POPULAR WIRELESS, June 2nd, 1928

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

SIR OLIVER LODGE WRITES IN THIS ISSUE

Popular Wireless

Every Thursday PRICE 3d.

No. 313. Vol. XIII. INCORPORATING "WIRELESS" June 2nd, 1928.

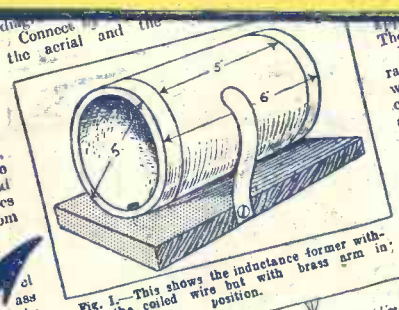


Fig. I.—This shows the inductance former without the coiled wire but with brass arm in position.

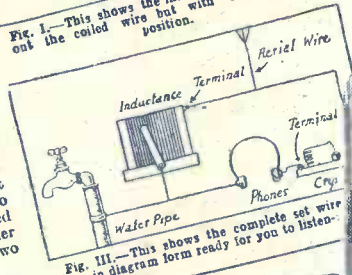
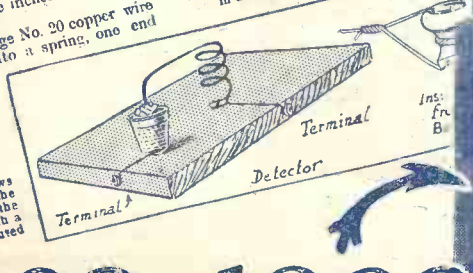


Fig. III.—This shows the complete set wire in diagram form ready for you to listen-



THE "BIRTHDAY" FOUR

1922-1928

Full Description Inside

CONTENTS

THERE'S full-toned melody in every Cossor Valve. Cossor Valves give perfect reproduction and distance too—they bring in seven countries on the famous Cossor "Melody Maker." Cossor Valves bring success to any Receiver. Use them in yours.

Cossor
The Melody maker

THERE'S MELODY IN EVERY

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Post this Coupon to-day!

Please send me your large constructional chart, "How to build the Cossor 'Melody Maker.'"

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P.W. 2/6/23

Popular Wireless

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RADIO NOTES AND NEWS.

P C J J Changes Wave-length—Roumania to Carol—Radio Lamplighting—Too Much Dickybird—Is Soldering Necessary?—"Skip-Distance"—Bells Across the Sea.

Natal Note.

PLEASE, it's our birthday to-day, and we're just six years old, but with a "circulation" and a reputation which many a centenarian might envy. Thanks to the enterprise and vision of the proprietors, to the capable editorial staff and to the unerring instinct of the public which tells them "what is what," "P.W." has in six years become a successful radio weekly known, bought and quoted all over the world.

Born Before B.B.C.

"P. W." was established before the British Broadcasting Company, when listeners and constructors were but a few compared with present-day numbers. But those behind the scenes, by long experience of radio, could foresee accurately the trend of things and were convinced that broadcasting and, in general, the science of radio, were destined to appeal to brains and imagination. And so we began, and so our faith has been justified. We are proud of our achievement, confident of our future, and grateful to Sir Oliver Lodge, the leading British scientist, for his belief in "P.W." and the inspiration he has afforded to us and through us to hundreds of thousands of readers, to whom we offer our thanks for their support.

An Afterthought.

SHOULD the foregoing paragraph seem to savour somewhat of self-praise, please to be reminded that "Ariel" is impersonal. He is the sprite of radio and does not share the laurels (or the biscuits) of the technical hounds. He creates Knights, Barts. and Barons, but does not instruct nor lead them. He is the ghostly commentator "behind the arras"; and sometimes the *bête noir* of the B.B.C.

P C J J Changes Wave-length.

ON account of interference, P C J J has altered its wave-length from 30·2 metres to 31·4 metres until further notice. We don't seem to get much forrarder with the "frequency" crusade, do we? It'll never be popular with the general public.

Roumania to Carol.

NOTHING political is intended by this heading, which is only meant to express the fact that Roumania will this year enter the concert of nations by establishing a broadcasting station at Bucarest. This station, which is to be erected by the ubiquitous Marconi Company, will have a rating of 12 kw. unmodulated energy to the aerial and will be able to transmit on any wave-length between 200 metres and 545 metres. (Roumania is the twentieth country to use Marconi broadcasting stations.)

Radio Lamplighting.

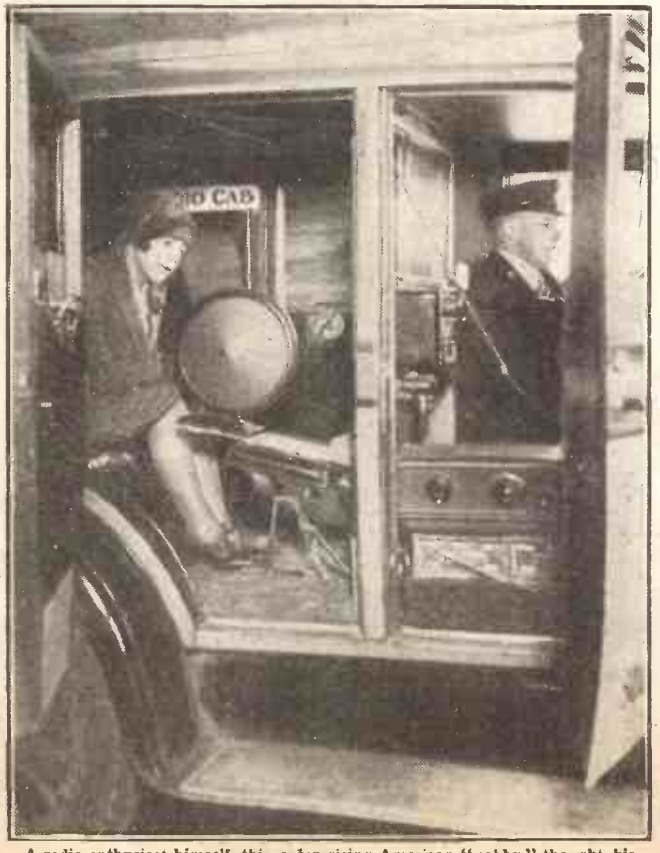
WITH reference to my note some weeks back about street-lighting by radio at Glen Falls, New York, Messrs. R.I. and Varley tell me that Messrs. Oliver Pell Control, Ltd., make and instal a system for lighting street lamps from a central station by superimposing a wave on the network, which actuates tuned relays for the various lamps or groups of lamps. I am delighted with the news, and to know that the system has been in operation at various places over here for some years. R.I. suggests that my memory is at fault. Not at all! Rather do I answer as did Johnson, when he was asked why he described "pastern" as "the knee of a horse"—"Ignorance, pure ignorance."

Hurrah for the Young 'Un!

THE British East African Broadcasting Company, whose formation I announced some months ago, opened its first station at Nairobi, Kenya Colony, on June 1st (weather and lions permitting). This station is claimed to be the first in a British colony to open a public service; if it

(*Continued on next page.*)

RIDE IN A RADIO CAB!



A radio enthusiast himself, this enterprising American "cabby" thought his patrons might like to lean back and listen in. So he installed a set and speaker, which brought him so much business that the idea has been extended to other cabs. When not in use, the "speaker" swings back against the driver's seat.

NOTES AND NEWS.

(*Continued from previous page.*)

is not I have no doubt I shall hear about it. However, the best of luck to the young 'un! May it never break down and may "X's" be kind to its audience. Will it be heard here? And will it kindly tell me its call-signal and *lambda?*

Radio Instead of Necessities?

ACCORDING to a Moscow message there are no less than seventy-seven radio stations in the Soviet Union—whatever that may be—and the Wireless Friends' Society has 200,000 members and 80 branches. Also, there are 80 radio periodicals published there. It sound fine! But——

Transmitting Note.

MR. L. PARFITT, G–6 P F, of "Waverley," King Street, Abertillery, Mon., asks me to announce that from now his new address will be 85, Queen Street, Abertillery, Mon. Glad it's not "Queer" Street. He is licensed to transmit on 8, 23, 45, 90 and 150-200 metres, but is usually to be found on 45 metres and would be glad to have reports on his telephony tests. Also he wants us to run a transmitter's page. But transmission is not "popular wireless," unfortunately. It's a cult confined to a lucky few.

Ignorance or Humour?

THE Osram people—lamps and valves, you know—have shown me a letter which they received in company with three of their valves. The writer of the letter said he had used the valves for about 4,500 hours, spread over 4 years, which works out at about 16s. per annum. Terrible! Now the darned things are feeling tired and won't work unless his accumulator is fully charged. The parcel containing the valves was tied with the ribbons of the military Long Service and Good Conduct Medals. I suspect a humorist and a jolly good testimonial. But I sympathise; because I've got a team of valves, 1923 vintage, which simply will not stop doing their job.

Radio Scepticism.

OF course, I have had shoals of letters from true believers, but the whole question seems to me to turn on the definition of "reception." What exactly does a man mean when he tells us he has "received" thirty Continental stations? Does he refer merely to identified call-signals, or to programmes—or items—properly heard.

A Typical Letter.

R. W. S. (Little Wakering), who does not claim any special virtues for himself or his sets, tells me that on the broadcast band he has "received" nearly 200 stations, and on the short-wave band 42 official broadcasting stations, including 4 in Australia, 1 in Japan (didn't know there were any in Japan!), 2 in Dutch East Indies, and 16 in the U.S.A. He has had a number of confirmations. His sets are both 0-v-2. Well, gentlemen, what is the answer? Are the sceptics just a few voices "crying in the wilderness," or are the Valve Barts. all mistaken?

Too Much Dickybird.

WHY *is* there all this fuss again about the broadcasting of the nightingale's noise? Added to my inability to hear Chamber Music without suffering is my complete lack of interest in that bird's whistling. Am I so soulless? Or am I simply honest and not a *poseur?* I like "Merrie England," Schubert's "Ave Maria" and Wagner's "Mastersingers," but I should prefer to hear a broadcast of a cock making the sun rise, or of "Phillip of Hyde Park Corner" in full blast, to that shrieking fowl the poets call Philomel.

Radio versus Beauty.

I have recently read about a lady of Detroit (U.S.A.) who, hearing on the wireless the word "Alaska," turned excitedly to her family and flattened her nose against a door. Sad to say, all she really heard was a U.S.A. station claiming to have been heard in the Yukon. Moral: Listen for the call-sign before announcing your triumph to the family. Sympathisers will be glad to know that the pretty little nose has since regained its prominence.

SHORT WAVES.

It is said that by means of television, a face may be heard. We often wondered what caused these awful noises we have heard on the radio, but now we begin to have a slight suspicion.—"Science and Invention."

* * *

SIMILAR CONTENTS.

A: I really can't make out what's wrong with my radio set. Maybe I need a new vacuum tube.

B: Just use your head, man; use your head.

* * *

An amateur broadcaster recently changed his residence, and we understand that on the first night he successfully relayed the linoleum. This is quite a new experiment, and we must congratulate this enterprising amateur.

* * *

Optimist: "G-g-g-good-m-m-morning, M-mister S-studio M-M-Manager. D-d-did you advert-t-tise f-for a g-g-good r-r-radio an-n-nouncer?"

* * *

Advertisement in provincial paper, "New stocks just in. Summer Sets." And some are not.

* * *

WHY DADS LEAVE HOME.

"Papa," inquired Junior, "if a bicycle is a two-wheeled vehicle and a tricycle is a three-wheeled vehicle, how many wheels has a kilocycle got?"—"Radio News."

* * *

Our Mary's bought a Super-het—
My word, it is a wow!
Most any station it will get;
'Twill walk them in, and how!

Poor Mary sold her lamb and cow
To kick in with the coin,
But said: "It's worth it, don't you see,
The BCL's to join."

Her erstwhile peaceful cottage
Is now the scene of wars;
The family for the locals wait,
While Mary will woo Mars.

Father says: "Now cut it out!"
He's a perfect wreck, you know;
For *wait* little sleep her poor dad gets
Is when the batteries are 2 LO.

—"Radio News."

Is Soldering Necessary?

"REGULAR READER'S" letter in our issue of May 5th has aroused conflicting emotions in "Dedhooker's" (Yarm) mind, who agrees with "Regular Reader" about the solder but appears to raise his eyebrows in an Elstonian way regarding "R.R.'s" results on the two-valver, and would like details of the set, which he considers has been assisted by the beer-laden air of Burton-on-Trent. The answer about soldering is that it is necessary for permanent wiring; twisted contacts, clips, and screw terminals develop high-resistance in course of time, due to dust, damp and corrosion.

The Iron Hand in Erin.

NOT long ago I commented on the fact that of 27,000 licensees in Ireland only 38 responded to an invitation to write in criticism of the broadcasting there. One of the 38 informs me that the curse of the counthry is no longer Cromwell, but Morse. He adds that the latest advice of the powers that be is, "If you do not like our programmes, you have a simple remedy; switch off." If that is a true report, all I can say is that the Irish people ought to "switch off" the "powers that be.

"Skip Distance."

THIS theory seems to need tightening up. H. H. K. tells me that at Anerley he regularly receives Mr. Marcuse's signals from 2 N M, Caterham, only a little way distant, at moderate loud-speaker strength. I believe that waves under 80 metres in length are generally supposed to be the "skippers." Now, Mr. Marcuse works on Sundays on 32 metres. We thus evidently have an exception, or there may be a certain distance from the transmitter within which the "skip" does not begin, due possibly to the angle at which the energy is radiated.

Bells Across the Sea.

A LITTLE romance of trade, ably provided by radio. On Anzac Day, April 26th, a set of carillon bells made by a Loughboro' firm and supplied to Sydney University were first used in a dedicatory service. In a house in London the committee for testing the bells, and representatives of the manufacturers, heard the service perfectly on a "Selector Short-Wave" Three set, hastily rigged up by Messrs. Selectors, Ltd., at short notice. That the makers were enabled to hear the first performance of their products across the earth is one of the minor but not uninteresting romances of radio.

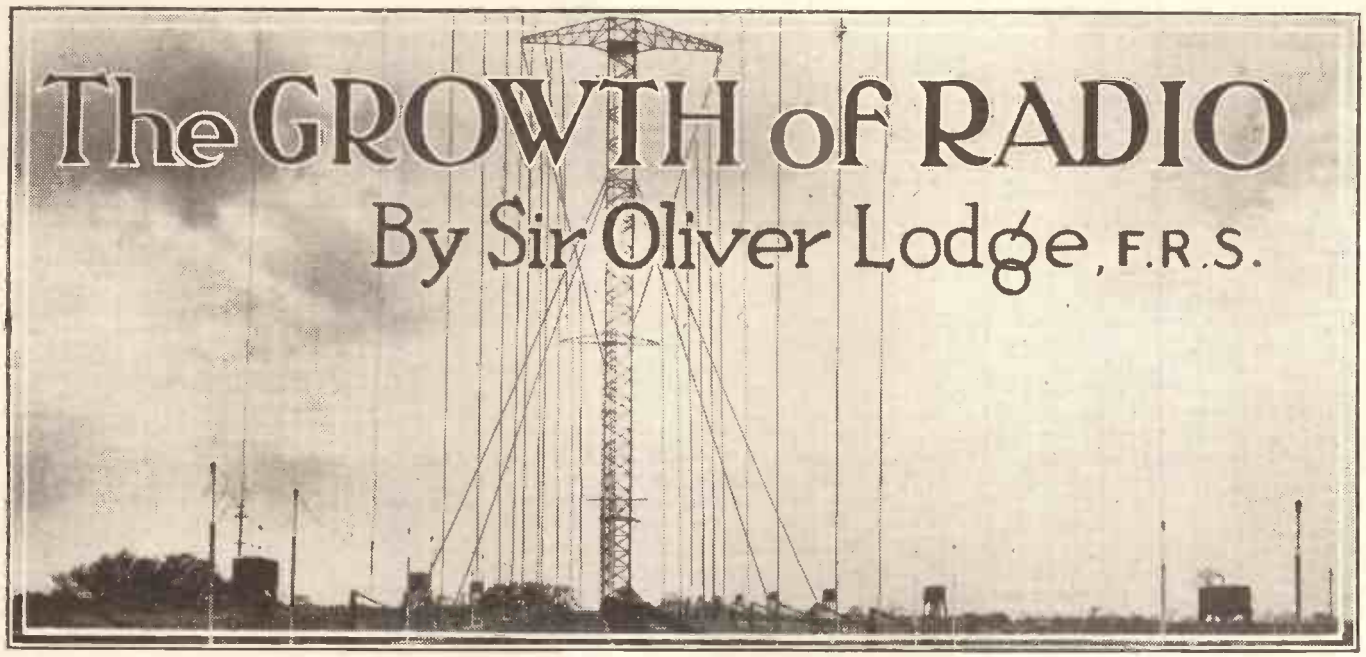
Cubist Rhetoric of a High-Brow.

WRITING to the Congress of the British Music Society, Mr. Cyril Scott, composer, let off a few wordy squibs which were meant to be witty and "superior." "At one time music was an art; it has now become a vice." In that case, then, Mr. Scott must be a producer of vice. "Gramophones and wireless are now habits instead of pleasures." None the worse for that, sir, even if it were true, though it is not. They have become both.

The Secluded Debaters.

THE guests at Wormwood Scrubbs evidently find that the B.B.C. "talks" provide something which their constitutions do not need when they are at large. These hermits study up the subjects of the talks and then debate them. I should like to see their faces during a talk on "Locks and Safes" or "A Visit to the Mint: How Money is Made," or "Climbing," or "How to Cultivate the Handwriting."

ARIEL.



The GROWTH of RADIO

By Sir Oliver Lodge, F.R.S.

We are pleased to be able to include in our Anniversary Number a special article from our Scientific Adviser, whose long association with "P.W." makes his good wishes all the more gratifying. Next week we and our readers will be able to reciprocate by sending Sir Oliver good wishes on the occasion of his 77th birthday.

AS you are approaching a sixth anniversary of the publication of POPULAR WIRELESS I send a message of congratulation to you and your readers on the growth and development of radio that has taken place during the interval.

Broadcasting has become a feature of the national life in most civilised countries, and as far as I can judge it has been managed in England on lines as good as it has been anywhere.

It has become a consolation to patients in hospitals, and has enlivened the winter evenings in country districts and outlying distant places, such as lighthouses and mountain cottages, to a surprising and beneficent extent. People need no longer feel isolated or cut off from the march of civilisation.

The annual cost is insignificant and the benefits are great. The ether is a universal means of communication, and its utilisation in this way is a surprising feature of our generation, which even twenty years ago could hardly have been anticipated. Moreover, the skill of amateurs has developed, and many improvements have resulted from this widespread and really simple method of communication.

What the future of broadcasting may be I cannot foresee. That it will always be used for the dissemination of political and other speeches and for instructive talks is likely enough. It can hardly fail to be an educative instrument, enlarging the view of life for those whose outlook would otherwise be narrow.

Programme Variety.

Concerts and musical performances will always be welcome. And it seems to lend itself surprisingly well to the dissemination of drama, the vividness of which in some cases is more than could have been anticipated, showing that good work in that direction is less dependent on vision than might have been thought likely. I hardly think that humorous entertainments, as a rule, come through as well and effectively as more serious topics. But doubtless the programme has to be arranged to suit all tastes.

I am surprised at the demand for so many options, and such a variety of programme from different stations; and I doubt if so extensive an assortment can be always maintained. Indeed, I imagine that it will be found that a few really good performances will be better in the long run than so great a variety.

We may all hope that times of crises will not arrive; but, if and when they do, broadcasting will be and has proved itself invaluable. The whole tendency of civilisation is to weld people together and to encourage a general community of thought.

Sir Oliver Lodge, F.R.S.

Debatable topics have already been cautiously introduced, and this aspect will, I expect, be extended in the future.

The religious services have been, on the whole, of a simple and helpful kind; and no attempt can be made to force them on the unwilling, for those to whom any item is unpalatable need not listen. That is one advantage of broadcasting: it incommodes nobody against their will.

Already, and very quickly, the art has reached a high state of efficiency, so that it hardly seems likely that any revolutionary improvement can be effected. That the high-power stations are able to transmit so clearly is more than could have been expected; and, except for unavoidable atmospheric disturbances, long-distance transmission has by the aid of relay stations become remarkably perfect. The skill of the engineers concerned is very noteworthy, and I am surprised at the accuracy of transmission along land lines of great length. I would have expected more distortion in line transmission, but in practice it seems almost as satisfactory as through the free ether of space.

Incidentally much information has been gained about the conditions in the upper air, and the performance of the Heaviside layer, with the theory of its activity which has now been developed by mathematicians, constitutes a genuine scientific discovery; and it is of more far-reaching importance than is as yet suspected except by a few experts. The theory is by no means easy to expound in ordinary language, and its consequences are surprising.

In the Van of Progress.

So, to sum up, the fact that ether waves could be really generated by electrical means was only discovered in the year 1888, and the methods of detection were at first of a rudimentary character. But now electrons themselves are harnessed to the service of man, their amazing tractability has been discovered and utilised, and in one form or another this branch of electrical engineering is bound to extend and develop in directions as yet unforeseen.

I trust that you and your readers will continue in the van of progress, and will be ready to hail and to take part in future developments of a kind at present unsuspected. Once an art has taken root and begun to flourish, it would be unwise to set any limits to the height to which it can rise. The power of producing sounds with strings and columns of air indirectly gave birth to the works of the great musical composers.

And so it may be hoped that, sooner or later, this enhanced power of communication by radio will be found to give rise to some special kind of genius, which shall make use of this new method for purposes and in ways comparable with human achievements in other directions and above our present capacity to imagine.

AFTER SIX YEARS.

"P.W.'s" First Issue—A "Popular" Journal—Latest Educational Broadcasting Activities.

By THE EDITOR.

THE first issue of POPULAR WIRELESS was on sale June 3rd, 1922, so this issue represents our sixth anniversary number. In that first issue, I wrote that the first number of POPULAR WIRELESS made its appearance in response to the great demand for a paper devoted to the interests of the wireless amateur.

"Many people," I wrote in that first editorial, "will instal receiving sets purely for the sake of the broadcasting programmes. They will not have the time or the inclination to make a deep study of wireless. Nevertheless, POPULAR WIRELESS will be indispensable to them, because it will, week by week, give the latest broadcasting news . . . The experimenter—the man or woman who is handy with his or her fingers—will find fascinating constructional articles by the best experts available. . . . The amateur who has advanced in his study of wireless will not be forgotten, and from time to time experts will cater for his needs. . . . In fact, POPULAR WIRELESS justifies its title.

"After all, 'popular' is a word only to be applied to something in the majority. And I feel that the majority of my readers will find this paper very popular indeed."

