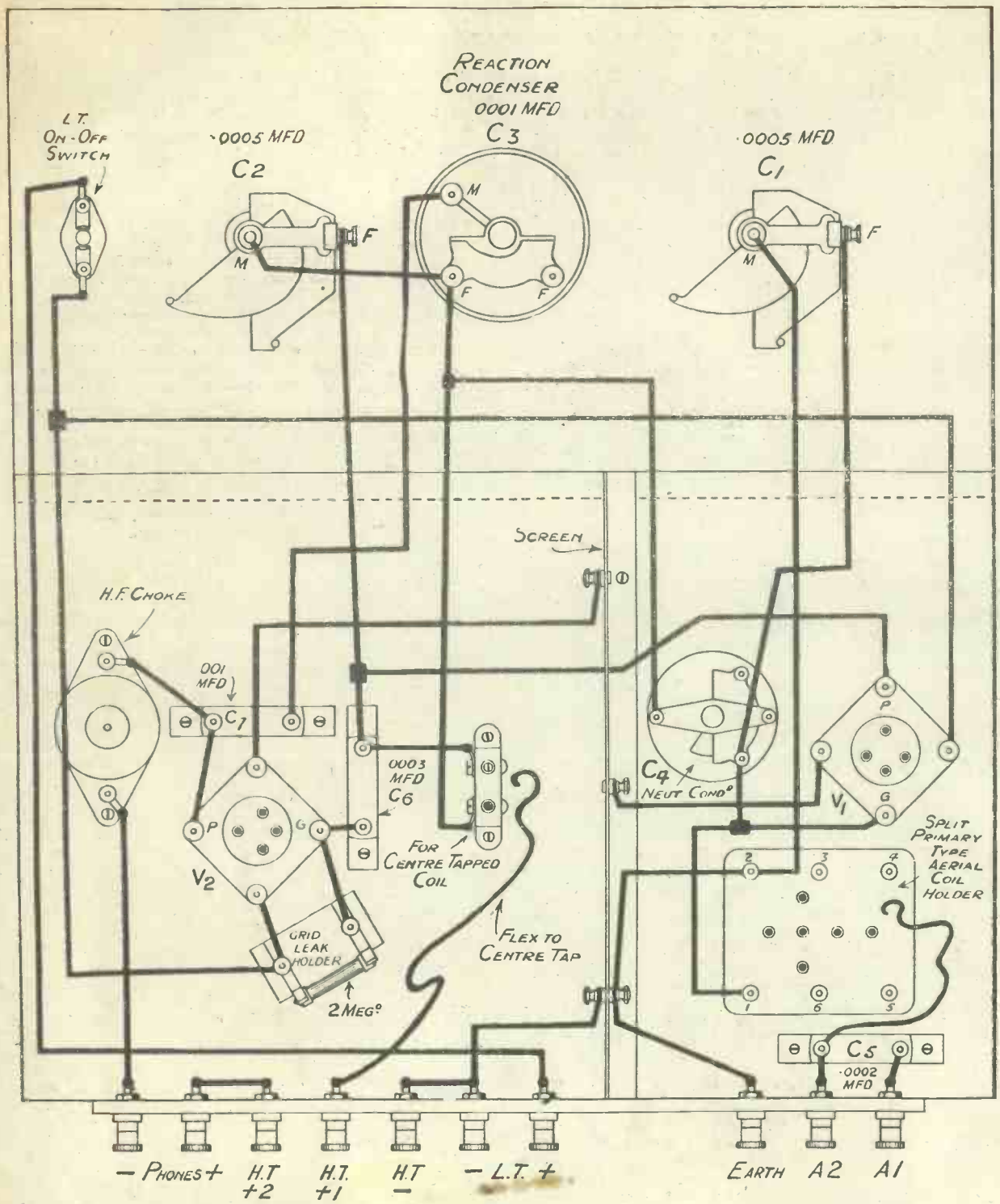
Now increase the neutralising condenser setting very gradually and the set will presently stop oscillating, and remain stable even when the dials are re-adjusted to make sure they are in step. Increase the neutralising condenser gradually again, and note its setting when the circuit begins to oscillate again.

Having found this point, take the neutralising condenser back half way to the setting at which it just stabilised the receiver (i.e. the first point you found), and that is the correct adjustment.

Finally, some odd points. Selectivity is controlled by the flex lead from the aerial terminal, which is to be placed on No. 3 (highest selectivity) or No. 4 (lower selectivity but greater strength as a rule) on the 6-pin coil base. Valves should both be of the H.F. type, and H.T. should be about 80 volts (100 is a trifle better) on the H.F. valve and about 60 (adjust for smoothest reaction) on the detector.

The valve type given, by the way, is just the standard recommendation for this type of circuit and can be depended upon for good results. However, some specimens of the R.C. type often turn out to be suitable, so if you have one or two of this kind it is as well to give them a trial.





WIRING DIAGRAM

V.107.

CUT ALONG THIS DOTTED LINE

Printed and published every Thursday by the Proprietors, The Amalgamated Press, Ltd., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices: Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. (Telephone: City 7261). Registered as a Newspaper for transmission by Canadian Magazine Post. Subscription Rates: Inland and Canada, 17/- per annum; 8/8 for six months. Abroad (excepting Canada), 19/6 per annum; 9/9 for six months. Sole Agents for South Africa: Central News Agency, Ltd. Sole agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd. Saturday, March 23rd, 1929