Promises Fulfilled.

Those words, which were written six years ago, have, I think, been fulfilled; at least judging by correspondence from our readers, POPULAR WIRELESS is still in essentials "Popular" and indispensable to the amateur who has made wireless his great hobby.

POPULAR WIRELESS made its appearance, it will be remembered, some months before broadcasting began in this country. In fact, under the title of "Broadcasting Programmes" our old friend, "Ariel," wrote: "Within a month it is hoped the National Telephony Broadcasting Scheme will be in operation." In fact, "Ariel" wrote those words several weeks running, but it was some time after POPULAR WIRELESS made its bow that the B.B.C. first started transmitting from the old 2 L O at Marconi House.

It is interesting to look back at that first issue of POPULAR WIRELESS; in it the readers who still possess a copy will find an article on how to erect an aerial, and on how to make a receiver for 35s. On another page, Mr. Gordon Selfridge expressed his views on the future of wireless, and another article represented the first of an elementary series in non-technical language for the beginner.

Enormous Strides.

POPULAR WIRELESS was a very small paper in those days compared with what it is these days, and if you have kept your copy of No. 1 and compare it with this issue you will see, not only from the editorial pages, but in the advertising pages, how enormous have been the strides made in the progress of broadcasting.

It does not seem six years ago since, under great difficulties, POPULAR WIRELESS was brought out at very short notice to satisfy the potential demand of the thousands and thousands of people in this country who have since realised that of all the great hobbies the world has ever known wireless is the greatest and the most fascinating.

And perhaps in six years time, when we celebrate our twelfth anniversary, we shall write also the identical words.

In the meantime, I should like to thank those many readers who have supported "P.W." so consistently and who have been kind enough to write in on this, our sixth anniversary, wishing us congratulations and good luck for the future.

Needless to say, "P.W." will continue to serve its readers as it has served them in the past, and that means consistent and devoted service to their needs and requirements.

More "Hadow" Meetings.

We understand that the British Broadcasting Corporation is following up the recently published Hadow Report on Educational Broadcasting by making arrangements for a series of conferences for the benefit of those interested in the expansion and utilisation of broadcasting in connection with education. Meetings have already been held at Southampton and in Scotland, but the climax will be reached next month when a big conference will be held in London.

Requests have been sent out to various educational authorities, organisations and universities and others interested asking for help and suggestions in preparing a general scheme. The B.B.C. is undoubtedly looking well into the future when the Regional Scheme will have been fully developed.

We have already pointed out that developments in educational broadcasting must not be carried out to the disadvantage of the entertainment side of the B.B.C.'s work, but it seems quite likely, as we forecast, that a certain amount of encroachment on programme time must be inevitable. The Conference to be held in London will have as its main duty the formation and shaping of a policy upon which all can agree. Then will arise, of course, the question of the expense of carrying out such a policy.

The Question of Finance.

The Hadow Report, it will be remembered, suggested that a certain amount of money might be allocated by a sort of raid on the wireless licence revenue retained by the Post Office. The controversy about this money retained by the Post Office has been going on for some time now, but that controversy will probably be inflamed all the more if the money is recovered from the Post Office for the purpose of fostering the B.B.C's educational scheme.

Complaints about programmes are still rife, and whether they are justified or not the majority of listeners will undoubtedly expect that any money regained from the Post Office should primarily be spent either on programmes or on the furtherance of the Regional Scheme.

But it would be undue optimism to expect that the Post Office will refund any of the listeners' licence money, and the Hadow Report suggestion must have been based on a very inadequate knowledge of Post Office politics!

OUR SCIENTIFIC ADVISER AT HOME.

A recent photograph of Sir Oliver and Lady Lodge, taken at their country house, Normanton, Lake, near Salisbury. Sir Oliver Lodge has been "P.W.'s" Scientific Adviser since its very early days, and the great scientist has taken the keenest interest in its maintained progress.

The "Birthday" Four

This remarkable receiver has been specially designed to provide a set that is suitable for all-round use. It is equally suitable as a portable set or as a household broadcast receiver. Designed, constructed and described by the

"P.W." RESEARCH DEPARTMENT.

UNKIND people may sometimes be heard to say that portable receivers are of two kinds—those you can carry and those you can't. And there is more truth in the allegation than one might at first think.

The fact of the matter is that if you want a set to be really, genuinely portable, in the sense that you can carry it along on picnics and what-not without arm-ache, you must be content with a fairly small and simple set giving headphone signals only (except at very short distances), and requiring a small, temporary aerial to be slung up.

If you want loud-speaker reception and a frame aerial, then you must be prepared to use quite a number of valves, and the set will inevitably be fairly heavy and bulky. It will no longer be a pleasant companion on any expedition in which much walking is involved, but that is no reason why people should be funny about this type of receiver.

It has certain perfectly definite applications wherein it can be extremely useful; the point is that they are quite different applications from those in which the very small and light kind of set is of value. The large and ambitious sort should really be regarded as an equipment for inclusion among the luggage when one goes away for a holiday, use about the house in various rooms, for motoring expeditions, and so on.

Special Advantages.

Regarded in this way, it becomes a very useful thing to possess, especially when it is realised that by building one of fairly good appearance it becomes a set which you can use as your main broadcast receiver in the winter (with the additional advantage of being able to move it from room to room) and as a holiday outfit in the summer.

The "P.W." Research Department has devoted some time to preparing designs for a typical specimen of each class of portable equipment. Of these the really portable outfit has already been described under the title of the "'Summer' One," and we are now giving details of a four-valve set which is intended to be a good example of the more elaborate class.

Frankly, this is not a very cheap set to build, but, on the other hand, it is very easy to make (most portables are rather difficult). The finished article is of very handsome appearance, and it gives very good results indeed. Remember, too, that it can be regarded as a standard receiving outfit for all-the-year-round work and you will probably realise that it is well worth consideration if you are contemplating the building of a fair-sized set in the near future.

The set uses a special four-valve circuit which we have found to be remarkably well suited to the requirements of a portable set of the frame-aerial type. It consists of a high-frequency valve employing a special form of the neutralised split tuned anode circuit which will probably be new to most readers of "P.W.," followed by a detector with a form of Hartley reaction and two stages of L.F. (one resistance and one transformer-coupled).

The special features of the H.F. coupling and reaction circuits are all produced by making suitable use of the tappings on the Cosmos "A.N.P." coil which is incorporated in the design, and you should be very careful to wire up this component correctly. A mistake here would completely upset the circuit. The terminals on the coil base are numbered, however, and there is little risk of a mistake if you are careful.

By the way, you may at first be a little puzzled to determine the correct way round to insert this coil in its base, so it should be explained that there is *no* right or wrong way. The coil is symmetrical and may be put in either way.

The set is assembled in a ready-made cabinet which is provided with space for a panel, a fitted baseboard, frame for winding the aerial, space for batteries, and aperture for a cone type loud speaker, so that the actual assembly is very easy, and you will only need to be provided with a little information in addition to that given by the photos and diagrams.

Winding the Frame.

The frame aerial consists of a winding of 14 turns of No. 22 D.C.C. wire, the turns being spaced about $\frac{3}{8}$ in. apart. The ends are taken to a couple of "Eelex" sockets in the wooden frame (this is of well-dried

(*Continued on next page.*)

There is ample room for quite large batteries in the lower part of the case, the H.T. battery shown being a 100-volt unit.

THE "BIRTHDAY" FOUR.

(*Continued from previous page.*)

wood, and there is little risk of leakage), so that connection can be made to the winding by means of a pair of flex leads and plugs.

The type of loud speaker to use will depend largely on the constructor's taste, and there is quite a wide choice available. In the original set we used an Amplion cone assembly, and this was supplied complete on a grille front.

The aperture in the cabinet intended for the loud speaker was already covered with a grille, so we cut this out (with a metal saw blade held in the fingers) and mounted the cone assembly direct in the circular hole so produced. A glance at the photos will make this clear. The actual method of mounting to be adopted will depend upon the particular unit chosen, but no serious difficulty is likely to be met with.

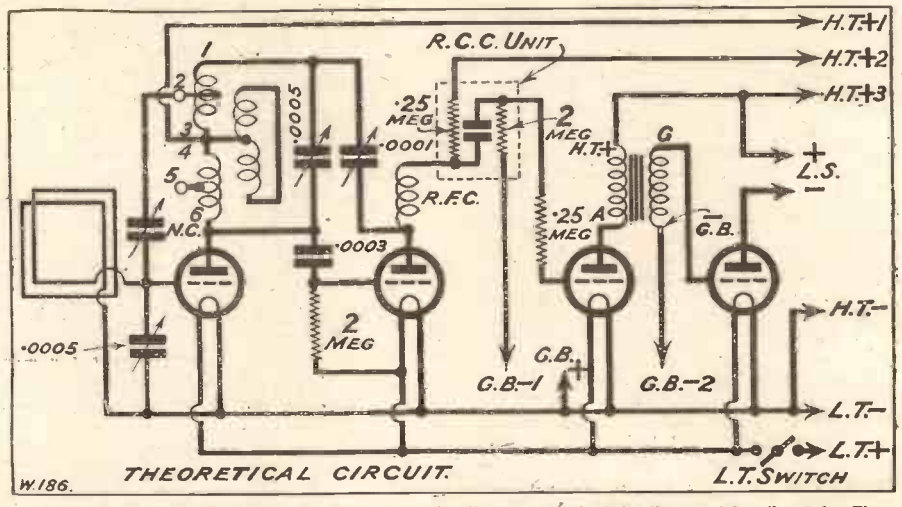
The rest of the constructional work is very simple and easy, and is merely a matter of mounting up the components in the exact positions indicated in the wiring diagram and wiring them up. (Be very careful to make good, sound joints, for the set may have to withstand a certain amount of jolting at times.) Note carefully that no terminal strip is provided on the set, all battery leads being soldered direct to suitable points on the wiring and provided with plugs or spade terminals, according to whether they are H.T. or L.T. leads.

The Accessories.

The set being finished, the next question to be settled is that of valves and batteries. In the original we used 2-volt valves throughout, with a 2-volt accumulator, which should be one of the unspillable type, such as the Oldham. You will require three valves of the H.F. type for the first three sockets, and an L.F. or small power type for the last socket, suitable types being available in all the well-known makes.

There is ample room for a good-sized H.T. battery, and in the original we used a Lissen 100-volt type, which is convenient because no separate grid-bias battery is needed. Any standard make can, of course, be used, with a separate G.B. unit.

Operating the set is quite simple, and the only point upon which the user need be warned is to rotate the set to bring the frame into the "loudest signals" direction for any given station. He will aso need instructions for neutralising the set, and these follow.



All the windings which you see in the anode circuit are comprised in the special coil used. The "shorted" winding is for the prevention of parasitic oscillations.

With everything connected up and the set turned on, adjust the reaction and neutralising condensers to minimum and note whether the set oscillates at any point on the tuning range. If it does not, bring up the reaction condenser very gradually until the set just breaks into oscillation when the tuning dials are in step with each other. If it *does* oscillate, of course, omit this step, and proceed to the next.

This is to increase very gradually the capacity of the neutralising condenser, a little at a time, until the set is stable over the whole tuning range. Note the setting of the "neut.," and then proceed to increase it until you find a point at which it causes the set to start oscillating again. Note the new setting, and then put the "neut." to a midway adjustment between the two. You will find this quite easy with the majority of valves, and you can then leave the neutralising condenser permanently adjusted and carry out all further operations on the tuning dials and reaction condenser.

Good Results.

Just a word on the results to be expected. On test the set gave full loud-speaker signals from 5 G B inside a building in the heart of the City, and when tested in a suburban locality it proved capable of bringing in Langenberg and Hamburg after dark with a little skilful manipulation. This, of course, is rather more than one should expect from any normal set working on a frame with only one ordinary H.F. stage, and is merely quoted to show that the sensitivity is definitely of a high order. In general, the aim in producing the set has been to ensure that it shall be capable of picking up either a main station or 5 G B practically anywhere in the country.

If really distant stations (foreigners and so on) are desired, it is possible to attach an aerial and earth, and you should then be able to pick up a very large number on the loud speaker. To do this all that is required is to attach the earth lead to the negative terminal of the L.T. battery and the aerial to a tapping point on the frame aerial located 3 or 4 turns from the end to which the lead from the filament of the H.F. valve is connected.

Frame Aerial Experiments.

You then have, in effect, a normal auto-coupled aerial circuit, the three or four turns just mentioned being included in the aerial-earth circuit and so providing a coupling effect. This can be varied so as to get different degrees of selectivity in the usual way by moving the position of the tapping further from or nearer to the "filament" end of the frame winding. Thus, on the 3-turn tapping you will get more selectivity than on the 4-turn, but signals may not be quite so strong.

You may find it interesting to try a whole series of tappings if you like experimental work for its own sake. Suitable points would be at the following numbers of turns: 2, 3, 4, 5 and 6, and you will then be able to find out some very interesting things for yourself about auto-coupled circuits. Of course, from the purely utilitarian point of

(*Continued on next page.*)

COMPONENTS AND MATERIALS.

1 Special cabinet (Camco).
1 Ebonite panel, 16 in. × 7 in. × ¼ in. or $\frac{3}{16}$ in. (Radion in original. Any good branded material).
2 ·0005 mfd. variable condensers (Formo, "Log" type in original. Any really small and compact type).
2 Plain or small vernier dials.
1 ·0001 mfd. miniature type reaction condenser (Peto-Scott in original. Cyldon and Ormond also suitable).
1 On-off switch (Benjamin, Igranic, L. & P., Lissen, Lotus, etc.).
4 Sprung valve holders (Benjamin, Bowyer-Lowe, Burne-Jones, B.T.H., Igranic, Lotus, Marconiphone, Pye, W.B., etc.).
1 Neutralising condenser (Gambrell in original. Any good type with a small minimum).
1 Cosmos A.N.P. coil and base (200-600 metres range).
1 R.C. unit (Lissen in original, with ½-meg. anode resistance, and 2-meg. leak. Any good compact type).
1 H.F. choke (R.I. & Varley in original. Any standard make).
1 L.F. transformer (A compact type such as the Mullard, which was used in the original, is essential here).
1 ·0003 mfd. fixed condenser (Clarke, Dubilier, Goltone, Igranic, Lissen, Mullard, T.C.C., etc.).
1 ½-meg. grid leak and holder (Dubilier, Igranic, Lissen, Mullard, etc.).
1 2-meg. ditto.
2 Sockets, (Clix, Eelex, etc.).
9 Battery plugs and 2 spade terminals or tags.
Small quantity of flex, material for frame aerial, Glazite, Junit, etc., for wiring up, etc.
1 Cone loud-speaker unit (Amplion portable assembly in original set, but see text).

THE "BIRTHDAY" FOUR

(*Continued from previous page.*)

view the two tappings originally specified will be sufficient.

When the set is used with an outside aerial in its permanent quarters, by the way, you will find that the directional effect of the frame aerial will practically disappear, so that you can arrange the set as a fixture in one position.

As a practical suggestion for the location of the tapping points on the frame-winding, it is advised that a short piece of wire be soldered to a point scraped bare of insulation on the 3rd turn, and another to the 4th turn, the ends of these being soldered to a couple of sockets mounted in the wooden frame. You can then provide your aerial lead with a plug upon its end, and insert this in one or other of the sockets.

It should perhaps be expained that the reasons why we recommended No. 22 D.C.C. wire at an earlier point in this article for the frame aerial were these: It is cheap, you can buy it almost anywhere, and the resulting frame aerial is of quite good efficiency. If, however, you want the very best frame aerial possible, it will be advisable to wind it with a heavier conductor, a very good material being the special frame aerial wire sold by the London Electric Wire Company.

This is a finely stranded, flexible

(*Continued on next page.*)

POINT-TO-POINT CONNECTIONS.

One filament contact of the valve holder V_1 to one filament contact on each of the valve holders V_2, V_4 and V_3, and from the latter to one side of the L.T. switch.

Other side of the L.T. switch to the L.T.+ spade terminal via a flexible lead.

Moving vanes of the 1st ·0005 mfd. variable condenser (for tuning frame aerial) to the remaining filament contact of V_1, to the remaining filament contacts of V_2, V_3 and V_4, and from the same filament contact of V_2 to the G.B.+ plug, H.T.— plug and L.T.— spade terminal via separate flexible leads.

Grid of V_1 to the top contact on the neutralising condenser, to the fixed vanes of the 1st ·0005 mfd. variable condenser (frame aerial), and from the grid of V_1, a flexible lead to one side of the frame aerial.

A flexible lead from the negative filament contact of V_1 goes to the remaining end of the frame aerial winding

Bottom contact on neutralising condenser to the No. 2 terminal on the A.N.P. coil base.

Plate of V_1 to No. 6 on the A.N.P. coil base, to one side of the ·0003 fixed grid condenser and to the fixed vanes of the 2nd ·0005 mfd. variable condenser (anode condenser).

Remaining side of the ·0003 fixed grid condenser to the grid of V_2 and to one side of the 2-meg. grid-leak holder. Other side of holder to the filament positive contact of V_2.

No. 4 terminal on the A.N.P. coil base to the H.T.+1 plug via a flexible lead.

No. 1 terminal on same base to the moving vanes of the 2nd ·0005 mfd. variable condenser (anode condenser), and to the moving vanes of the ·0001 mfd. reaction condenser.

Plate of V_2 to the top contact on the H.F. choke and to the fixed vanes of the ·0001 mfd. reaction condenser.

Earthing plate terminal on reaction condenser to the negative filament contact of V_4.

Bottom contact on H.F. choke to the "P" terminal on the R.C.C. unit.

"L.T." terminal on R.C.C. unit to the G.B.—1 plug via a flexible lead.

"H.T." terminal on R.C.C. unit to the H.T.+2 plug via a flexible lead.

"G" terminal on R.C.C. unit to one side of the ·25-meg. grid-leak holder. Other side of this holder to the grid of V_3.

Plate of V_3 to the "A" terminal on the L.F. transformer.

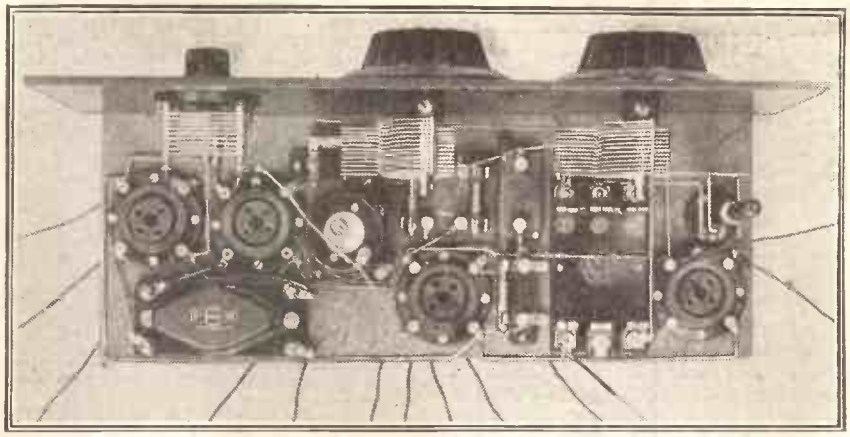
"G" terminal on transformer to the grid of V_4.

"—G.B." terminal on transformer to the G.B.—2 plug via a flexible lead.

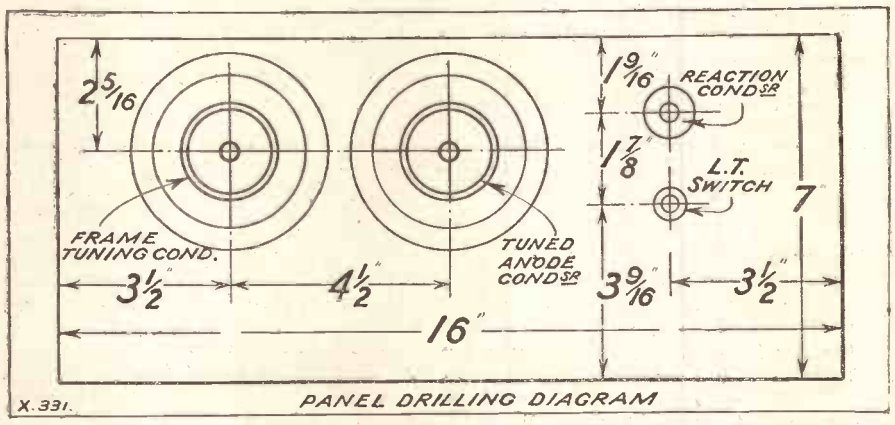
Plate of V_4 to one side of the loud-speaker winding.

Remaining side of loud-speaker winding to the "+H.T." terminal on the L.F. transformer and to the H.T.+3 plug via a flexible lead.

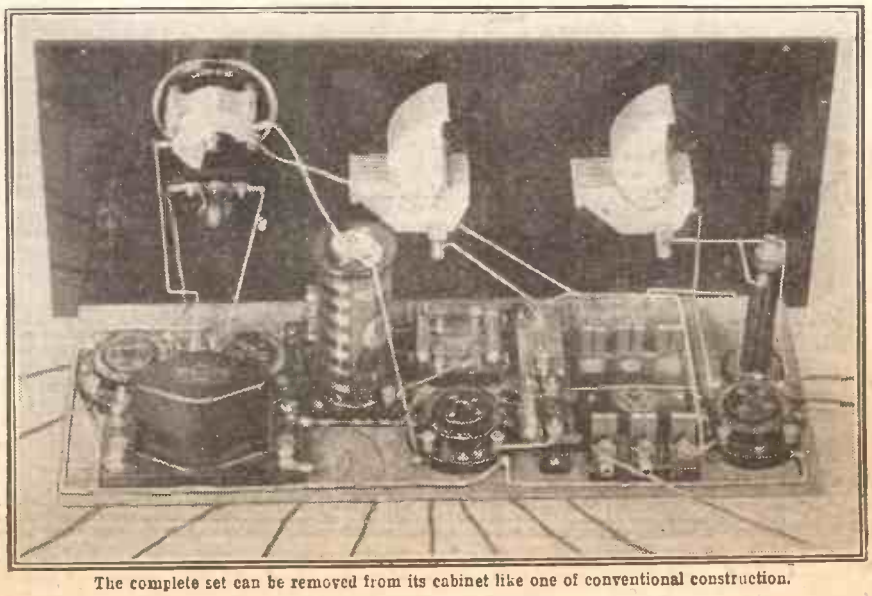
This completes the wiring of the receiver.



A good job of packing! Follow the diagram carefully and you will find it quite easy to fit everything in.



X.331. PANEL DRILLING DIAGRAM



The complete set can be removed from its cabinet like one of conventional construction.

THE "BIRTHDAY" FOUR.

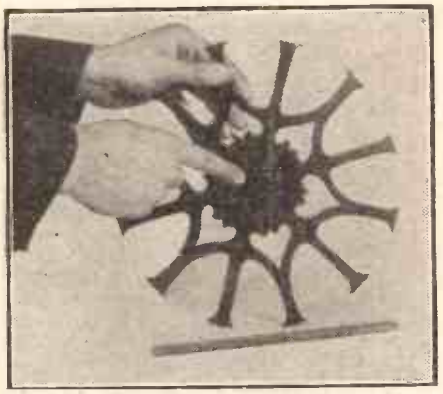
(Continued from previous page).

conductor, with a silk covering, and you will find it particularly easy to wind. The gain in efficiency, of course, is not enormous, but it is distinctly worth while if you are likely to be using the set at considerable distances from your nearest station.

If you use the Amplion portable cone assembly of the same model as the one in the original set, you may at first be a little puzzled to discover the use of the third lead in the flex connector attached to the unit. This is actually a means of "earthing" the frame of the unit, which is sometimes found to have a valuable stabilising effect in multi-valve portable sets.

"Earthing" the Speaker.

We did not find it necessary in the "Birthday" Four since the L.F. side proved very stable, but if you have any difficulty here, such as might result from the use of widely different components in the L.F. circuits, you should try the effect of connecting the third lead to any convenient point on the L.T. circuit (direct to the accumulator itself, for example). This point, of course, applies only to this particular type of speaker, and can be disregarded by users of other kinds.



This is the grille which was cut out of the cabinet when the loud speaker was fitted. With other types of speaker the grille can be left in place and the unit fitted in its centre.

Although this point is mentioned here, the reader need not be alarmed at the mention of possible L.F. howling trouble, for he is not at all likely to experience it unless he makes very radical changes.

With the original components the set is perfectly stable, but if, for example, you used a very high anode resistance in the R.C. unit you might have a little trouble on the L.F. side, so follow the design carefully.

SOME SOLDERING TIPS.

Immediately a joint has been soldered the excess flux should be wiped away with a clean cloth or otherwise dust will eventually settle upon this flux and form a conductive path, liable to give rise to leakage and extraneous noises.

* * *

When resin is used as a flux it is especially important that the surface of the wax should be well cleaned.

* * *

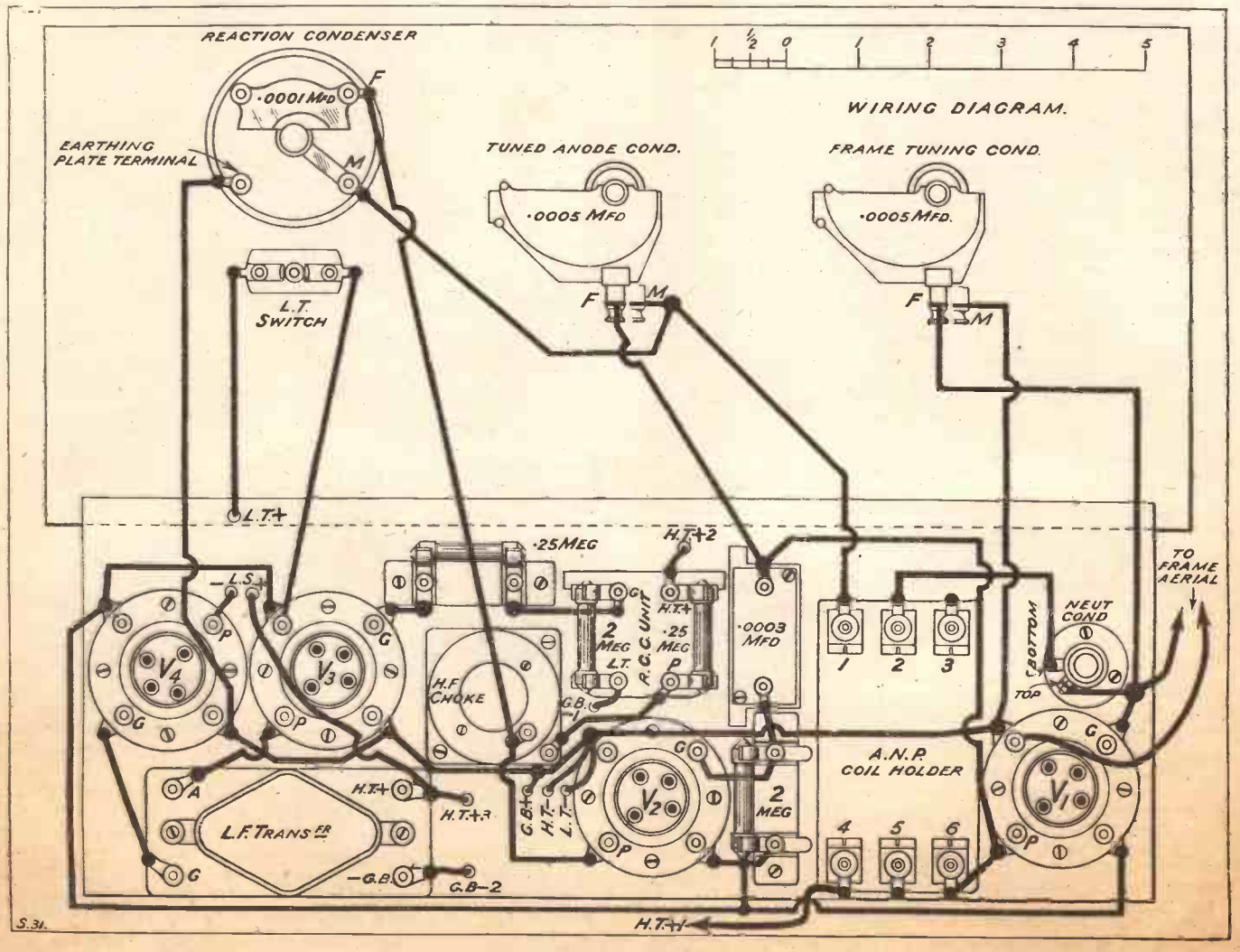
It is not safe to use killed spirits as a flux when soldering the *inside* of a receiver, as when the iron is applied the killed spirits splutter with results fatal to the neighbouring metal work.

* * *

When a soldering iron has to be heated in a fire it is a good plan to place an empty tin upon this, inserting the end of the iron into the tin, so that it is heated without coming into actual contact with the smoke and flames.

* * *

Do not use a soldering iron with a long and thick iron handle, or most of the heat will be radiated away from the copper bit by this.



There are several important factors needing consideration if distortion is to be avoided, and if your set contains an L.F. transformer you should carefully read this article.

By W. JAMES.

IT has long been recognised that a receiver having a transformer-coupled low-frequency stage will amplify the alternating current, which represents the speech and music fairly uniformly, provided a good transformer and suitable valves are used. The range of frequencies of importance is from below 50 cycles to 8,000 or 10,000 cycles, and for perfect results the amplifier should magnify a current of any frequency within this range by an equal amount.

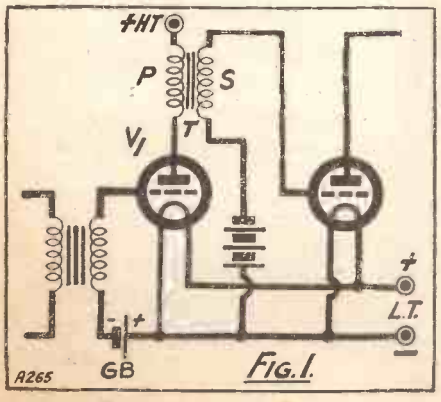
The tendency in practice is for the very low and the very high notes to be magnified by a smaller amount than those of middle frequency. This is due to the electrical characteristics of the amplifier, the working characteristics of the valves being of as much importance as those of the transformer.

Out of the large number of transformers marketed it is easy to choose several that magnify with reasonable uniformity provided they are properly used. One of the important characteristics of the transformer is its inductance. This depends on the number of turns of wire included in the primary coil, and on the size of the iron core and its magnetic properties. It also depends on the value of the current flowing through the coil.

Degree of Amplification.

The amount by which the low notes are magnified is decided by the inductance of the primary, the ratio of the transformer, and the magnification factor of the valve. Notes of middle frequency are usually amplified by the full amount; that is, by an amount given by the magnification factor of the valve multiplied by the transformer ratio.

How much the high notes are magnified is decided by the construction of the transformer and the various capacities in the circuit. These comprise the capacity of

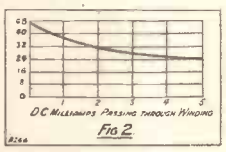


the valve connected to the grid terminal of the transformer, the self-capacity of the primary and the secondary coils, and the value of the condenser used across the primary winding.

Generally the high note amplification is sufficient and the purpose of this article is to draw attention to the way in which the amplification of the low tones varies under practical working conditions.

We have said that the amplification of a note having a low frequency depends on the *inductance* of the transformer, and that the value of the inductance depends on the current flowing. The amount of amplification given by a particular transformer and valve will, therefore, depend on the value of the anode current which flows through the primary winding.

A transformer is usually connected as in Fig. 1, where P is the primary winding, and the value of the current which flows through this coil is determined by the valve V, and the value of the high tension and grid bias. If valve V_1 is of the H.F. type, which has an anode impedance of, roughly, 20,000 ohms, and is used with a high tension of 90 volts and a grid bias of negative 1·5 the anode current will be about 1·5 milliamperes. But when valve V_1 is of the L.F. type, having an impedance of roughly 8,000 ohms, the anode current will be about 5 milliamperes for a high tension of 120 volts and a grid bias of negative 3.



Inductance Drop.

The amount of current flowing through the primary winding of the transformer, therefore depends on the type of valve used, and the amount of high tension and grid bias applied to it. As this current increases the inductance of the primary falls off, which in turn reduces the proportion of amplification of the low notes.

There is not much information available as to the variation in the inductance of a transformer for different currents, but Messrs. Ferranti Ltd. have recently published curves showing how the inductance of a choking coil varies with the direct current passing through it. Fig. 2 shows the variation in inductance of a choking coil whose direct-current resistance is just over 700 ohms.

The curve shows that the initial inductance is roughly 48 henries; with 1 milliampere of direct current the inductance has fallen to 36 henries. It is 32 henries when the direct current is 2 milliamperes and only 24 henries when the current is 5 milliamperes.

A low-frequency transformer may be regarded as a choking coil which is provided with a secondary winding, but it is to be expected that a good transformer will have more turns of wire than the choke referred to, and will, therefore, vary more greatly in inductance for similar changes in the value of direct current passing through the primary.

One particular transformer has a nominal inductance of 150 henries. When used with a valve V_1, Fig. 1, of 20,000 ohms passing a steady current of 1·5 milliamperes the inductance is about 120 henries. This stage, comprising the valve and transformer, will, therefore, amplify a 50-cycle note about ·9 times as much as one of 1,000 cycles.

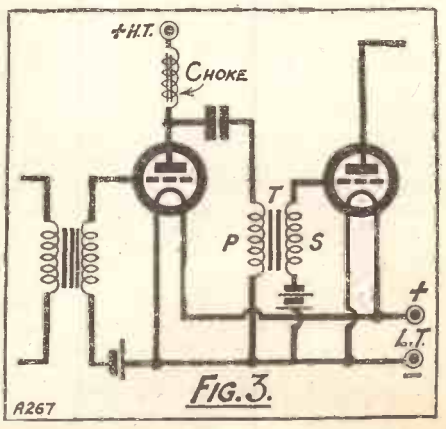
In order to raise the relative amplification of the lower notes one might remove the 20,000-ohm valve and use one of 10,000 ohms. If the inductance of the primary of the transformer was not altered a 50 cycle note would be amplified ·975 times as much as a 1,000 cycle note. But in practice the inductance of the primary will have been reduced because the 10,000 ohms valve passes a heavier current.

Limiting Anode Current.

If the current is 6 milliamperes the inductance will be about 80 henries, and the actual amplification of a 50-cycle note will be about ·925 of a note having a frequency of 1,000 cycles.

The point it is particularly wished to emphasise is this, that owing to the *heavier current flowing through the primary the inductance has been reduced*, with the result that there is nothing like a proportionate gain in the magnification of a low note.

This is why the makers of a good transformer recommend that the anode current be not more than a certain amount—usually three or four milliamperes.



The figures given show that unless precautions are taken to limit the value of the high-tension current, that the inductance may fall off by such an amount that the expected amplification of a low note is not obtained. When it is essential to use a valve passing a heavy anode current and a coupling transformer must be used. it is often an advantage to pass the high-tension current to the valve through a choking coil and to couple the transformer by means of a large condenser as in Fig. 3.

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

MAKING GRAMOPHONE RECORDS

DIRECT AND ELECTRICAL RECORDING—THE PROBLEM OF SELECTIVITY, ETC., ETC.

Making Gramophone Records.

MANY people imagine that the use of an electrical pick-up with a gramophone simply enables the sound to be reproduced through the wireless amplifier and therefore gives a considerably increased volume of reproduction.

Whilst this is generally true, it does not represent by any means the only, or even, I think, the most important advantage. There are several other points which ought to be borne in mind in connection with electrical reproduction, and it may be useful to those readers who have not yet "gone over" to electrical gramophone reproduction to consider some of the main points.

In the first place, most of the records which are now marketed by the best gramophone record manufacturers have been made originally by what is known as the "electrical recording" process.

Direct Recording.

In the earlier days of gramophone recording (in fact, up to three or four years ago) the voice of a singer (for example) was recorded in the following way: The artist would sing into a trumpet, and at the small end of the trumpet was connected a sound-box, which for all practical purposes was similar to the conventional gramophone sound-box used for reproduction. This "recording sound-box," however, instead of being fitted with a steel needle, was equipped with a tiny, sharp-pointed sapphire.

This "cutting stylus" engaged with the surface of a rotating circular slab of recording wax, the stylus being progressively moved across the disc by means of an automatic screw-feed arrangement. In this way a spiral track was cut upon the wax slab and the vibrations due to the singer's voice were also recorded in this track as it was being cut. It will be clear that the only energy available for vibrating the diaphragm was that which came direct from the singer's throat, and the whole arrangement was obviously one capable of much scientific improvement.

Electrical Recording.

Now, if the artist, instead of singing direct into the trumpet, sings before a microphone (somewhat similar to that used for broadcasting purposes), we evidently have a simple way of amplifying the sound to any desired extent, for the singer's voice merely operates the microphone, the energy is transferred into electrical variations, and these may be passed through valve amplifiers in the usual way and a large amount of additional energy supplied from electrical sources.

This means that all kinds of delicate shading and details of the original rendition are recorded in the master record and are duplicated in the commercial record as you buy it. For correct reproduction of this commercial record it is very desirable to use a sound-box which does not rely entirely, for the energy in reproduced sound, upon the mechanical "drive" of the needle by the record.

By using an electrical pick-up the actual mechanical engagement between the needle and the record may be quite a light and delicate one and an engagement which with an ordinary sound-box would give only a very feeble reproduction. But by the use of the subsequent valve amplifying arrangement the energy may be very largely increased and consequently the loud speaker may be efficiently operated. Thus an electrical pick-up, apart from its many other advantages, can be "easy on records."

There are many other interesting points in connection with electrical recording and electrical pick-ups, but I am afraid I cannot devote more space to this at the moment and will have to refer to it again later on.

The Problem of Selectivity.

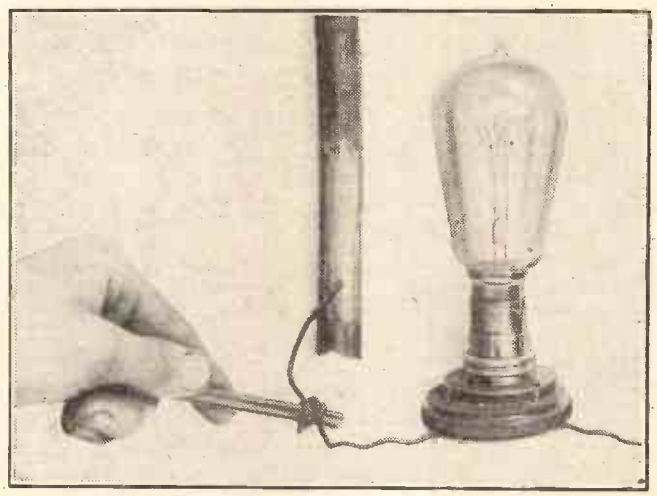
Without using high-frequency amplification it is generally rather difficult to get good selectivity with a receiver, notwithstanding the claims often made for various circuits employing detector and one or two low-frequency amplifiers.

This lack of selectivity is sometimes due to the use of too large an aerial, with the consequent large capacity and damping, and the almost equal reception of stations within moderate range.

It follows that with a receiver in which considerable amplification is used, a comparatively small aerial is necessary if sharp tuning is to be obtained.

Other methods for obtaining selectivity are to use centre-tapped coils, as in some varieties of the Hartley circuit, or an aperiodic aerial coupler as in Reinartz

(*Continued on page 496.*)



WHICH MAIN IS EARTHED?

An easy method of finding which side of the mains is earthed is illustrated here. All that is necessary is to connect a lamp in series with one lead, and touch this upon a water pipe or other earthed conductor. If the lamp lights it indicates that the lead is NOT earthed. Note: Great care is always necessary in the handling of electric-light or power mains.

NEWS FROM SAVOY HILL. FROM OUR OWN CORRESPONDENTS.

SZIGETI IN THE STUDIO

YORK MINSTER AGAIN—TECHNICAL DISCOVERIES—TENNIS COMMENTARIES, ETC., ETC.

Szigeti in the Studio.

SZIGETI, the famous Hungarian violinist, who was so successful at a recent Queen's Hall National Concert, will give a recital from a London studio next Tuesday (June 5th).

York Minster Again.

There is to be another of the popular Sunday morning relays from York Minster on June 17th. The Archbishop of York will preach at a special "Civic and Military Service," which has been substituted for the "Military Service" broadcast last summer. The service, which will begin at 10.15 a.m., will consist of shortened Matins, an anthem and two popular hymns, closing with a trumpet and drum fanfare leading to the National Anthem.

Technical Discoveries.

There are rumours that the engineering department of the B.B.C. has just made certain important discoveries which will have a vital bearing on the development of the whole Regional Scheme. Savoy Hill is not ready to discuss the subject yet, but it can be confidently anticipated that the autumn will see far-reaching and beneficial improvements in the distribution of broadcasting in Britain. Even a rumour of this kind will be warmly welcomed by a long-suffering listening public.

Tennis Commentaries.

Centre-court matches at the All-England Lawn Tennis Club championships at Wimbledon from June 25th to July 7th will again

(*Continued on page 494.*)

THAT H.T. BATTERY

Some personal experiences with H.T. batteries that go to prove how very reliable the modern supplier of anode potential can be.

By DUDLEY KEITH.

A FEW days ago a friend of mine came to listen on my apparatus to a special wireless programme that was being broadcast. Of course, the usual trouble had happened to him—his batteries had run down—and although he had managed to borrow an accumulator, yet his H.T. was so bad that he decided to give up attempts to listen and trotted round to me.

Although he has electric light in his house, he still goes on using dry batteries for his H.T.

Now there is nothing against the dry battery H.T. as long as it is used properly, but when you go and buy one of the ordinary 66-volt batteries and join it to another one so as to have 120 or so, and then put it on a receiver which is taking at least 10 and perhaps 14 milliamps, and expect the battery to stand up to it, you are asking for trouble.

That is exactly what my friend had done and exactly what he found. I asked him why he did not use the mains, but he said: "I don't like the idea of meddling with the mains, and I shouldn't feel safe." That, of course, was a quite mistaken point of view, as I pointed out to him, for he has D.C. in his house and a D.C. eliminator is neither expensive nor difficult to build, and when once built gives no trouble.

No Trouble.

You connect it to the mains and then leave it alone. But although I explained all this, he was not convinced that it would do exactly what he wanted. Somehow or other he liked the idea of being able to see a battery; the battery was there and his H.T. was there in that battery. The fact that it could come from the mains did not seem to him the same sort of thing at all.

So I tackled him on another point. I showed him the types of H.T. batteries which I was using, for not being on the mains myself I have to use batteries of various descriptions, and he was amazed to see the odd collection of stock which was being employed. I was running quite a big set, and was using quite a big H.T. battery for grid bias to start with, a battery of somewhere about 45 to 60 volts, of the small type, similar to that which he had been using for his high tension, and as the set was taking about 30 milliamps, the H.T. batteries that were being used for anode potential were of large dimensions.

There were 80-volts as accumulator H.T. followed by 45-volts of large capacity dry battery followed by 90-volts of large capacity wet battery, and upon seeing all this collection of gear, my friend remarked: "But surely you would do better to use one type or another and not mix them?"

Successful Dry Battery.

Well, from the point of view of uniformity perhaps I would; but from the point of view of signal strength I do not think I could better it unless I had accumulator H.T. throughout, and then the effect would probably not be noticeable.

As a matter of fact, I was running this mixture of batteries to test which was the best type of battery to use, and the results of the tests have left me about as much in the dark as I was when I started.

In the first case the accumulator stands up to its discharge exceedingly well, being a large capacity H.T. battery of the 5,000 milliamp type, and it lasts me for at least two months. I have it charged every six weeks in order to keep it in good condition, but it has not dropped voltage at the end of that time.

The dry battery is of the very large type, and I have two of the 45-volters in parallel.

They are rated to give somewhere about 25 milliamps each, so that here again they

A typical triple capacity wet H.T. Leclanché battery.

are giving well under their maximum rated current, and they are giving excellent results.

The 45-volt cells, joined in parallel, have been going constantly every night for about two and a half to three hours for over four months, and they have only dropped voltage by three and a half volts.

Wet Leclanché Cells.

This drop came very near the commencement of their life, after the first two or three weeks, and they have remained constant ever since, so that there is nothing against dry cells for this H.T.

Lastly, we come to the wet-type of battery which I am using—90-volts triple capacity Leclanché type. Here I have met with complete success. I have had this battery on for four and a half months, and it only needed "charging" about a week ago. The idea of the wet battery seemed rather to appeal to my friend, especially when I explained to him that in reality this worked out slightly cheaper than the other two and, from the point of view of trouble, it came second on the list.

By trouble, I mean trouble in up-keep. The dry battery, of course, does not need recharging or attention at all until it runs right down, when you have to throw it away and get a new one. The accumulator wants recharging at regular intervals and lasts for quite a long time, but the wet battery only wants recharging with a special mixture provided by the makers about every three and a half or four months according to how much current you take out of it.

Cheap and Satisfactory.

Apparently my friend had been of the opinion that every time you had to recharge a wet battery you had to change the sacs, take out the zincs, clean them and possibly replace them, if they have worn away; but I was able to prove to him that not only in the case of this wet-capacity battery which had been giving a heavy discharge for over four and a half months, but also in the case of a smaller type of wet battery that I was using with a short-wave receiver, neither the sacs nor the zincs had to be touched after that period of time. As a matter of fact, the smaller battery had been operating for about six months, without anything being done to it at all except topping up occasionally with solution.

The large battery has once been washed out and replaced with new solution, and then I found that the sacs and the zincs were quite O.K. for another run. This wet battery was not my first experience with this type, and I have been able to prove that about nine months' life can be obtained from a wet battery going pretty hard without having to attend to either the zinc or the sac.

The main thing to watch in connection with all types of H.T. battery is that they are kept clean. Accumulators that "creep" are fatal to good results, and should either be replaced by a make of better design or else a little mineral oil on the surface of the electrolyte may assist. The battery should be wiped regularly and kept free of dust and moisture. The same, of course, applies to the dry and wet Leclanché types of H.T. batteries—dust is a deadly enemy, as is its favourite ally, damp.

THAT RADIO SCEPTIC!

By BERNARD ELSTON.

Readers will no doubt have followed with interest the correspondence which has appeared during the last few weeks (generally under the above heading) referring to Mr. Elston's original communication. It will be remembered that in this letter he aired his disbelief in many of the "DX reports" that are brought forward by readers, and ventured the statement that he considered radio enthusiasts "as bad as fishermen" in exaggeration regarding their achievements. In this article Mr. Elston has more to say on this subject, and at the conclusion is appended an important Editorial announcement.

SINCE writing my first letter to POPULAR WIRELESS that was published under the heading of "A Radio Sceptic," life has been one large spot of bother.

Every Thursday I stagger home from a day of toil, and having dressed for dinner—a great fag as we have no nail in our kitchen to hang my coat on, so I have to put it behind the scullery door—and then, having consumed the classic three courses, settle down comfortably with my old friend, "P.W."

I used to enjoy my Thursday evenings; do I now? Do I blazes! Beginning at the beginning, I feverishly search the front advertisement pages for something free; I am usually disappointed, of course, and then with sinking heart start in on "Ariel's article. For a paragraph or two all may go well, then, bang, right in the seat of my pants lands a real hefty one, and I guess the only person who is really happy over the size of "Ariel's" feet is the bootmaker.

Having torn me limb from limb and strewn my body all over the place, he lightheartedly turns to victims fresh, more often than not the B.B.C., but they, of course, deserve it, and as I loathe Chamber noise and talks even more than "Ariel" does, I gather a little solace.

For a page or two all goes well, and then I come to the "Correspondence" page. My name leaps from the page; I am assailed from every side, I am brutally kicked, I am browbeaten, I am pitied, I am treated like a lost soul. It breaks my heart. But I am of the backbone of England, does it break my spirit, does it make me foreswear my convictions? Yes, I mean NO!

"And So It Grows."

And so, I am not yet repentant. I still maintain that "Old Nick" has a special corner set aside and labelled "Liars Corner" for fishermen and some wireless men, those wireless men who claim anything from eight to thirty stations on a cheap, simple straight 0-v-1 or 0-v-2 designed for medium and long wave-lengths.

Most of the correspondents who, bless 'em, have trounced me so soundly have, by the very language of their letters, made it evident that they were keen, skilful "fans," and most of them were using special sets designed for specific purposes.

I took the stand, and still maintain it, of the "ordinary family man." What is an "ordinary family man"? I don't know, but my guess is as good as yours. I visualise him in the thousands, without the ability, initiative or cash to build more than one set. He just wants one set for pure entertainment. Captain P. P. has told him that if he wants a loud speaker he must have three valves, and "P.W." have backed this, a detector and two L.F. It has got to be cheap, because he has not a lot of cash to spare, £7 or £8 is the utmost he can borrow from the wife, and that has got to buy everything. "P.W." comes along with a suitable circuit, he builds it, gets his local, 5 X X, and 5 G B on the speaker, and, perhaps a German; he is tickled to death, so are the whole blooming family until about three weeks later he opens up his "P.W." to learn he is just a plain big stiff, dead from the neck up and down, because little Willie, age 7, and Auntie Sarah, age 70, have built it and got twelve stations on the speaker the first evening. A week later another correspondent caps this by getting twenty stations without aerial or earth—and so it grows.

"My Worthy Opponent 'Ariel.'"

Where one or more stages of H.F. are used, where special short-wave sets are employed, or where experienced men build the latest modern, but expensive sets, half the earth may be possible and I will not doubt the writers, but with poor old "father's" eight-quid 0-v-2 I am a sceptic, a real honest-to-goodness SCEPTIC.

No, gentlemen, I am not going to believe it, not until our "P.W." designs an 0-v-2 suitable for medium and long wave-bands, to cost with all accessories not more than £8, and invites me along to operate it. In this direction I hope the Editor will note that I shall expect lavish hospitality with all our Northern delicacies such as chop and chips and that great wireless humorist's famous "Lancashire cocktail," but I prefer tripe in mine instead of a cow-heel.

Or, my worthy opponent "Ariel" has a good idea in his Club test, but in this case the set must conform to the ideas outlined above, be one that is available to the "ordinary family man" through the pages of "P.W." and they must draw lots for three operators and give their average as the final result.

"My Scepticism Remains Unshaken."

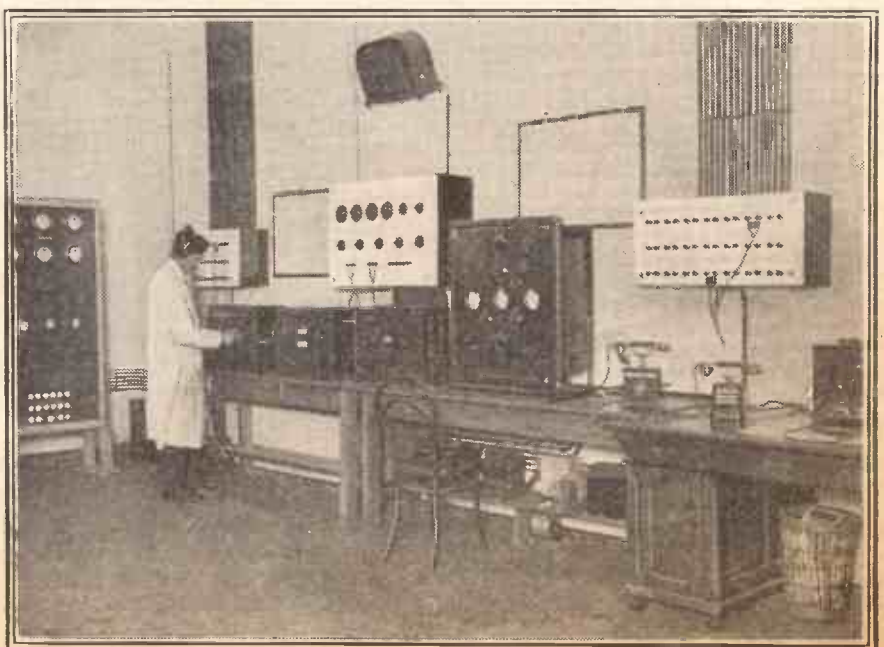
Give me this, and I will apologise to the world at large in capital letters, but until you do, my scepticism on the subject of eight-quid 0-v-2's remains unshaken.

It is useless you all putting on your football boots, clogs, etc., and wending your way to Manchester, because by the same post as this is being sent, I have applied to the police for protection.

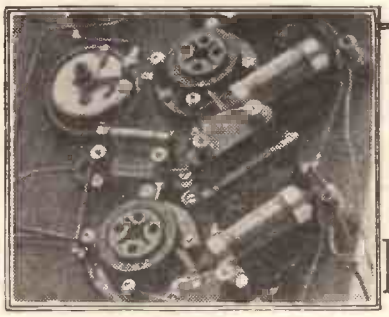
As Henry the First—or was it Lord Wellington or George Robey—said, "Up now, ye dogs of war, and drink his bleed." The Insurance collector who calls four or five times a week for my 3d. also happens to be a reader of "P.W." and the last time he called he put a note under the door to say that if I continued this correspondence his company would cancel my policy.

[*The "P.W." Research and Construction Dept. has blithely taken up at least one of the gauntlets thrown down by Mr. Elston. Mr. G. P. Kendall has martialled all his resources for an attack, and he and his assistants are, at the time of writing, feverishly engaged in the production of a receiver which, to be known as the "Sceptic's Three," will, we believe and hope, completely stagger our cheerful sceptic and all who build the set. Further news of the campaign will appear next week.*—TECHNICAL EDITOR.]

RADIO AT THE BERLIN CONSERVATORY.



A complete transmitting and receiving outfit has been installed for testing purposes at the Berlin Conservatory of Music. The system is a very up-to-date one and practice transmissions of all kinds of speech and music are to be made. The above photo shows the "intensifying" and control room.



The VALUE of RESISTANCE

A simple explanation of one of the most important radio factors and where it is needed and where it is a nuisance.

By D. GLOVER.

MANY people are apt to talk of resistance as though it were something of an entirely unwanted nature. They argue that resistance implies waste and that we could do all sorts of wonderful things if we could only entirely eliminate it.

Such views indicate an inappreciation of the true facts. Certainly there are instances where we could very well dispense with *ohmic* resistance. It is, to take only one example, quite an unnecessary factor in an output L.F. choke. And in high-frequency circuits, resistance, no doubt, is a nuisance; but, on the other hand, there are cases where ohms are of paramount importance.

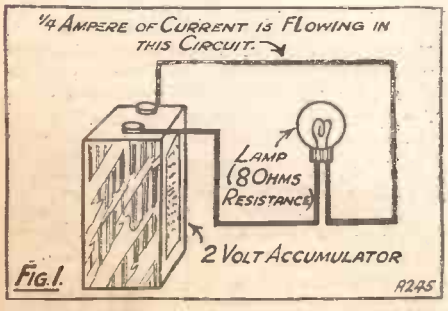
Simple Calculations.

It is seldom possible to disassociate resistance from voltage and current. These three things are, in fact, so closely tied up that knowing any two we can always work out the value of the remaining factor. That is Ohms law, and a very useful and convenient law it is, too. If you can always remember that voltage equals current multiplied by resistance, and resistance equals voltage divided by current, and current equals voltage divided by resistance, you will be able to cope with many seemingly difficult little problems.

Supposing we take the simple circuit of a single cell accumulator which will provide a pressure of two volts, joined to a small pea lamp. The accumulator cell has negligible resistance. Now, if you know the current which is flowing in this simple Fig. 1 circuit you can calculate its resistance. Similarly, if you know its resistance you can calculate the current.

If the small lamp is taking a quarter of an ampere then you have only to divide this quarter into two in order to discover that the lamp has a resistance of eight ohms. The two is, of course, the voltage of the cell. Now you will see right away that you can regulate the current flowing in this circuit by means of resistance.

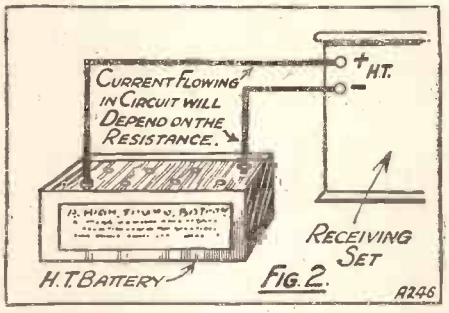
This you do with a rheostat in a radio set. You control the current which flows through the filament of the valve in this way. A filament rheostat is an example of resistance usefully applied. But it is



the sort of servant, colloquially speaking, which may very easily turn round and bite you. A filament rheostat becomes a wasteful consumer of power if it is used to break down the current of a valve which normally would operate with 2 volts, from a 4-volt or 6-volt accumulator.

Let us take a concrete example. Let us make our lamp in the Fig. 1 circuit a 2-volt valve. Connected directly across a 2-volt accumulator cell this cell takes its rated current of a quarter of an ampere. If a 4-volt accumulator were used, the current which would flow through that valve would be in the neighbourhood of half an ampere and far too much. Overrunning the valve in this way might even burn it out.

In order to reduce the current flowing in that circuit to the required quarter of an



ampere, one would have to bring the resistance up to 16 ohms. You could do this by introducing a filament rheostat. But you will see that you are taking a quarter of an ampere from each of two 2-volt accumulator cells, and are, in fact, using exactly one more accumulator cell than is needed.

An Interesting Fact.

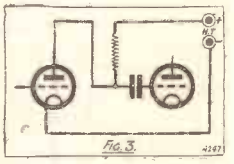
I am now going to draw your attention to an interesting fact. Ohms law applies to the H.T. battery. Now, you will know that the life of an H.T. battery depends to a great extent upon the amount of current which it is asked to deliver. A 7s. 11d. 66-volt H.T. battery might last six months if only asked to deliver a thousandth of an ampere two hours every day, but connected to a very large multi-valve receiver, this battery might last only two or three weeks, for the current it would be asked to deliver might well be in the neighbourhood of twenty or thirty times that previous thousandth of an ampere (See Fig. 2).

Now, the current which flows from an H.T. battery will depend upon the resistance of the circuit to which it is connected. The circuit will comprise the H.T. battery itself, which will have a certain amount of resistance, and certain things inside the receiving set. If the resistance of the circuit were reduced to a negligible quantity the same would happen to the battery's life. Therefore, resistance here must have a certain very definite value. I do not think that that can be considered fallacious reasoning!

The resistance in this H.T. battery circuit will, in many receivers, equal the resistance of the valve or valves plus the resistance of an anode-coupling resistance or other such items. And one cannot say that ohmic resistance is an unwanted item in regard to an anode resistance (Fig. 3). As a matter of fact this is the only quality one requires of such a component. The less capacity, inductance, and so forth it has the better, and these are negligible when the item is really efficient.

In Mains Units.

Resistance is, again, a very important thing in mains units. Here variable resistances play an important rôle in the adjustment of voltages. Then, again, we have the ubiquitous potentiometer. And, generally speaking, the higher the resistance of a potentiometer the better.



No, resistance is not necessarily a bugbear, and, in cases, may be very definitely needed.

CUTTING PLYWOOD.

HOME constructors will find that a considerable saving can be effected by using ply-wood for panels, cabinets, etc., particularly when an experimental "hook-up" is being assembled.

This wood will also look exceedingly smart if rubbed down with fine glass-paper, given one coat of good walnut stain, and finally polished with furniture polish, vigorously applied and worked well into the grain.

One often finds that, if sawn, the wood tends to splinter, and the following will be found an exceptionally easy and quick way of getting a smooth, even cut.

First mark the portion to be cut, using a scribe for this purpose. Then place the unwanted portion in a partly opened drawer (or clamp to the edge of a firm table or bench), leaving the panel quite free, similar to the spring board at the local swimming baths.

Now bend the board downwards, keeping the line as near to the drawer as possible, and with a very sharp knife carefully follow the scribed line.

Repeat this operation until the cut is complete, keeping the board under pressure all the time.

With a little practice, straight lines will be easy, and even curves and circles can be cut by this method. A circle, however, must be cut in two or three parts, each cut taking roughly a third of the circle.

COUPLING CHARACTERISTICS

In order to obtain the highest amplification together with pure reproduction it is necessary very carefully to choose the value of components in R.C.C. circuits. Here are some practical hints on this important subject.

By A. JOHNSON-RANDALL.

RESISTANCE-CAPACITY COUPLING is like many other forms of amplification—it is full of little traps for the unwary. It is true that provided the right values are chosen, R.C. coupling can give a remarkable straight-line frequency curve, but if proper precautions are not taken the curve may become something practically as bad as that obtained with a moderately dud transformer.

The skeleton arrangement of a resistance-capacity amplifier is shown in Fig. 1. The shape of the curve depends largely upon the values of C the coupling condenser and R_1 the grid resistance, and also to some extent upon the value of R the anode resistance, and the type of valve used. If a really first-class curve is required too high a magnification should not be aimed at, since, contrary to popular belief, an increase in the value of the resistance R tends to cause the curve to depart from its straight line on the higher musical frequencies.

Muffled Reproduction.

This effect may be seen by reference to Fig. 2, where it will be noticed that the upper portion of the curve shows a marked falling off on the higher frequencies. As the frequency increases the combined effects of any small capacities become equivalent to a condenser in shunt with the anode resistance, and tend to bypass these higher frequencies, thus decreasing the voltage amplification across the resistance. In many cases where anode resistances having values in the neighbourhood of 1 megohm

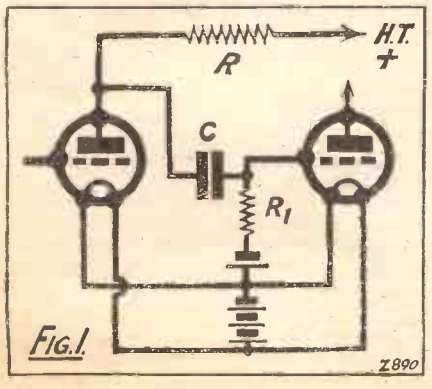


FIG. 1.

are employed, this drop in amplification may occur at one thousand cycles and the reproduction becomes muffled and ".bassy."

This gives a false effect and listeners frequently labour under the impression that the low tone is due to a preponderance of bass, but this is not so, it is more usually due to this cut off of the higher musical frequencies. In my opinion, it is just as necessary for the upper frequencies to be maintained as it is for the design to be arranged so as to produce the low notes.

Good practical values for the resistance R are 100,000 ohms, in the case of the anode resistance in series with an anode rectifier, because in this case it must be remembered that there is usually a very small fixed condenser of, say, ·0001 mfd. connected in parallel with the resistance for bypassing purposes. This, of course, tends to reduce the amplification of the higher frequencies.

In the second stage, 250,000 ohms is about the limit unless by chance the loud speaker employed is rather high pitched.

Now, the cut-off on the lower frequencies is dependent upon the value of the coupling condenser C and the grid resistance R_1, which may be assumed to be connected in

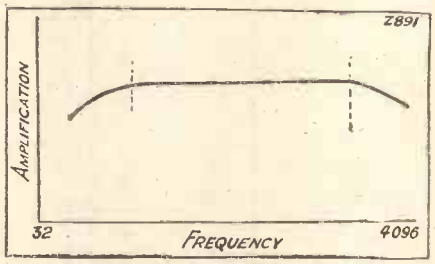


Fig. 2.—Showing how the amplification falls off on the higher and lower notes. The object is to keep this line (curve) as straight as possible.

series with the coupling condenser. The grid resistance is also virtually in parallel with the anode resistance, and in consequence its value should be four or five times that of the anode resistance because, since it is connected in shunt, it will tend to decrease the total resistance in the anode circuit.

The Grid Condenser.

This will give a resulting decrease in amplification, since the value of the coupling condenser is dependent upon the value of the grid resistance, and when considering C it is always necessary to consider R_1 as well.

It is useless attempting to use a very large coupling condenser in conjunction with a high value of grid resistance, because although theoretically it would be possible to reproduce all the bass required, in practice if one happens to have a very loud signal applied to the grid of the valve, causing a momentary flow of grid current, the condenser would tend to become charged, and serious distortion, and, possibly, choking would occur. On the other hand, if we make it small and tend to make R_1 too large, grid current may again become a serious factor, and, in addition this very high value of R_1 would tend to promote a falling characteristic.

It will, therefore, be seen that in order to obtain uniform amplification at all frequencies resistance-capacity coupling values must be a compromise and, in addition, it is not desirable to aim at high magnification unless some form of correction is applied to the upper frequencies in order to maintain a fairly level characteristic.

In practice a coupling condenser must have a very high insulation resistance because a very small leak of the order of several megohms will enable a small positive bias to be applied via the anode of the preceding valve to the grid of the R.C. valve, with a consequent danger of serious distortion arising.

Good Insulation Essential.

It is practically essential to employ a mica dielectric, and in many cases it is safer to use a small condenser on account of its high insulation resistance. If two stages of R.C. coupling are used, the size of the coupling condenser must be greater than with one stage in order to give the same percentage of amplification at a given frequency.

If three stages are used the coupling condenser must be larger still, and so on. If even amplification at practically all frequencies between, say, 50 and 5,000 cycles is desired, do not go higher than 250,000 ohms for the anode resistance, and use coupling condensers having values of say ·01 or ·02 mfd. in conjunction with grid leaks of 1 or 2 megohms.

The A.C. resistance of the valve has some bearing upon the amplification of the higher frequencies, and it is advisable to keep this value down as low as possible consistent with adequate amplification. A valve with an A.C. resistance of 17,000 to 20,000 ohms and a mu of 20 makes an excellent anode rectifier or first-stage amplifier.

FOUR USEFUL TIPS.

The wire stays from aerial masts should not be run through the foliage of valuable fruit trees, as charges due to nearby lightning may easily do damage to the trees.

* * *

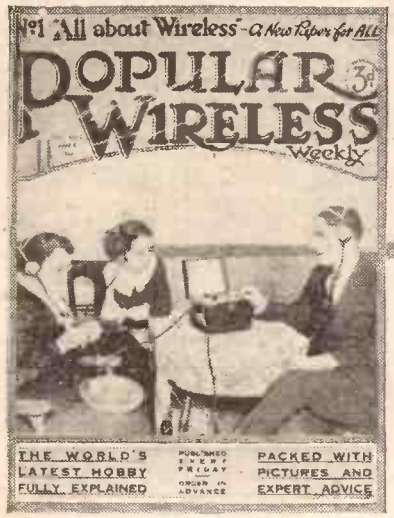
The difficulty of fastening a central spindle firmly to a cone can sometimes be overcome satisfactorily by carefully melting a very small supply of sealing wax around the spindle at the apex of the cone.

* * *

Where the "earth" consists of a clip around the water pipe improved contact may often be obtained by giving the clip a few sharp blows with a punch or nail so so as to form little projecting teeth that will bite through any film on the water pipe into the metal beneath.

* * *

When a valve set is moved temporarily for outdoor entertainment it should be remembered that the modern anti-microphonic valve holder allows considerable lateral movement of the valves, and that to protect these sponge rubbers or some similar shock absorbing material is all that is necessary.



A reproduction of "P.W.'s" first cover.

"P.W.'S" SIXTH ANNIVERSARY

A FEW OF THE LETTERS WE HAVE RECEIVED IN CONNECTION WITH OUR BIRTHDAY.

From the DIRECTOR-GENERAL OF THE B.B.C.

"The B.B.C. is gratified to observe the increasing cordiality of its relations with the Wireless Press generally. Your stimulating support is assessed at its true value. Many happy returns."

J. C. W. REITH.

From the CHIEF ENGINEER OF THE B.B.C.

"It is a great pleasure to me to congratulate POPULAR WIRELESS *on its birthday and wish it many happy returns of the day. I am sure that few realise the important work that is done by the Wireless Press in educating the public towards the ideal of perfect reception in every home on a simple and inexpensive set."*

Sir John Reith.

P. P. ECKERSLEY.

From Mr. S. R. MULLARD, M.B.E.

"Allow me to congratulate you on the valuable position your paper has secured for itself in the homes of thousands of radio owners to whom it has undoubtedly proved of immense utility.

"I wish you continued success on this your sixth anniversary both at Home and Abroad."

S. R. MULLARD, *Managing Director,*
Mullard Wireless Service Co., Ltd.

From a Director of S. G. BROWN, LTD.

"We understand that on June 2nd you celebrate the sixth anniversary of POPULAR WIRELESS. *Since the publication of the first issue, your paper has kept up that very high standard of technical articles and news items for which it was first noted. We look upon* POPULAR WIRELESS *as one of the pioneers of Radio journals, and we wish it every success for the future."*

ALICE S. G. BROWN,
Secretary & Director.

From the Managing-Director of BURNE-JONES & CO., LTD.

"Please accept our congratulations on the sixth anniversary of POPULAR WIRELESS.

"Since its introduction an outstanding feature of POPULAR WIRELESS *is the consistent high standard of its contents, more especially in regard to the technical side of wireless, which is presented to readers in simple language, making a popular appeal to both the beginner and the advanced wireless enthusiast.*

BURNE-JONES.

From the Managing-Director of DUBILIER CONDENSER CO., LTD.

"I take great pleasure in tendering my best wishes to POPULAR WIRELESS *on its sixth anniversary, and heartily congratulate you and all connected with the paper in having succeeded in maintaining your eminent position on the jounalistic side of the Radio industry.*

"Naturally, if POPULAR WIRELESS *had not provided what its readers want it would have failed, and those of us who know how difficult it is to forecast and provide what the Radio public will require thoroughly appreciate the soundness of your efforts in this direction.*

"The Radio manufacturers have always had your assistance at their disposal, and I am sure that your policy will continue to give your paper the popularity it enjoys and deserves.

W. H. GOODMAN.

From the Managing-Director of LISSEN LTD.

"Your sixth birthday! I wonder if I shall see your sixtieth? If not, I know there are certainly many who will, and I confidently expect that they will find POPULAR WIRELESS *as live and young at the end of that time as it is to-day. The freshness and vividness of its pages is a feature of your journal. You not only keep pace with current developments, but often anticipate them.*

"Your paper seems to have a distinctiveness and individuality which you have made peculiarly your own, and if you can keep this up, and I think there is every sign that you can, I feel sure that as year after year passes your influence and helpfulness to the Radio listener and Radio constructor will continually expand, and your paper flourish.

Capt. P. P. Eckersley.

"I have found POPULAR WIRELESS *exceedingly valuable in keeping in touch with your big buying public and I can personally testify to the very firm hold it has in its sphere.*

"My best wishes for your continued success."

T. N. COLE.

From the Managing-Director of GRAHAM AMPLION LTD.

"I believe your Sixth Anniversary Number is to be published shortly, and am taking the opportunity of sending you a few lines to congratulate you on your journal, and on the particular occasion which you are celebrating, also to wish you the very best of good fortune in the future.

"Although we may not always agree with your policy or views, yet we like your paper and will be among the first to hope that you will continue to flourish.

"Journals that make it a definite part of their policy to be without fear or favour are bound to command the respect of British business people, and I do know that POPULAR WIRELESS *comes into that category.*

"I am looking forward to having my copy of your Anniversary Number, which is sure to be a good one."

W. H. LYNAS.

From the Managing-Director of MARCONI'S WIRELESS TELEGRAPH CO., LTD.

"I congratulate POPULAR WIRELESS *on attaining its sixth anniversary, and you as its Editor on the success that has been achieved under your direction.*

*"*POPULAR WIRELESS *made a place for itself with its first number, and it has maintained the interest of its readers in a remarkable way during the six years of its existence. It is now an established institution, and one can wish it 'Many Happy Returns' of the anniversary with pleasure and with confidence.*

Mr. F. G. Kellaway.

"The wireless listener and the wireless amateur are important factors in the development of the wireless industry to-day, and you are doing a valuable work in catering for the interests of these sections of the public."

F. G. KELLAWAY.

From GILBERT ADVERTISING LTD.

"I hear that on June 2nd you are publishing your Sixth Anniversary Number. In view of my close association with your paper and the wireless industry in general during the past six years, it gives me very great pleasure to put on record my keen appreciation of the services that your paper has rendered to the industry.

"I think it is often forgotten how much radio enthusiasts owe to POPULAR WIRELESS *and its pioneer work. Your paper has always been extremely well produced—its pages have invariably been most interesting—and its illustrations have been remarkably clear.*

"These points appeal to me particularly as a member of the advertising profession. In this connection it is interesting to note that Gilbert Advertising Ltd. have paid more than £25,000 for advertising space in POPULAR WIRELESS. *As you will agree, £5,000 a year is quite a lot of money to spend in any one weekly technical publication, but my clients have always found that* POPULAR WIRELESS *readers are responsive and loyal to their paper."*

ERNEST R. GILBERT, *Director.*

(*Continued on page 496.*)

SHORT-WAVE NOTES.

By W. L. S.

IT is interesting to note, on a bad night, the difference between the atmospherics on the various sections of the short-wave spectrum, by which I mean the 80-metre, 40-metre, 20-metre, and 10-metre wave-length bands.

A few nights back I was troubled with atmospherics on the broadcast band (I freely confess to listening up there *sometimes*!), and decided to discontinue the "holiday" and come down below again. I found atmospherics almost equally bad on the 20- and 80-metre bands, but there were practically none on the 40-metre band. This seems a very peculiar effect, to say the least of it. Is it that the disturbances we receive on short waves are actually harmonics of the long-wave interference that atmospherics are supposed to be, or are there really genuine "short-wave atmospherics" with their own skip-distances and characteristics?

Sahara Statics?

It seems unlikely to me that the latter can be the case, as the range of a short-wave receiver is so tremendous that one would surely be always hearing atmospherics from some part or other of the world if they were in any way comparable with real short-wave signals! I have often thought that the birthplace of most of these unpleasant disturbers of the piece must be the tropical region of Central Africa, and possibly the Sahara.

Three weeks back there was a wonderful spell of conditions for really long-distance work on the 20-metre band. Australians and New Zealanders came through in shoals in the mornings, and DX was the rule for the low-power man. Now, however, it has again become the exception. During the past five days hardly anything has been heard of the West Coast American stations or of the Antipodes.

Of course, the worst of notes like these in connection with short-wave work is that by the time they appear in print conditions will probably have undergone a complete change again, so uncertain are the vagaries of the short waves. Never, however, do conditions seem to be sufficiently bad to prevent the reception of 2 X A D and the other American commercial stations, whether C.W. or telephony.

HINTS FOR THE S.-W. ENTHUSIAST.

The tuning range of an ordinary variable condenser of, say, ·0005 mfd. can be reduced for short-wave work to an approximate maximum of ·0001 capacity, by connecting a ·0001 fixed condenser in series with it across the tuning coil.

* * *

It is generally possible to obtain better results with a small reaction coil closely coupled to the grid circuit than with a larger reaction coil placed at a greater distance from it.

* * *

For smooth reaction control a high value of grid leak is often necessary upon the short waves, and a resistance of 5 megohms or even more can often be used with advantage.

* * *

When reaction control is not perfect it often pays to insert a variable resistance for the detector valve's filament, and slight adjustments of this will often overcome a difficulty in the control of oscillation.

HAVE YOU TRIED THIS?

By H. J. B. C.

EVERY constructor is only too familiar with the fact that whenever a small nut or terminal head has to be screwed into place on any component inside a wireless receiver it invariably falls out of one's fingers and rolls away into some odd corner. The difficulty of the initial task is thus further enhanced by having to extricate the small wayward object from its hiding-place and tempers get frayed in the effort. The occurrence is so frequent that it does not need enlarging upon, and having been a victim myself I was delighted to come across a simple dodge the other day which simplified matters considerably, and I pass on the information for the benefit of those readers to whom the idea is new.

A "Nutty" Screwdriver.

To pick up loose nuts or terminal heads from the baseboard all that is required is a thin square stick very slightly tapered. Just push the taper end of the stick into the screwed hole of the nut and apply sufficient pressure to grip the thread with the wood and lift it from the baseboard.

To screw a nut into position on a component it should be held on the stick end in a similar manner and twisted round over the screwed thread so that it engages sufficiently to hold in place, when the stick may be withdrawn and the job completed with the fingers or pliers. One or two of these sticks, of length according to desire, should be kept handy, but a good substitute is a match-stick when anything else is not available.

CORRESPONDENCE.

THE SCIENCE MUSEUM RECEIVER

DISCONNECTED PHONE RECEPTION—H.T. FUSES.

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

THE SCIENCE MUSEUM RECEIVER.

The Editor POPULAR WIRELESS.

Dear Sir,—Mr. Pacy asks me to give my opinion of the Science Museum receiver. Two years ago this set and speaker could easily hold the palm for fidelity of reproduction. If there is one person to whom we all owe a debt of gratitude for showing the way, both by this demonstration set and by his writings, it is Dr. MacLachlan. He certainly possesses the qualifications I referred to in my last letter, and I cite him as a living proof of my contention. The Museum receiver was a revelation to me two years ago, and I gladly acknowledge the fact. Its designer would be the last to claim that it is perfect. If there is any part of the apparatus that I would criticise, it is the set rather than the "loud-speaking telephone." It seems to me that the chief cause of deficiency in realistic reproduction to-day is the introduction of the time constant in all known forms of low frequency amplification. It is this that provides an insuperable barrier to real fidelity of effect. Eliminate the time factor or reduce it to negligible proportions, and at once we can achieve such desiderata as definition, harmonic proportion, expression, and the stereophonic effect referred to by Mr. Pacy. I submit that with three stages of audio-frequency amplification and with grid leaks (as used in the Museum circuit) it is quite impossible to accomplish our aim. It so happens that the Patent Office is provisionally protecting a new coupling device of mine in which the time constant is to all intents and purposes eliminated, and at the same time the entire band of audible frequencies is amplified with reasonable uniformity. Think what it means to have abolished this time factor! The reproduction is enormously improved, because the performance stands out from the loud speaker with life-like realism, the various sounds are clear-cut and well defined, the harmonics are presented in due proportion, the low tones possess a real "fundamental punch" combined with their natural overtones (thus eliminating all "boom"), speech is characterised by those various emphases which compel the listener's attention, music is translated into sequences of light and shade, and the nett result is thrilling in the extreme. It is not possible to get harmonic proportion with the normal types of resistance or impedance coupling, nor am I at all enamoured of the push-pull system. These are, of course, personal views, but they are based on experience.

NOEL BONAVIA HUNT.

Hampstead, London, N.W.6.

DISCONNECTED 'PHONE RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—Will you kindly allow me to say a few words in your valuable paper in reply to the correspondent who has received reception with telephones entirely disconnected from set; also to the other correspondents who challenged the former to do this feat with his hands in his pockets, standing on a cork mat, knowing that this was the impossible? But not one of these correspondents replied and stated the cause of same; therefore I must do so.

The cause of this freak is as follows: The output of the second valve is, of course, across the primary of the second transformer, i.e. as in amplifier. This winding is the sole cause of the freak, i.e. induction of body and primary winding. Whether they stand on cork mats or not, your correspondents will not stop this occurring; but, of course, they must hold the 'phone terminals.

If they care to try this, I shall be pleased to hear their reports on same, taking for granted, of course, that they possess three-valve transformer-coupled sets. Hoping I have satisfied one and all on the cause of this freak, and thanking you for you valuable space, I remain, sir,

Yours faithfully,

"A REGULAR READER."

Burton-on-Trent, Staffs.

H.T. FUSES.

The Editor, POPULAR WIRELESS.

Dear Sir,—In an article "Simple H.T. Fuses," by H. J. B. in your issue of May 12th, he states that flashlamp bulbs make good fuses. In my experience, however, I have found that they usually take too long to blow out, and the valve goes first in preference to the bulb. I look to a suitable fuse wire from the wireless manufacturers in the future.

Yours truly,

A. J. S. MCMILLAN.

Northants.

RECEPTION OF KALUNDBORG.

The Editor, POPULAR WIRELESS.

Dear Sir,—You asked for reports of Kalundborg some time ago. A clerical friend of mine installed a five-valve Marconi set some time ago, using the church spire to erect a magnificent aerial. Some nights afterwards I heard his set going 400 yards away. Meeting him some weeks later, I asked him how it was working. "Very well at times, but not so well in misty weather."

I told him I could not understand that as 5 X X comes in here on my two-valver as steadily as could be.

"Oh, Daventry!" he said. "I never use Daventry. I was talking of Kalundborg, which is easily the best station of the lot."

Yours sincerely,

MICHAEL J. CORBETT.

York.

EXTRAORDINARY VALVES

Some of the lesser-known variations of the familiar radio "tube" are discussed

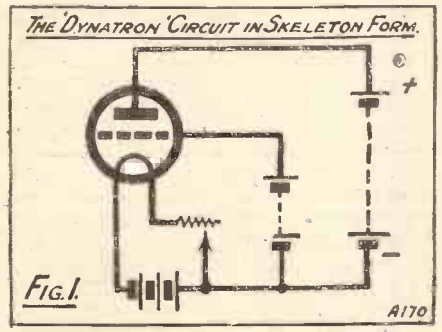
By J. F. CORRIGAN, M.Sc., A.I.C.

VALVE manufacturers have, within the last year or two, made wonderful strides in the improvement of their products, so much so that one is inclined to doubt whether the ordinary rectifying or amplifying valve is, in its present form, susceptible to a much greater efficiency increase. Commercial receiving valves of the ordinary type—and among these may be included the now well-known four-electrode valve employed in "Unidyne" circuits—are in their constructional details so familiar to the general amateur that they have ceased to be of any particular interest to him in that respect.

There are, however, quite a number of other types of valves which have been evolved from time to time by various ingenious inventors, but which owing to their complexity or lack of extra efficiency have failed to be taken up by manufacturers.

A Simple Valve.

The "dynatron" forms a simple example of this class of valve. Essentially, it possesses the same construction as an



ordinary valve. Its grid, however, is given a higher positive potential than the plate. The effect of this arrangement is that the stream of electrons from the filament flow past the grid and impinge upon the plate with such a force that the latter emits a stream of electrons on its own account. This plate electron stream is then collected by the grid of the valve, and the interaction between the electron stream from the plate and that from the filament results in a series of sustained oscillation being developed in an external circuit, and which can be utilised for working a transmitter. A skeleton dynatron circuit is given at Fig. 1.

Dual Purpose.

If to a dynatron valve a fourth electrode in the form of a control grid is added the sustained oscillations from the valve can be modulated at will by means of a microphone circuit. Such a four-electrode dynatron valve is called a "pliodynatron," and it can thus be made to undertake the functions of the separate oscillating and modulating valves which are ordinarily employed in broadcast transmissions.

Not satisfied with a four-electrode valve, several inventors have endeavoured to produce a five-electrode one of greater efficiency than the normal three-electrode valve. One of the most interesting of these five-electrode valves is the one due to Professor Fleming, who, as every reader will know, invented the original rectifying valve.

The Fleming five-electrode valve is shown in the circuit diagram, Fig. 2. It contains a filament and four symmetrically-arranged plates. There is no grid or high-tension supply. Two of the plates are connected together in the headphone circuit, the remaining two being connected to the input circuit. In the absence of current impulses from the input of the valve, the electron stream from the filament is divided equally between the two plates X and Z. However, when current impulses flow into the valve from the input circuit, a potential difference is created between the two plates A and B. Thus a portion of the electron stream is diverted from the filament to one of the plates A and B. If the oscillatory current from the input circuit makes the plate A positive, the electron stream will flow to the latter, and, of course, if at any instant the opposite plate B is made positive, the electron stream will flow in that direction. A varying current is thus set up in the telephone circuit by the alteration and variation of the electron flow through the plates A and B, and this gives rise to the telephone current.

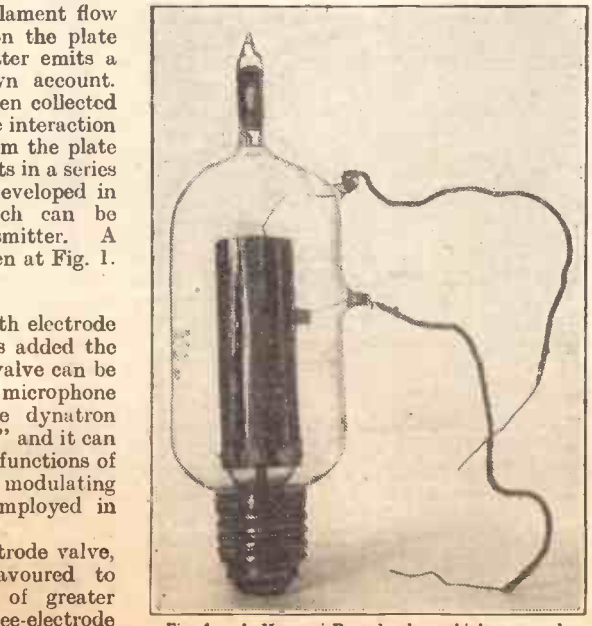
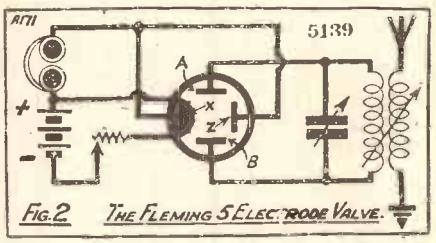


Fig. 4. A Marconi-Round valve, which was made about 13 years ago.

What is known as the "Two-filament Cross Stream" valve is really a modification of Professor Fleming's five-electrode valve described above. The two-filament cross stream valve and its circuit is drawn in Fig. 3. Its construction will be clear from the diagram. Two filaments are employed, a plate-carrying high tension, and two further electrodes, X and Z, connected across the input of the valve circuit. It will be noted that one of the filaments is connected to a tapping on

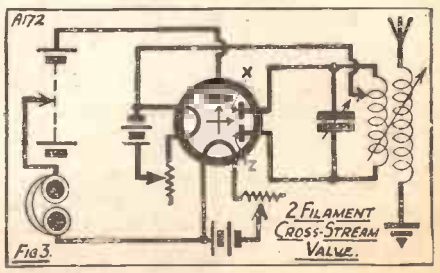


the input coil. Thus the two electrodes connected across the latter coil are alternately made positive and negative by the incoming signals.

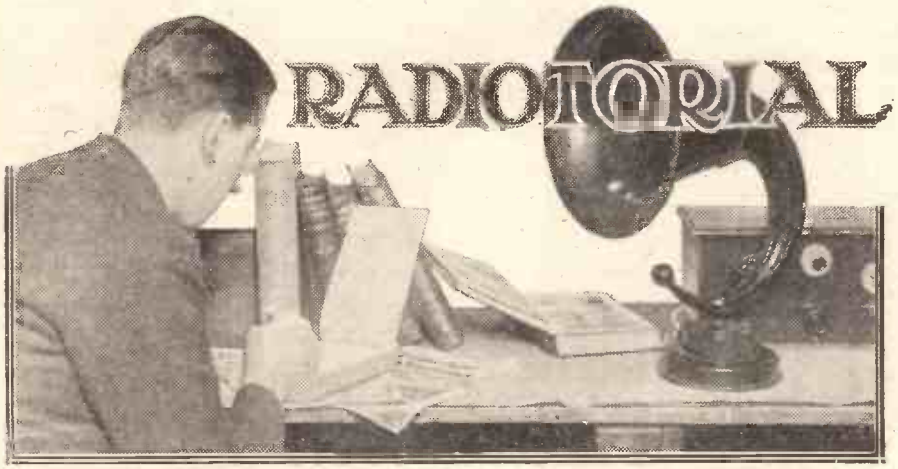
The "Round" Valve.

In the absence of signals, the plate current is derived from both filaments. When, however, signals arrive, the current is passed to the electrodes X and Z, thus giving rise to current impulses which pass to the receiving 'phones.

By way of passing, the curious valve illustrated in the photograph, Fig. 4, will interest many amateurs. This is an early three-electrode rectifying valve constructed about the year 1915. It is, in fact, a Marconi-Round valve which was used for a time during the early days of the war. The filament, which is some three inches long, is



enclosed in a nickel cage comprising the grid, and around this is placed a nickel cylinder which is seen in the photograph. The small tube on the top of the valve contains a little asbestos which was gently warmed from time to time in order to absorb residual traces of gases which could not be removed by other means. As a rectifier, the valve was comparatively efficient, but its day has long since gone by.



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

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

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

QUESTIONS AND ANSWERS.

LOUD-SPEAKER ECHO.

T. J. E. (York).—"Not long ago we moved into a new house and one of my first impressions of it was that it would be rotten for wireless, for when the set was first rigged up in one of the empty rooms it sounded awfully tinny and echoey. But strangely enough, when we got thoroughly settled down, and the room was properly furnished this effect seemed to go, and I have been told since that it was possibly due to the fact that the room was empty, bare walls, floor, etc., and this affected the reproduction. Is this possible?"

It is not only possible but extremely probable that the effect you noticed was due to the bare room. Just as the drapings on the walls, floor, ceiling, etc., affect results in the studio, so do the furnishings in a room where the loud speaker is placed affect the reproduction. Such variations are often of small degree at the receiving end, but in an extreme case like yours where the room was quite empty, they are not only noticeable but are frequently quite pronounced.

THAT BURNT-OUT PRIMARY.

R. N. W. (Norwich).—"Although I had been warned that it was no good, I tried using a transformer with burnt-out primary as a choke, in a loud-speaker filter output. It worked after a fashion, but was certainly giving nowhere near the results of the proper choke which I have now installed. Why is the secondary of a transformer unsuitable?"

L.F. transformers are intended and designed to be used after valves having comparatively small plate currents. In such circumstances a rather small core can be used without detriment, but if an attempt is made to use the same transformer as an output choke it is called upon to carry quite a heavy current (the valve being of low impedance, and probably requiring more H.T.), so that the danger of magnetic saturation is considerable. In fact, it is always present.

A further factor which mitigates against the success of the transformer secondary is the fact that it has a very much larger number of turns than a properly constructed choke, and as the number of turns is one of the factors producing the total magnetic flux this has an important bearing upon the saturation of the iron core.

TERMINAL TROUBLE.

L. D. D. (Sidcup, Kent).—"Some time ago in 'P.W.' I saw an account of how to keep battery terminals from becoming green. My terminals were all right at the time, so I did not pay much attention to it, but now I

(*Continued on page* 488.)

APPARATUS TESTED

THE FAMOUS R.K. SPEAKER —THREE NEW COSMOS VALVES—"RADIO FOR THE MILLION"—ASHLEY RADIO VALVE HOLDERS.

* *

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

THE FAMOUS R.K. SPEAKER.

THE R.K. loud speaker, manufactured by The British Thomson-Houston Co., Ltd. (who own and control the Rice-Kellogg patents in this country), has hitherto only been available in cabinet form complete with its own special amplifier arranged for direct operation from the electricity supply mains—a super loud speaker at a reasonable price, but, nevertheless, too expensive for many thousands of radio enthusiasts.

It is, therefore, very welcome news that, in addition to the complete instrument, the B.T.H. people have decided to market the R.K. coil-driven loud-speaker units alone, to enable home constructors to build their own complete instruments.

The B.T.H. R.K. coil-driven loud-speaker unit, which can now be obtained through all radio stores, is the actual sound producing element exactly as fitted to the complete loud speaker, and is, therefore, a unit which may be relied upon to give complete satisfaction.

The R.K. coil-driven unit is of the electro-magnetic type, and is supplied in three forms for operating respectively from 6 volt, 100-120 volt, and 200-240 volt sources of supply.

A standard B.T.H. output transformer to the moving coil is embodied in the unit, the input to this transformer and to the field winding being by means of insulated terminals mounted on to the back of the unit. The unit is supplied in a pleasing brown finish and has a metal support slotted for mounting on to a baseboard.

THREE NEW COSMOS VALVES.

Three new Cosmos "Short-Path" valves have arrived to strengthen the 2-volt range. There is first of all the S.P.16B. Blue Spot which has the following characteristics. Filament voltage, 2; filament current, ·03 amperes; impedance, 70,000 ohms; voltage amplification factor, 35. The price is 10s. 6d. As will be seen, this valve is particularly suitable for use in resistance-capacity units, although we have found it to be excellent in certain H.F. positions. Its performance is also of a high order as a detector. Altogether, it is a very useful little valve.

The S.P.16R. Red Spot operates at 1·6 volts; filament current being ·09 ampere; its amplification factor is 6·5, and impedance 16,000 ohms. This valve is less of a specialised nature and is very versatile indeed. It is, in fact, a very representative "general-purpose" valve and in several of its rôles its performance falls very little short of that of a good 6-volter. We particularly like it as a detector preceding a transformer coupling, although it is almost

(*Continued on page* 488.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 486.)

find that one of them is quite coated in this way. Will you please tell me what is the remedy ?"

You can easily remove the green film from the accumulator terminal by washing it in a solution of ordinary washing soda. When clean the terminals should be lightly coated with petroleum jelly, and if kept in this condition you will have no further trouble from corrosion.

TRACKING THE CRACKLE.

M. R. (Cromer).—" We were away staying with some friends during April, so for one reason or another the set has not been used for about seven weeks. Now when we go to turn it on again we find that a funny crackling noise has appeared, and although everything inside looks all right as far as I can tell, I notice one very funny thing about it. If I touch the top of the set near the loud-speaker terminal with my finger, the crackle becomes absolutely deafening, every light tap being accompanied by a real bellow. My friend, who is a bit of a wireless fiend, suggested that the transformer had gone, so we tried his in place of mine, but the results were exactly the same, and I said I shall have to write to 'P.W.' about it. And here I am. What can I do now ? "

From your description we think your trouble is due to a dry joint, or other concealed break in the continuity of the wiring. Possibly one of the flexible leads has gone, but we suspect that it is really one of the soldered joints which has broken, although it is quite likely that anything but a careful examination will not reveal this. We should disconnect the batteries, turn the set over and give a good sharp tap to the various connections to make sure they really are connected. If you can find one (or more) that is shaky you may be pretty sure that when this is removed the crackling will have disappeared.

CONTROL OF VOLUME.

J. R. (Keston).—" Some time ago I saw in 'P.W.' a reference to a good form of volume control, by means of a variable grid leak. I should like to fit something of the kind to my set (H.F., Det. and L.F. resistance-coupled), and I have on hand a tapped grid leak (sketch enclosed). Can this be used for the purpose, and if so, what are the connections ?"

The tapped grid leak is quite suitable for use as a volume control provided you make the small modification described below. Your own grid leak has only two terminals, one connected to the switch arm, which travels over the tappings, and one connected to one end of the resistance. You will have to connect a lead to the *other* end of the resistance also (a suitable method being to solder a lead to the last tapping stud, taking this lead to another terminal).

To connect up, all you have to do is to disconnect the present grid leak from the last valve's grid. It will then remain joined to the G.B. negative lead at one end, and to the coupling condenser at the other; but remove it and connect the respective ends of the new grid leak to these prints instead.

Finally, join the variable grid leak's switch arm to the grid terminal of the last valve, and you will find that volume is now smoothly controlled by the movement of the variable grid leak.

IMPROVING THE CRYSTAL SET.

" INTERESTED " (Measham).—" Perhaps you can tell me the meaning of this, and so help other people to improve their results. It is a simple little crystal set with enclosed 'semi-permanent' detector, and quite by accident I discovered that if a pencil is placed on one end of the crystal detector and gently pressed so as to push the two crystals together the results get much louder. About twice as loud. But it is not easy to keep the pencil steady, so it is sometimes better than others. Can you explain this ? "

In pressing with the pencil you re-discovered something that has been known for years—the fact that with certain crystals it is not only the point of contact that matters, but the *pressure* of contact, as well. Most of the semi-permanent and permanent detectors are arranged by the manufacturer so that the correct pressure is applied for best results, but in your case the spring appears to have weakened, so that extra pressure is required to bring results up to full strength.

WHY DO GRID BATTERIES LAST?

" FED UP " (Woolwich).—" My question is a simple one, but I want a *short and convincing* answer. Not a lot of *technical* stuff out of a book, but something *practical*. (All the wireless books now seem full of this *theory*, but I hope 'P.W.' doesn't follow suit. It's *no good* for a working man who wants *results*, and the less they cost the better.) So what I want to know is, why do grid-bias batteries *last longer* than the same batteries used for H.T. "

Simply because *no current* is taken from the *grid-bias* battery.

HOW TO MAKE THE "P.W." STANDARDISED WAVE-TRAP.

S. M. F. (Hertfordshire).—" I thought perhaps it was because I was living in a bad locality that I could not get the London programmes free of 5 G B. Several people have remarked to me that 'it is nice to have alternative programmes, but they spoil one another when they tread on each other's heels.' And that is what has been happening in my set ever since Daventry Junior started.

" It seemed not much good trying to reach out for foreign stations when both London and Daventry seem to want the condenser to themselves. But the other night I was round at a friend's house, and to my astonishment he was able to bring in not only London and Daventry clear of each other, but several other stations as well, all free from interference. The set is very similar to my own, so I was very curious as to how he did it, and he

(*Continued on page* 490.)

APPARATUS TESTED.

(*Continued from page* 486.)

equally useful in the majority of H.F. positions. In an initial L.F. stage with 120 volts H.T. and some 6 volts grid bias it will handle quite a hefty input without the slightest indication of distress. The price of the S.P.16R. is 10s. 6d.

The S.P.16G. Green Spot, which also retails at 10s. 6d, has remarkably fine characteristics. Its impedance is 17,000 ohms, its voltage amplification factor 16; so that it will be seen that it has an abnormally high mutual conductance for a 2-volter. The filament voltage is 2; and it takes a current of ·09 ampere. It was designed especially for transformer coupling both H.F. and L.F. and, of course, for a detector stage, and for use in portable sets. It can be used as a resistance-capacity coupler and we have found its performance excellent in this respect.

These new Cosmos Short-Path valves are indeed notable arrivals and will contribute in no small measure to the still further popularisation of the 2-volt range.

"RADIO FOR THE MILLION."

The March issue of "Radio For The Million," which is published quarterly contains among many other interesting articles, full instructions for making the "Mullard Master Three" suitable for the reception of short wave-length stations. Very little has to be done, as the design of the set is essentially very efficient for the purpose. There are no structural alterations required. All that is needed is a special coil unit, and complete details of this are given. With this March number also there is presented a clear blue print of the "Mullard Mikado P.M. Receiver," a well-designed two-valver.

"P.W." readers should make a point of securing their copies of this interesting Mullard magazine before the demand eliminates the supply.

THE PHILIPS' TRICKLE CHARGER.

This remarkably compact and very efficient unit, which was dealt with recently in these pages, retails at the reasonable price of 55s and not £3 5s. as stated by us.

Captain Bert Hinkler, A.F.C., and his mother broadcasting talks from Bundaberg through 3 L O, the popular Melbourne Station.

ASHLEY RADIO VALVE HOLDERS.

The Ashley Wireless Telephone Co., Ltd., of Liverpool, recently sent us several of their new anti-microphonic valve holders. They retail at 1s. 2d. each. We consider them very good value for money, for they are well designed and well made. The insulating moulding consists of high-class bakelite and neat nickel terminals are provided additionally to the soldering tags. These latter continue as springs which are soldered to the sockets in the central moulding. This latter is cut away in the centre and the sockets are sunk in order to prevent filament-H.T. short circuits.

On test we found the anti-microphonic qualities of the holder distinctly good. The holder is of the base-board-mounting variety and large, cleanly-cut holes are provided for the screws. Altogether the holder is an attractive production and the manufacturers should have no difficulty in achieving their desire to compete with the cheap foreign varieties which are on the market.

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 488.)

told me that the whole secret was the 'P.W.' wave-trap. Naturally I want to get one going, too, so that I can get the full results on my own set. Will you therefore please send me the measurement details of this wave-trap?"

The Standard Trap (which primarily consists of a home-made coil and small variable condenser) is assembled upon a small wooden baseboard measuring 3¾ in. by 8¼ in. and about ¾ in. thick, the intention being that this baseboard shall be screwed down directly upon the wooden base of 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 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.

A good 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 are 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 match stick 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 leads soldered on to them.

Mounted upon the baseboard close to 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. 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 screw-driver 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 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.

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

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

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

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

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

VOLTMETER CONNECTIONS.

F. H. W. (Harwich).—"I recently purchased a voltmeter for testing the exact voltage supplied to my valves (four-valve set). It is a good little instrument, and with it I have been able to obtain exact adjustment on all valves, which I control by separate rheostats. But I find it rather a nuisance to use because readings have to be taken when the valves are in position, and it is not easy to get the leads from the voltmeter to the legs of the valves. Could I arrange simple switching for this, and if so, how?"

It is very easy to arrange switching for this purpose if, as is probable, each valve has one filament leg joined to the L.T. negative terminal. In such a case arrange that the negative side of the voltmeter is connected to this wire also, and then connect to each of the respective filament legs of the valve holders a short wire joined to a socket placed in an easily accessible position.

By connecting a suitable plug to a flexible lead on the *positive* side of the voltmeter, and then, pushing this plug into the various sockets in turn, the respective voltages across the particular valves in question may be read off directly.

If, however, each valve is not joined to one particular lead, but the insertion of switches or rheostats interfere with direct wiring, it will simply be necessary to lead from each valve holder *two* sockets, one from each of the filament terminals. Mark these negative and positive, according to which side of the L.T. battery they are connected, and then, by means of *two* plugs connected to the voltmeter (also marked according to polarity), plug these two into the respective sockets for the required voltages.

DISCONNECT THE H.T. FIRST.

F. R. W. (Leeds, Yorks).—"Looking through some back numbers of 'P.W.' the other day, I came across a picture entitled 'Disconnect

(*Continued on page* 492.)

A FLEET STREET BIRTHDAY.

Some Radio Memories.
By THE EDITOR.

FORTY years ago this week one of our contemporaries, upon the fortunes of which was built up the firm publishing POPULAR WIRELESS, "Modern Wireless," and "The Wireless Constructor." made its first appearance. That contemporary was "ANSWERS," and it was the paper with which Alfred Harmsworth, later to become famous as Lord Northcliffe, began what is undoubtedly the greatest and most interesting romance in the many romances of Fleet Street.

Readers of POPULAR WIRELESS, apart from the many other attractions which our contemporary holds for them, may be interested to know that "Answers" was the first paper of its kind to cater for the wireless constructor. That story in itself is interesting. Just after the War the writer—when demobilised—submitted a plan for the utilisation of wireless in Fleet Street, and newspaper work generally, to the late Lord Northcliffe, and subsequently many suggestions made in that plan were adopted.

Did You Build It?

I have told the story in full in my book: "Broadcasting for Everyone." At that time Lord Northcliffe or "The Chief," as he was affectionately known to his staff, was not particularly interested in wireless, but in a subsequent conversation with him on the matter, arising out of the report submitted, the writer soon discovered that he had the same far-reaching views about wireless, and the same uncanny gift of looking to the future with regard to the invention, as he displayed in connection with motoring and aviation.

The report which was submitted to Lord Northcliffe suggested various ways in which reporters could utilise portable wireless sets for receiving their instructions from head office when at a distance, and later on the "Daily Mail" inaugurated a series of experiments whereby reporters were kept in touch with the News Editor when away from Carmelite House.

Arising out of this conversation with Lord Northcliffe the writer paid a visit to the then Editor of "Answers" who, like The Chief, at once saw—although broadcasting was then quite unknown—the potential possibilities of wireless as a hobby, and he straightaway commissioned three wireless articles dealing with the construction of a simple crystal set. These, I think, appeared in "Answers" as early as 1919 or 1920, certainly long before any other periodical of a non-technical nature had really catered for potential wireless enthusiasts.

£1 a Week for Life.

"Answers" to-day is known the world over, and it is interesting to remember that forty years ago, when Lord Northcliffe was a young man of twenty-three, he started this paper in a little office in Paternoster Row, rented at 12s. 6d. a week, and struggled with the task of deciding which of the hundreds of ideas which whirled through his quick brain would increase the circulation of his paper before his capital had disappeared.

Success was slow at first; but later on he laid the foundation of his own wonderful fortunes and career as the greatest journalist of all times. He was the first to introduce free insurance for readers against death or disablement, and he was the first to make the then unheard-of offer of a prize of £1 a week for life to the competitor making the nearest guess of the total amount of gold and silver in the Bank of England on December 4th, 1888.

A Bumper Issue.

To-day, so many years later, "Answers" is still ahead of all its rivals, both in size and interest of its competition offers; but, popular as the "Answers" competitions have become ever since 1888 and 1889. these offers alone have not been responsible for placing the paper in the position of being indisputably Britain's National Weekly. That title has been well earned by the unrivalled interest and importance of its contents. Within the last twelve months it has published important articles by Sir Hall Caine, Mr. Ramsay MacDonald, the Bishop of London, Sir Herbert Samuel and many other famous authors. The issue on sale now (the special 40th Birthday Number) contains an offer of £3 a week for life in a new picture contest, another prize offer of £1,000, and many contributions by more distinguished writers than have ever appeared in a single issue of a weekly paper before. The list includes contributions by Viscount Cecil of Chelwood, the Rev. H. R. L. Sheppard, Lady Rhondda. Miss Helen Wills, Harry Preston, Maurice Tate, "L. G. M.," Professor Mottram, James Sexton, M.P., Edgar Jepson, etc., etc.

This is probably the greatest issue of the paper around which centres Fleet Street's greatest romance, and I feel sure all my readers will be interested and should secure a copy of what is undoubtedly an edition de luxe of Britain's National Weekly.

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 490.)

That H.T. First,' I ought to have been warned by this, but neglect of that simple piece of advice has cost me the life of one of my valves.

"Consequently, I now remember to disconnect the H.T. every time, but I am building a set for an old friend of mine who is rather absent-minded and knows nothing about wireless, so I should like to put a switch in it. The idea is that this would do two things at once—turn off the H.T., and turn off the filaments, too. Where can I get particulars of how to make a switch of this kind?"

Details of an easily made switch of this kind were given in the March issue of "Modern Wireless" (back numbers of "M.W." are obtainable from The Amalgamated Press Ltd., Back Number Department, Bear Alley, Farringdon Street, London, E.C.4).

COILS FOR THE "ANTIPODES ADAPTOR."

W. J. (Mottingham).—"Can I get the coils for the 'Antipodes Adaptor' ready-wound, or can I get a former all ready to put the turns on? If so, how much, and where?"

You can get either the ready-wound coils or the formers for winding from Messrs. Burne-Jones, 288, Borough High Street, London, S.E.1. The prices are: Former alone, 3s.; ditto, with two-pin base, 4s. 6d.; ditto with two-pin base, ready wound, 5s. 6d.; ebonite base, 2s. 6d.

NEWS FROM SAVOY HILL.

(*Continued from page 478.*)

be the subjects of running commentaries. Captain H. B. T. Wakeham and Colonel R. B. Brand will be the commentators. By the way, Colonel Brand is the popular "host" at Savoy Hill. It is his duty to receive and look after talkers, artistes, and visitors to the studios.

The Rise of Edward Clark.

It was only to be expected that the B.B.C. would soon begin to produce new conductors and musicians of sufficient talent to be recognised internationally. The first of the "discoveries" in conducting appears to be Mr. Edward Clark, whose work is attracting much attention on the Continent, particularly in Berlin, Paris, and Budapest. It is understood that Mr. Clark is shortly to be the "guest-conductor" of several of the best known and most exclusive musical societies of the Continent. Three years ago Mr. Clark was musical director at Newcastle Station, where he was in close contact with Mr. Rule, the authority on radio drama.

Controversy Lags.

No one could accuse Savoy Hill of rushing at controversy. Six weeks elapsed between the lifting of the ban by the Prime Minister and the first debate on May 18th. Meanwhile there is still no announcement of what the Parties agree with the B.B.C. on political broadcasting. Several snags were encountered. The Liberals are rumoured as being profoundly dissatisfied with the trend of events.

Their attempt to get the same facilities as the Government has not succeeded, and they are considering withdrawal entirely. An announcement of such a decision would cause great joy in both Conservative and Labour camps, who would be quick to split up the facilities abandoned by the Liberals.

Lady Bertha Dawkins.

Lady Bertha Dawkins, who is Lady-in-Waiting to the Queen, has promised to broadcast an appeal on behalf of the Professional Classes Aid Council from the London Studio on Sunday, June 10th. The Council, which was founded in 1914 as the Professional Classes War Relief Council, and subsequently re-constituted on a peace basis in 1921, is giving valuable assistance in the education and training of young people, and in aiding ministers of religion, officers of the services, teachers, authors, musicians, actors, and other members of the professional classes, their widows and dependents, particularly in times of illness and convalescence.

Sir Landon Ronald's Recovery.

Many friends of Sir Landon Ronald will be delighted to hear that he has now recovered from his serious illness, and particularly with the news that he is to conduct a programme of his own compositions during an orchestral concert in the London Studio of Friday evening, June 22nd. The artistes taking part are Doris Vane and Harold Williams, and among the orchestral items which will be heard are "The Garden of Allah" Suite, the Aria "Adonais," the Lament "Shahjehan," and the "Birthday Overture."

TECHNICAL NOTES.

(*Continued from page 478.*)

circuits. Wave-traps, of course, suggest themselves, but, although much used by experimenters, they do not commend themselves to the average broadcast listener owing to the need for extra apparatus and additional controls.

Grid Rectification.

With leaky condenser rectification it is often more difficult to obtain sharp selectivity than with anode-bend rectification. This is owing to the fact that with leaky condenser rectification there is often quite a considerable amount of grid current flowing, which is equivalent to a leak between the grid and filament of the detector valve. Since this is equivalent to a leak across the tuning coil, it is easy to see why selectivity is difficult to obtain.

With anode-bend rectification, however, using a potentiometer, the grid is strongly negative and consequently the grid current will, as a rule, be very small—or, in other words, the equivalent of the leak mentioned above is considerably reduced.

A Curious Resistor.

A curious and novel way of making a commercial resistor of accurate resistance value is used by the Electromotive Engineering Corporation, U.S.A., in making their so-called "Hy-Watt" fixed resistors. To make a resistor, an insulating tube is taken, upon which is baked a coating of a special resistance compound. This compound is homogeneous in nature, and provides a continuous and constant resistance path.

The completely coated tube, before being machined, would have a comparatively low resistance, but to obtain the required resistance a spiral groove is cut in the coating of resistance material. The coated tube is placed in the machine and the spiral groove cuts completely through the resistance coating, leaving the coating in the form of a spiral ribbon on the tube. The length of the ribbon, and therefore the resistance of the unit, depends upon the length of the spiral cut.

Accurate Resistance Values.

Whilst the resistance unit is in the machine that cuts the spiral, it is also connected in an electrical circuit with a resistance indicator. As the spiral cut is started the meter shows the increasing resistance and the cut, which is made at a pre-determined pitch, can be stopped when the resistance, as indicated by the meter, reaches the desired value. In this way a remarkably high degree of accuracy for a commercial product of this kind is obtained very simply and inexpensively.

To ensure good contact between the metal end caps and the resistance material, the ends of the resistance-coated tubes are electro-plated, end caps being then clamped in position and the whole unit being given a coating of insulating compound for protection.

These units are for use in radio-receiver circuits, transmitters, or "power-packs" (American for high-tension and low-tension main-supply units or eliminators), and will dissipate as much as 6 watts.

Transformer and Valves.

When choosing a low-frequency transformer, special attention should be paid to the manufacturers' instructions with regard to the type of valve in the anode circuit of which the transformer is to be connected. Generally, a much greater current will flow through the primary winding when a low-impedance valve is used than when one of the medium-impedance type is employed.

Saturation is often indicated by a "muffly" character in the reproduction.

"P.W.'s" SIXTH ANNIVERSARY.

(*Continued from page 483.*)

From the Managing Director of R.I. & VARLEY, LTD.

"I should like to offer you my sincere congratulations on the anniversary of the sixth year of publication of POPULAR WIRELESS. *This paper was the first radio journal to cater for the general public in wireless matters, and after six years it still holds a pre-eminent position amongst that section of the public who desire to keep up to date in wireless science without probing too deeply into the technical side of the subject.*

"I believe I have seen every copy of POPULAR WIRELESSS *since it first appeared, and one of its brightest features is the intimate character which is maintained between the editorial side and the public—it can be aptly described as a family paper on wireless, and the fact that it has had a circulation curve which has been rising from the start is the best proof of its usefulness and popularity.*

"I wish it every success on its sixth birthday."

J. JOSEPH.

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. Registeredas a newspaper for transmission by Canadian Magazine Post. Subscription Rates: Inland, 17/4 per annum; 8/8 for six months. Abroad, 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.; and for Canada: The Imperial News Co. (Canada), Ltd. Saturday, June 2nd 1928.
R/R

POPULAR WIRELESS, June 9th, 1928. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THE WIRELESS PAPER WITH THE LARGEST CIRCULATION

Popular Wireless

Every Thursday PRICE 3d.

No. 314. Vol. XIII. INCORPORATING "WIRELESS" June 9th, 1928.

The "DERBY" THREE

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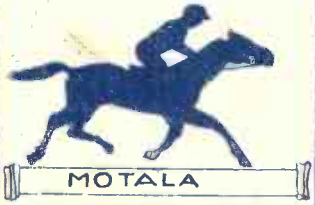
Stopping Popping

For the Set Builder

How to Make a "Lo-Note" Loudspeaker

Politics and Broadcasting



Popular Wireless

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RADIO NOTES AND NEWS.

A Word to the B.B.C.—A Princely Amateur—Pats for Britain—Beam Empire Broadcasts?—An Imperial Duty—The Radio Sceptic—Notice to Clubs.

A Word to the B.B.C.

THE first "controversial" debate, Benn versus Maxton, seemed to me to be very interesting and a pleasant change from the carefully sterilised 'debates" previously broadcast. Both combatants showed excellent restraint, and the affair thus did not degenerate into cross-talk. But—a number of the best "hits" were drowned out by the laughter of those in the studio. Please don't allow it to happen next time.

"Morse."

SOMEWHAT bothered with Morse interruption to-night while tuned to 5 G B; a long speech by one of those ships with a note like the noise of a dying pig. Young daughter asked why the B.B.C. "sent it out" as well as music. Explained that the B.B.C didn't, but that it came in on our aerial from a ship. "Well, dad, why does he pick ours? Can't he have a turn on auntie's?"

Where's the Snag?

BROADCASTING in Spain stays where it was a long time ago. Not because Spain and its people are impervious to progress, but because it just does not appeal. A man returned from South America tells me that except in a few of the largest towns the idea does not catch on. Latins are enormously fond of talk. I have seen a Spanish crowd listen a whole afternoon to an orator who jumped up and down, bit the air, and pulled down handfuls of upper atmosphere. Why don't radio talks take? Because Latins are not "fireside folk," as a rule.

Pats for Britain.

SINCE we are "talking furrin," let me tell you that I met a naughty Dutchman to-day, who shocked me by his preference for any country but Holland. This young man had served a British radio firm for a long time. Then, about 1925, I put him in the way of a job abroad, also with a British concern, in which he did good work. Back came he to Holland, bursting with radio experience, ripe for a post in the homeland. But they gave him the cold mitt. Only civil servants need apply. "Oh, 'ow I 'ate my country!" he told me. "Give me vork annyvere in der Breeteesh Empire—annyvere." A good chap, but can't think straight, evidently.

A Princely Amateur.

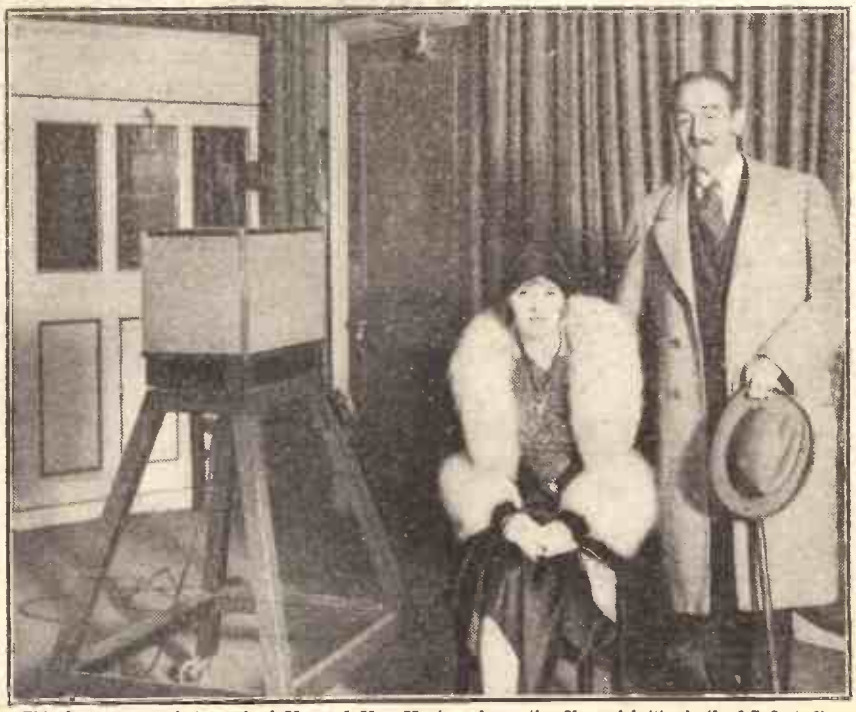
THE Prince of Siam is bitten with radio. Professionally, I believe, he is quite an authority on battleship sets and so forth, because he is a clever naval man; but he does not disdain to twiddle the dials for pure fun. Although he is Minister of Communications he wants to be a valve Bart., and has cabled to 3 L O (Melbourne) announcing his successful interception of their short-wave signals. Further, he has instructed the Siamese Naval Department to report officially on 3 L O's signals. If you want to copy him, make up the "Sydney" Two.

Proportion.

AS you may well suppose, I am always being called in to diagnose cases of "won't work properly." Apart from sheer blundering, such as reversed battery connections or broken connections, the majority of cases are those of lack of proportion. Proper valve reception is a matter of nicety of adjustment, which comes to one as a sort of retarded instinct, after much practice. The secret of tuning is to begin at the weak signal—and then *work it up*. So many amateurs pile on the H.T. and the L.F. regardless. Too much reaction has spoiled many a programme. Spare the reaction; it's a fatal trap for the unwary.

(*Continued on next page.*)

MR. & MRS. MENJOU MEET "MIKE."



This honeymoon photograph of Mr. and Mrs. Menjou shows the film celebrities in the 2 L O studio from which they broadcast a greeting to their British admirers.

NOTES AND NEWS.

(*Continued from previous page.*)

Working 'Em Up.

I FEAR that I become tutorial, but perhaps you will bear with me. Get your signal first with the detector stage held right down. Then aim at getting your results with a minimum of detector H.T. and L.T. Just work 'em up.

"P.W." and Television.

A VALUED reader of Billericay sends me a clipping from a Sunday paper gossip page in which the gossiper deplores the number of detractors of television. My correspondent says, "I refrain from comment." If his meaning is that "P.W." is one of the detractors it is clear that he misunderstands our attitude, and has not read the Editor's articles carefully. He might just as well argue that the "Daily Mail" pooh-poohed aviation because it offered prizes for flights. As a matter of fact, "P.W.'s" action demonstrated the exact present position of television in this country.

Beam Empire Broadcasts.

THIS sounds contradictory, but is not really. G. L. S. (Victoria, Australia), in a welcome letter, asks me whether I think the Beam system will be ultimately the means of effecting a good Empire broadcasting system, or whether ordinary short waves will get the honour. I think the ordinary short waves will win, because they are true "broadcast"; the Empire is not only India and the great Dominions; we have to think of the people scattered over Africa, Asia, and the islands of the sea. Who is to pay for the Beams? (Four at least would be required, *at least*.) Technically, the Beam wins. In practice, I declare for 5 S W or its successor.

An Imperial Duty.

IT is piteous, this cry from all parts of the Empire for broadcasting from home. The coldest of policies, political expediency, demands its introduction. Race instinct and common clannishness echo the demand. It must be done, and if we were as clever as we boast it would have been tackled by the Government with a hustle. The Germans would do it "like a shot," without finnicking about "guaranteed service," and so forth.

Let's Hang Together.

I don't mean what you mean. Not at all. I mean, let us British at home do what we can to relieve the pangs of nostalgia of the Britons who live far away from dear, wet, but ever-beloved little England, or the yearnings of our folk, who, though perhaps born overseas, yet think of England as "home." I have been smoking and enjoying some extra fat cigarettes, "Rhodians" (made from Rhodesian tobacco by Lambert & Butler). The men that grew the weed are trying to develop Empire resources. Let us smoke their products, and in return give them radio straight out of this island that they love.

Learn Morse.

I AM really sorry that my Barts. and Barons do not, as a class, learn Morse, or, rather, learn to read Morse. A few months' application and the thing is done. Then Morse will cease to be a curse, but will be eagerly sought after. Ships and coast stations get enormous distances; besides, there is all the world of amateur transmitters to explore. Just imagine you, Bill Brown, in Peckham, or Wigan, or Glasgow, sitting in your den listening to a ship labouring round Capt Agulhas talking to another off Finisterre, or a sealer in the Antarctic asking New Zealand to send stores, as they are frozen up for the winter. There's romance for you!

SHORT WAVES.

NEED FOR FINESSE.

One of the hardest Bridge problems on the radio is to keep it tuned out.—"Judge."

* * *

Radio Fan's Better-half: "Oh, Gerrard, why don't you tune in some of those *lower harmonics* that this article mentions? I just love to hear good mouth-organ music on the radio!"—"Science and Invention."

* * *

Old Lady (returning loud speaker recently purchased): "I've tried every possible way, but I can't get any stations with this loud speaker, my man."
Salesman: "I'm sorry, madam. What make of set are you using?"
Old Lady: "Set? Oh, I haven't got a set!"

* * *

"At times I can get nothing but a howl, and am surprised that I am not the guilty party." Extract from a listener's letter.—"News of the World."

* * *

Father: "I've got a queer humming noise in my left ear."
Small Son: "Maybe it's your batteries charging, daddy."

* * *

Query from Fleet Street: "What is penny dreadful music?"
Reply: "A great proportion of the noise from 2 Z Y (Manchester) miscalled music, and performed by so-called musicians."—"Melody" in "Manchester Evening News."

* * *

Tall Man: "Congratulate me, Bill, the happiest event since I married!"
Short Man: "Boy or girl?"
Tall Man: "No. P C J J on one valve!"

* * *

What happened to the boy who dropped a light in a tin of benzine?
He hasn't benzine since.—"Popular Science."

* * *

A TELEVISUAL TRAGEDY.

A listener living at Belvoir (pronounced Beaver),
For an artiste caught love-smitten fever;
But her image he spied,
Seized a hammer, and cried:
"Base vocal deceiver!"—and smashed his receiver.—"Radio News."

Light Interlude.

HEBREW patriarch to Scots laird: "I take a crystal set for a bad debt and I get all the financial news for noddings on my bedstead aerial." Scots laird: "Losh, mon! I took a fine big dog—*wi'* his collar, mark you—for a bad debt, and he says 'oof-oof' all day. *And I've nae cr-r-ystals to buy.*"

Dan Goes Abroad.

MANY listeners will be interested to learn that Mr. Dan Godfrey, Junior, has secured the conductorship of the Durban Municipal Orchestra. Mr. Godfrey was formerly director of the Manchester Station of the B.B.C., later becoming very popular as the conductor of 2 L O's orchestra. Mr. Godfrey certainly has "the gifts," and Durban has chosen well. Luck, Dan!

Picked from the Bunch.

JUNE 9th, 2 L O and 5 X X. Narrative of athletic meeting, Cambridge University v. A.A.A. at Cambridge. (By H. M. Abrahams. June 12th, Cardiff and 5 X X. The Prince of Wales unveiling the Welsh National War Memorial, Cardiff. June 15th. The Earl of Balfour's speech at the tenth anniversary of the English Speaking Union.

"P.W.'s" Birthday.

ON the occasion of our sixth anniversary (reached by last week's number) we received many letters from prominent people, including the following. It is from Senatore Marconi, but reached us just too late for that special number:

"Many developments have taken place in the technique of wireless transmission and reception since the first number of POPULAR WIRELESS was issued, and its sixth birthday finds wireless in all its branches still progressing steadily and taking a great and increasing part in national and international affairs.

"The stimulation of public interest in the fascinating science of broadcasting, the encouragement of the amateur, and the stabilisation of wireless trade conditions, have undoubtedly been assisted by such publications as yours, and I congratulate POPULAR WIRELESS upon the completion of another year of service to the amateur, the listening public, and the wireless industry.

G. MARCONI."

The Radio Sceptic.

YOU will recollect that W.A.E.R. (St. Austell) offered to lend Mr. Elston his "Antipodes Adaptor." Now Mr. Elston asks me to thank W.A.E.R. for the sporting offer, of which he cannot avail himself just now, having only recently moved, so that he has no aerial. That's a pity! Our sceptical friend, who feels that he has just about had his full whack of kicks, points out that his original yowl was not directed against the users of "super-sets."

Families and Imaginations.

NO, his complaint is of the owners of "straight" sets made up at a cost of £7 or £8, who "claim absurd results." He does not attack my guaranteed "Valve Barts." with their special skill and special sets—which clears the air, I think, for it appears that he is now inclined to believe that with sets like the "Sydney" Two, America and Australia can be and are often within reach. What Mr. Elston wants is good L.S. results from local, 5 X X and 5 G B, plus the best, nearest Continentals, on four valves. I will see what I can find for him.

Notice for a Kind Club.

IN connection with this little flare-up, I recently suggested a club test. Mr. Elston modifies my proposed conditions, in view of his new stand, as follows: (1) A "straight" three-valver that has been described in "P.W."; (2) total cost, with accessories, not exceeding £8 (retail); (3) the results reported to be the average arrived at by three operators drawn by lots. Now then, "P.W." has always obliged those clubs who have asked us to give them publicity; will not one of them devote an evening to this test and report the result to me? To oblige "Ariel"! The result will interest tens of thousands of good radio fellows.

ARIEL.

SCHENECTADY'S SURPRISE

About a year ago W G Y, the famous American station, startled the broadcasting world by erecting a 50-kw. transmitter. Now it appears that this was merely a "baby try-out."

From OUR SPECIAL CORRESPONDENT.

SCHENECTADY sprang a surprise upon many broadcast listeners in America when its station designers and engineers came out a few months ago with their "biggest ever," a giant transmitter capable of imparting a 100-kw. energy to the aerial of W G Y. This transmitter has been designed to comprise more than an experiment in the high-power transmission of radio broadcasts. It is, in fact, intended to constitute, in the main, the station's permanent and regular broadcasting equipment, and, as such, a few details of this successful enterprise will afford some degree of interest to the more technically-inclined reader.

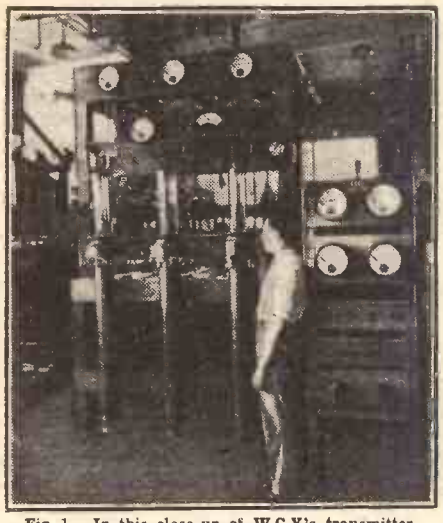


Fig. 1. In this close-up of W G Y's transmitter three of the 100-kw. valves are shown.

The Vital Valves.

The new Schenectady transmitter is the first in the world to put a power of 100 kw. into the aerial. It was designed last year in the experimental laboratories of the General Electric Company, an institution from which many famous radio developments have come. The photograph shown at Fig. 2 depicts a general view of the transmitter. Considering the power dealt with by the transmitter, the whole equipment has been designed and erected in a remarkably compact manner, the new 100-kw. transmitter actually taking up less floor space than its 50-kw. predecessor.

The transmitter employs five specially designed 100-kw. transmitting valves, three of which may be seen in the accompanying photograph, Fig. 1. Two of the valves shown on this photograph are used as amplifiers, the remaining one shown being kept by as a "spare" for any possible time of emergency.

Looking again at photograph Fig. 1, we see here the two amplifying valves on the left, and the emergency valve on the right. Each valve is almost completely surrounded by a metal water-cooling jacket through which a rapid stream of cold water is kept flowing. Each valve has a plate consisting of a copper cylinder 3 ft. long and 3¼ in. in diameter. The valves possess thick filaments which utilise a current of 210 amperes at approximately 30 volts. They are worked in parallel, and are coupled inductively to the aerial circuit. The transparent portions of the valves are, of course, composed of fused silica, a tough and transparent material which not only has an extremely high melting point, but which also does not show any tendency to crack under the influence of sudden heating or uneven cooling.

The modulator of the new 100-kw. transmitter of Station W G Y at South Schenectady is depicted in the heading photograph. Here it will be seen that the valves used are of the same general design as the amplifying valves. The Schenectady modulator employs three of these giant valves which are said to be able to handle a very high power without at the same time giving rise to any distortion of the modulating currents.

W G Y has not redesigned its aerial for use with the new transmitter. It still employs a 2-ft. diameter cage aerial suspended some 250 ft. from the ground, whilst for its earthing arrangements the station utilises the services of a counterpoise which consists of a roughly circular network of copper wires, the diameter of which is approximately 250 ft.

Owing to the high power now handled by the transmitter, the W G Y engineers have deemed it advisable to think out all sorts of protective and warning devices. For instance, one ingenious device automatically warns the engineer in charge of the plant in the event of the water supply to the outer cooling jackets of the valves failing for any reason. In this manner, the possibility of much damage being done to the transmitter is eliminated.

Life-Saving Devices.

In the event of the breakdown of any of the five 100-kw. valves employed in the transmitter, an automatic device cuts off the power. The personal safeguards connected with the transmitter are of the usual type. For instance, the opening of certain "gates" surrounding the H.T. side of the transmitter automatically breaks the circuit, thereby making it impossible for an individual to come into fatal contact with any "live" portion of the plant.

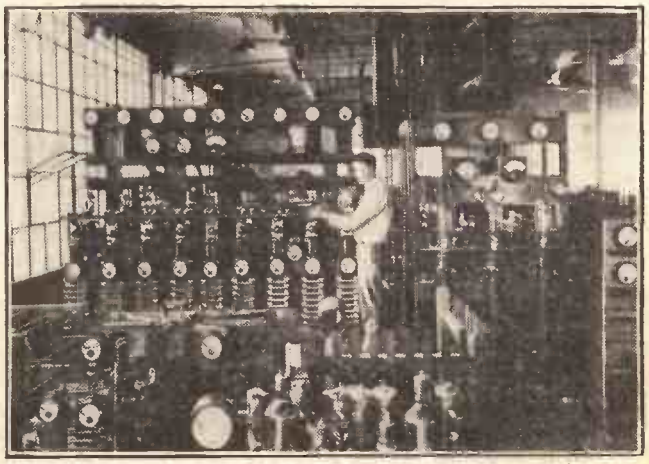


Fig. 2. A general view of Schenectady's new super-power transmitter.

POLITICS AND BROADCASTING.

The problem of political broadcasts has been left for the time being in the hands of the B.B.C. "The B.B.C. is non-political, and it has an admirable opportunity for showing fairness and firmness in dealing with the question."

By THE EDITOR.

SOME time ago now, Mr. Winston Churchill made some caustic remarks with regard to the ban on wireless broadcasting controversy and, as a direct result, the Government eventually lifted the ban on controversial broadcasts.

The B.B.C. then went into the question of how talks and debates for future broadcasts should be made more interesting controversially, and we understood that, in due course, political debates would be broadcast by representatives of the parties in the House of Commons.

For some time past now negotiations have been going on between the three chief political parties, i.e. the Conservative Party, the Labour Party, and the Liberal Party, in conjunction with B.B.C. officials, on this very question. Conferences have been held, and among those who have been attending were Mr. J. C. C. Davidson, chairman of the Conservative Party organisation, the Chief Government Whip, the Secretary of the Labour Party, the Chief Labour Whip, and the Chief Liberal Whip, and others.

At these conferences efforts have been made to draw up an agreed scheme of political speeches for broadcasting, as a preliminary, apparently, to a more extensive use of broadcasting during the General Election campaign which is anticipated for next year.

Unfair Claims.

At the last conference it was put forward that Mr. Baldwin should speak for half an hour one evening, that Mr. Ramsay MacDonald should follow up for a similar period about a week later, and that Mr. Lloyd George should speak the following week.

It is surprising to learn, and also disappointing, that the negotiations have broken down because the Conservative organisers claimed that their Party should be allowed one speech for each Opposition speech. Arguments appeared to be futile, and in the end the Conference broke up with the agreement that the whole matter should be left for the time being in the hands of the B.B.C.

There is no doubt that, on grounds of political equity, the Conservative Party are demanding too much when they claim one speech for each Opposition speech, and it is to be hoped that the B.B.C. will now seize this opportunity for dealing firmly with the matter. The B.B.C. is non-political, and it has an admirable opportunity for showing fairness and firmness in dealing with the question.

There is no doubt that if further conferences are held only another deadlock will be reached; but if the B.B.C. takes a strong hand and begins by extending an invitation to Mr. Baldwin to broadcast, and if that invitation is refused, extending it to Mr. Lloyd George and Mr. Ramsay MacDonald—either of whom is bound to accept—then the Conservative Party will have to fall in with the B.B.C.'s scheme.

Perhaps it is just as well that the B.B.C. have been left to solve this problem. We feel confident they will do so, and that listeners will not be debarred from hearing what should be an interesting series of political debates because of the greediness of the Conservative Party in demanding a share in the talks which, quite naturally, the other political parties would not agree to.

Equality Essential.

It comes down to this. Tories have demanded a two to one chance in the broadcasting debates, but the most they should expect would be an even chance. The same applies to any party in power.

This expression of opinion is not biased by any political fervour—for POPULAR WIRELESS has no politics—but purely on the grounds that if a solution is to be found and listeners are to enjoy political debates, all parties concerned must agree to share equally in the available programme time allotted.

* * *

We understand that the Wireless League, which was formed for the specific purpose of dealing with listeners' opinions on broadcasting programmes, and for disseminating free technical and legal advice to its members, together with insurance against the risks of accidental damage to aerials, has announced that it can no longer continue to function owing to lack of public support.

It is stated that all those who have paid their subscriptions will have any insurance claims met until the end of the financial year in September next; but it has been decided that new members shall be taken and the League's activities resumed should anything occur during the next few months in the broadcasting world to warrant a full resumption of the League's duties.

It is only a few months ago now since the Wireless League absorbed the Wireless Association. The Wireless Association, it will be remembered, had two classes of members; one class at a guinea a year, and another class at a membership of 5s. a year.

Only Two Left.

At the time we pointed out that the growing number of these wireless societies was only watering the value of all of them down to almost nothing. There never has been room for more than two good radio societies.

The partial failure of the Wireless League leaves, therefore, only the Radio Association and the Radio Society of Great Britain: both those societies, as we have pointed out before, are more or less moribund, and it is a sad thing that in a country like Great Britain, where there are more than two and a half million licences, there is not, so far, a really successful radio society which can cater not only for the needs of the amateur, but for the needs of the ordinary non-technical listener.

It is stated that the reasons for the failure of the Wireless League turn chiefly on the lack of sufficient support.

It has been said that the League's policy with regard to the B.B.C. and the Postmaster-General is too indefinite, and listeners were not attracted by a namby-pamby attitude of policy which really led to nothing in the long run.

In point of fact, it will be remembered that the Wireless League has never really had a proper programme. It may have had on paper, but it has never yet shown any definite signs of vitality and kick, which is so necessary if it is to fulfil the functions of a good and really alive radio society.

New Society Wanted.

We do not regret the partial passing of the Wireless League, but we hope that from its ashes, and from the ashes of many other radio societies of its kind, a new society will arise in the near future which will really fulfil the functions essential to such a society and give the listener and the amateur a service based upon a really intelligent and vital policy.

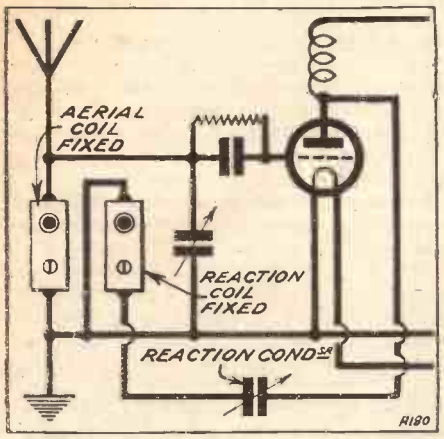
* * *

It is interesting to note that although the Beam wireless services were only guaranteed to give full service for four out of every twenty-four hours, they have proved to be very reliable except for certain short periods during the twenty-four hours, and in summer or winter can greatly exceed the four hours which were expected of them.

A selection of short articles of an eminently practical nature and covering all phases of radio-receiver construction, operation and maintenance.

Fixed Coil Holders.

COIL holders closely and permanently coupled are popular for certain forms of Reinartz receivers. The diagram shows the way to connect them. The essential point to note is that both holders are the same way round.



If one of the coils is reversed but the order of connections left the same, the result will not be similar in effect. The object of taking the pin element to earth is to ensure the correct use of an X coil in the aerial circuit. The pin element of the aerial coil must be taken to the socket element of the reaction coil, the pin element of the latter connecting to the variable reaction condenser. Coils of odd make should not be used, in case the direction of winding should differ in the coils themselves.

Useful Reels.

MOST constructors accumulate a quantity of spare lengths of wire which is very often wasted through being cast aside and left until it becomes hopelessly entangled. It is handy to have by a number of reels for the purpose of neatly storing odd lengths of wire of various gauges. For this empty cotton reels are suitable, while photographic amateurs will find that blank camera spools can be employed.

Storing Small Parts.

I WONDER how many times wireless constructors have upset a boxful of assorted small parts, or spent hours looking for some particular small item? Every constructor should make up a box divided into a number of small divisions by means of ply-wood sections. If the sections are made to come flush with the under-side of a sliding lid, the box may even be dropped without a single part falling out or becoming displaced.

An L.T. Battery Tip.

MANY may prefer to take plug-in connections to their L.T. battery, as this method is certainly more convenient and quicker than the usual spade terminal connections. One must, of course, be careful if this is done not to confuse the L.T. leads with the H.T. leads. However, the option of this arrangement is easily provided by simply drilling a hole of suitable size for the plug to be used in the centre of each cap of the L.T. accumulator. The caps being of soft metal, as a rule, are easy to drill with a hand-drill or brace, and spade terminal connections can also be used.

A Short-Wave Coupler.

A NEUTRODYNE CONDENSER makes an excellent aerial coupler for use on the short waves. Connect it in series with the aerial terminal on the set. A small on-off switch can be connected across it to cut it out for use on medium and long waves. A makeshift condenser for the same purpose can be made by twisting two small pieces of insulated wire together. The aerial is connected to one wire, and the set to the other.

Non-Fray Flex.

FLEX leads have a way of fraying out at the ends, but this is a habit which is by no means incurable. If you do not mind spending a little time and trouble on the leads, you will do best to solder the strands together. Twist up the strands, put a spot of flux on them, and roll them about in the blob of solder on the soldering iron. Finish off by binding the end of the insulation with a few turns of cotton or silk.

For temporary connections soldering is hardly worth while. But however tightly you twist up the flex strands, the head of a terminal will be almost sure to catch one of them and become jammed as you screw it down. Put a flat washer on the top of the flex, between it and the terminal head, and you will have no more trouble with loose strands.

A Basin Loud Speaker.

HAVE you ever tried the effect of using an ordinary basin for a loud speaker? An old enamel basin of suitable size and shape is attached to a unit and reed in the usual manner by drilling a small hole centrally in the basin. If the device is properly fixed up, the resultant tone is very good, and the experiment is interesting and costs little to try.

Home-made Drills.

A VERY useful set of drills may be made from a discarded set of knitting-needles. These are broken off in varying lengths, the finest needle being the shortest. The tip of each drill is then set on the grindstone. Such drills are very useful for odd-size drillings on ebonite panels, and it will be found that as the largest drill thus used is comparatively small, and the material worked upon reasonably soft, there is no need for the usual clearing groove. Once set, the drills will last a considerable time without re-setting, as the metal is already hardened.

Cabinet "Feet."

UNLESS "feet" in one form or another are attached to the base of a wireless cabinet, the cabinet wood is very liable to scratch any furniture if it should be accidentally or intentionally moved across the surface. There are several methods open to adoption by the constructor, and individual taste should be met by one of them.

Of course, in many cases feet are already provided, two popular arrangements being small hemispherical rubbers nailed in at the four corners, or small squares of thick felt glued to the wood. The last named can be carried out quite easily by the

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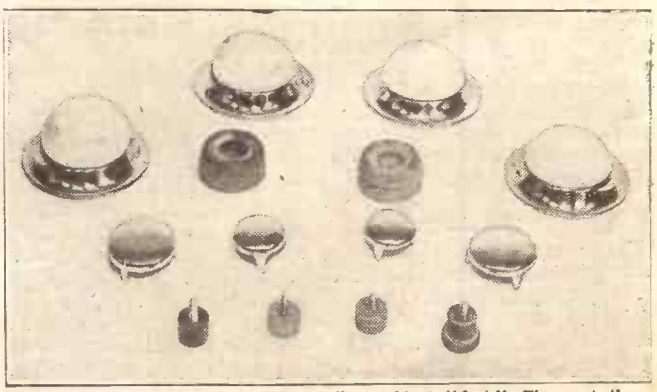

A selection of articles which form excellent cabinet "feet." Those at the back are specially made for the purpose, while the door-stops and "silent castors" will readily be recognised.

FOR THE SET BUILDER.

(Continued from previous page.)

constructor himself or, if preferred, four Eddystone Absorbos may be very quickly fitted, the large or small variety being chosen according to cabinet size. Another expedient which fills the breach is to press into service four rubber door steps and, although these are not so resilient as the Absorbos, they are very effective.

Again, the reader can turn to a set of "silent castors," such as those purchased at Woolworths' for a copper or two a card. These are nominally for use on chair feet, but their smooth surface makes them excellent for fixing to the cabinet. They are shown in the accompanying photograph together with one or two other forms of feet mentioned in the article.

Failing the adoption of any of these suggestions, there is another good expedient which work quite well. Procure four small wander plug tops, coloured Clix insulators or something similar to this, and slightly recess the existing hole in each one so that the head of a countersunk brass screw will just slip inside. Screw these into the cabinet base, one at each corner, and the result will be a set with very neat and serviceable cabinet feet.

Testing Glowless Valves.

THE burnt-out filament of a "glowless" dull-emitter valve is hard to diagnose. Signals fail suddenly in the middle of the programme, and you cannot discover what the cause is. Even if you suspect a burnt-out valve, you are unable to confirm your suspicions without an ammeter.

You can test these valves quite easily with the help of a pocket compass. Quite a cheap compass will do for the test, the type that is sold to be carried on a watch chain. Switch off the set and put the compass close under one of the filament leads to the suspected valve. Move the set if necessary so that the compass needle points along the lead. Now switch on the filament battery and, if the valve is sound, the compass needle will swing round, coming to rest at an angle to the lead.

A Double Aerial Lead.

IT is very useful at times to have a double aerial lead from the aerial switch to the set. One lead is taken to the receiver in the usual manner, while the other lead is equipped with a series condenser of the fixed type. If provision is also made for clipping in such a condenser, the value may be varied in accordance with the immediate need or purpose in view. In this way it is easy to attach either lead to the receiver, whichever may be desired for use at the time, the use of the serics condenser thus being independent of the receiver itself.

Counter-sinking.

TO ensure a neat appearance, which is particularly desirable in the case of panels, it is necessary to countersink the screws to a uniform depth throughout, and the head of each screw should be just a little below the surface of the panel.

The simplest way of ensuring this is to make an experimental drilling first to suit the screw used, counting the number of turns of the brace necessary to do this and gauging the pressure applied. After this it is only necessary to repeat the operation carefully in an exactly similar manner, making the same number of turns for each countersink and applying an equal pressure throughout. With a little practice this becomes quite easy, and thus there is no need for gauging depth by the aid of any mechanical gadget. If the screw-head is sunk just below the panel, as suggested, it may be completely hidden by covering with a little cobblers' wax.

Ten Radio Quality Pointers.

1. Tune in signals of sufficient strength from a good broadcasting station. That's the foundation of good tone quality.

2. Employ the best possible amplifier, capable of the necessary amplification without distortion.

3. Use valves of sufficient capacity to handle the energy, particularly for the last or power valve.

4. Have ample H.T. voltage and current available for the various valves, so they may work at their full capacity at all times.

5. Employ the necessary grid biasing for all valves requiring same. A variable resistor, such as the "clarostat," will provide the precise balance between plate voltage and grid biasing needed.

6. By all means procure the best type of loud speaker for your set. It is sometimes wise to try out several types until the one that matches your amplifier and pleases your ear most is found.

7. There should be some form of volume control, for a set without a volume control is like an automobile without a steering wheel.

8. And, in addition to volume, there should be a tone control, in the form of a variable resistor across the secondary of the first audio transformer, or, better still, a variable resistor and $\frac{1}{4}$-mfd. condenser in series across the amplifier output.

9. Experiment with various positions for the loud speaker until the best results are obtained.

10. Always adjust the cone type speaker driving pin, with the speaker silent, to compensate for weather and temperature changes before starting a programme.

H.T. ACCUMULATOR HINTS.

It is important that the liquid in an H.T. accumulator should not be spilt on the case, or a conductive path will be formed which may result in leakage.

* * *

Perfect insulation is essential with H.T. accumulators, as any leakage, however small, constitutes a *continuous* discharge, so that even if the current is microscopically small the results can be quite comparatively serious in a few weeks.

* * *

H.T. accumulators require very careful charging at the correct rate and should not be entrusted to a "handyman" whose experience of charging is limited to the larger and more robust L.T. type of accumulator.

* * *

It is particularly important that only *distilled* water (obtainable at a chemist's) should be added to an H.T. accumulator to make up for evaporation.

* * *

Owing to its smaller capacity, the shorting of an H.T. accumulator is far more serious than the shorting of an L.T. battery.

* * *

Not only should the individual H.T. accumulator cells be kept clean and well insulated but it is especially important that rows of cells should be perfectly free from any tendency to leakage. (Owing to the great difference in voltage between adjacent rows, the utmost care should be taken to insulate one row from the next.)

MAKE YOUR SET SELECTIVE.

A very high order of selectivity can be achieved in a very simple manner where normally a set has only a single coil, tuned by a paralleled condenser, in its aerial circuit. A few feet of wire (practically any gauge with any covering will do) is roughly wound into coil form and tied to the aerial plug-in coil, as shown above. Aerial and earth leads are then taken to the ends of this new coil instead of the set. The bigger the coil the less the selectivity attained. Twenty turns is an average number.

THE "DERBY" THREE

This set is a real winner, both for distance and volume. The new standardised "P.W." loading coil is employed and the set can be switched from long to short waves without changing coils.

By THE "P.W." TECHNICAL RESEARCH DEPARTMENT.

"LONG and short waves without coil changing"—how nice it sounds! No fag of opening the cabinet and grappling with three or four badly-fitting interchangeable coils in its dark interior, only to find that you don't like the 5 X X programme, either, and so must do it all again to get back to the local, nothing like that, just a movement of one or two switches and you're there.

True, but did you ever stop to think what such sets must be like from the designer's point of view? The fact of the matter is that they are making his life a very hard one, as we have hinted before. With all the more modern neutralised H.F. types, especially those using a little screening, it was possible for a good designer to plan everything out carefully, have the set built straight away in its final form in the "P.W." workshops, and then put it on test in full confidence that, with at the most a few experimental modifications of minor details, it would at once give the expected results and be passed for publication.

Getting Rid of the Snags.

When we came to take up the question of "long-short" sets seriously, as we did some few months ago, however, we soon found that those happy days were over and strenuous times were ahead. We struck snags innumerable, and our one consolation is that in overcoming them (or devising ways of getting round them!) we have accumulated a mass of most valuable information which will be available to readers of our journals alone, and will enable us to give them wave-change sets from which the snags have been pretty thoroughly ironed out.

With most of these receivers we have found it necessary to revert to the experimental methods of the earlier days of radio, first building the set in a rough form, testing it out and finding it to be full of vices, and then settling down patiently to eliminate them one by one by a modification here, a slight change in lay-out there, then an alteration of some circuit detail, and so on, until we finally arrived at our goal of a well-behaved, efficient receiver. Some of these sets have already been published (e.g., the "All-Programme" Two and the "All-Programme" Three in "P.W.," and the "Quick-Change" Four in "Modern Wireless"), and many more complete sets, H.F. units, etc., are now finished and awaiting their turn.

The present design, the "Derby" Three, has been no exception to the general "perspiration and agony" rule, for it

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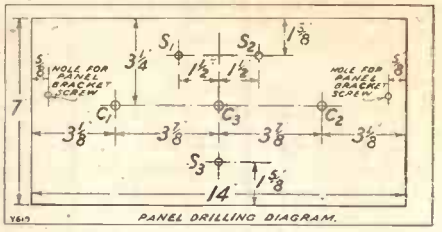
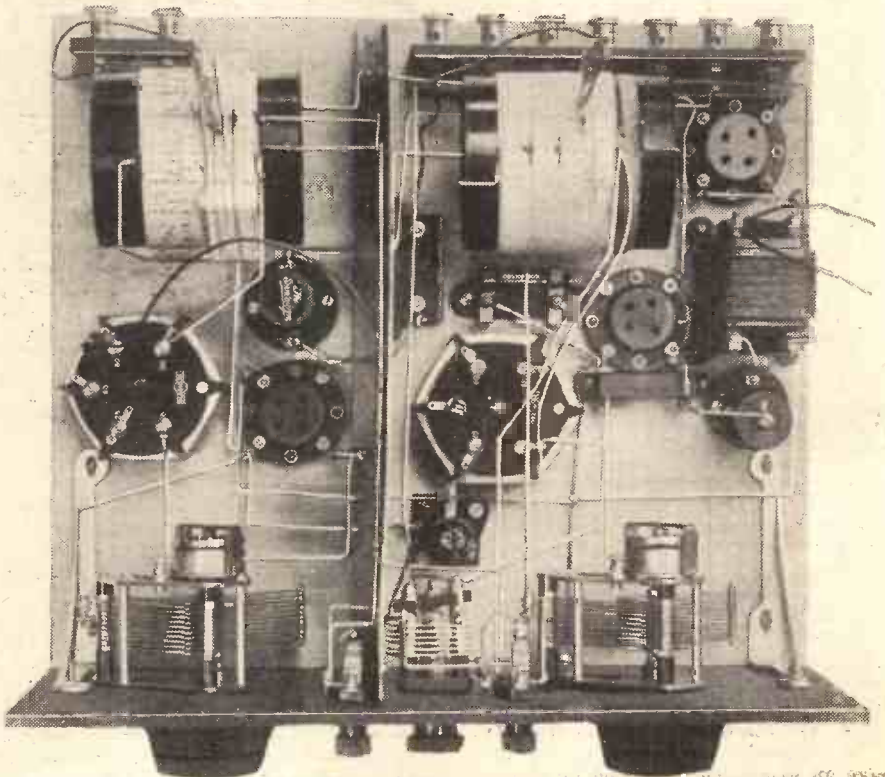


COMPONENTS REQUIRED.

- 1 Cabinet, 14 in. × 7 in. × 12 in. deep (Peto-Scott in original. Any of the usual make, Arteraft, Bond, Cameo, Caxton, Makerimport, Pickett, Raymond, etc.).
- 1 Ebonite panel, 14 in. × 7 in. × ¼ in. or ⅜ in. (Any good branded material).
- 2 ·0005 mfd. variable condensers with vernier movements (Dubilier "K.C." in original. Any good make).
- 1 L.F transformer (Any reasonably compact type. B.T.H. in original).
- 1 Neutralising condenser (J. B. or other standard make).
- 3 Sprung valve holders (Benjamin, Bowyer-Lowe, Burne-Jones, Lotus, etc.).
- 1 ·0001 mfd. miniature variable condenser (Ormond in original, Cyldon, Peto-Scott, etc.).
- 2 Push-pull on-off type switches (see text). (Lissen, Lotus, etc.).
- 1 Plain L.T. on-off switch (Benjamin, Igranic, Lissen, Lotus, etc.).
- 2 H.F. Chokes (any standard make).
- 2 Standard loading coils (Burne-Jones, Paroussi, Wearite, etc.).
- 2 ·001 mfd. fixed condensers (Clarke, Dubilier, Igranic, Lissen, Mullard, T.C.C., etc.).
- 1 ·0003 mfd. fixed condenser (ditto).
- 1 2-Meg grid leak and holder (Dubilier, Igranic, Lissen, Mullard, etc.).
- 2 Terminal strips, one 7 in. × 2 in. × ¼ in. and one 2¼ in. × 2 in. × ¼ in., or alternately, one strip 12 in. × 2 in. × ¼ in. to screw direct to back of baseboard.
- 9 Indicating terminals (Belling-Lee, Eelex, Igranic, etc.).
- 1 Sheet of copper, 11¾ in. × 6 in. × 1/32 in. thick.
- 2 Panel brackets.
- 1 Strip of wood, ½ in. × ⅜ in. × 22 in. long, for screen and terminal strip supports.
- Materials for broadcast-wave coils (see text).
- Quantity of No. 18 or 20 S.W.G. tinned copper wire and Systoflex or alternatively Glazite or Junit with Systoflex (not plain wire alone).
- 4 Tapping clips.
- 2 Grid-bias plugs and short lengths of flexible wire.



For an H.F., Det. and L.F. set with switching, the wiring is remarkably straightforward.

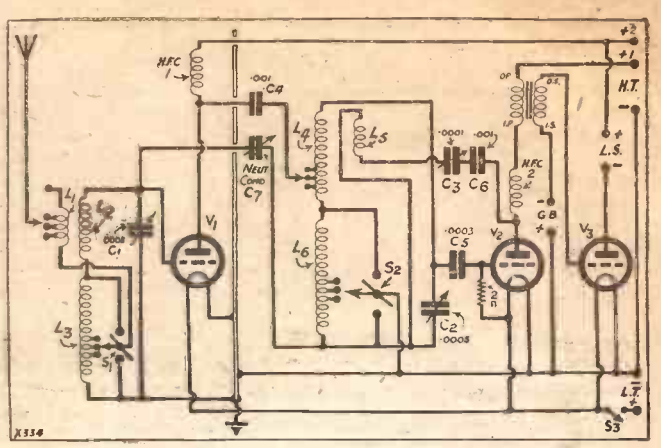
THE "DERBY" THREE.

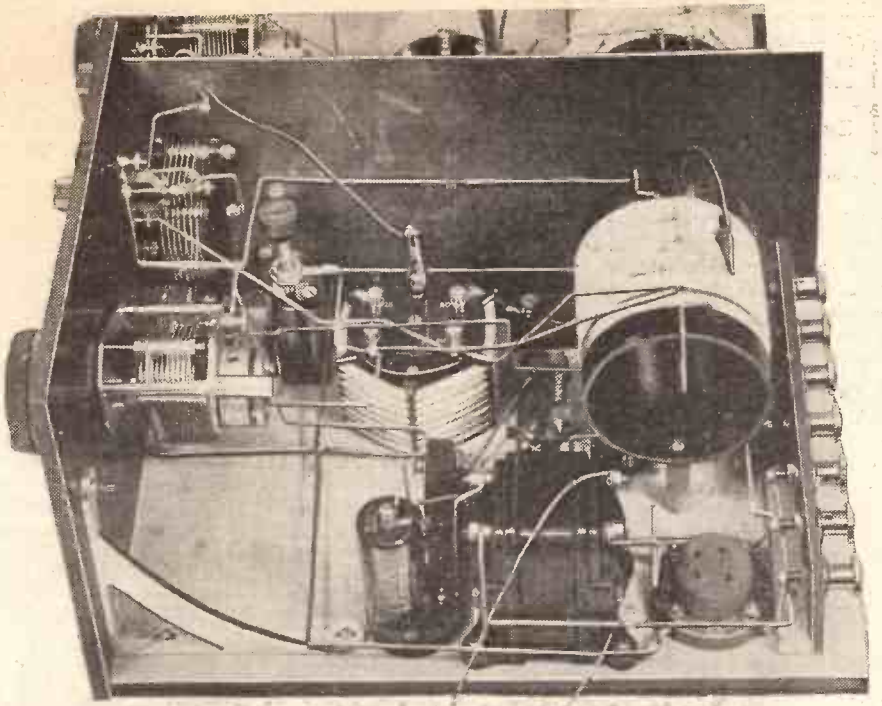
(Continued from previous page.)

caused us plenty of both before we got it down to its present efficient form. We had trouble with instability, trouble with unsatisfactory switches, trouble of all sorts, but patient experimenting devised cures, and the final result is good. We think you will like it, for it really is a sensitive "H.F., det., L.F." set, with which you can go from a short to a long-wave station simply by pushing a couple of knobs and re-tuning on the dials, an operation which any member of the family can perform, however non-technical they may be.

The final form of the circuit, as you will see from the diagram, is fairly simple, consisting of an H.F. valve coupled by the parallel-feed method to the detector, a simple reaction scheme, and one stage of transformer-coupled L.F. amplification. The main interest of the circuit lies in the special system of switching and the special devices for ensuring satisfactory working on both long and short waves.

The more advanced reader will be able to follow these out on the complete circuit diagram, with the aid of the explanations which follow. First, there is a semi-aperiodic aerial circuit, consisting of a tapped winding on one of the coils, the number of turns in use being variable in the ordinary way by moving a spring clip. This is wound over the top of another coil, to which it is thus tightly coupled, this latter being a secondary which, with its associated tuning condenser, forms the grid circuit of the H.F. valve.

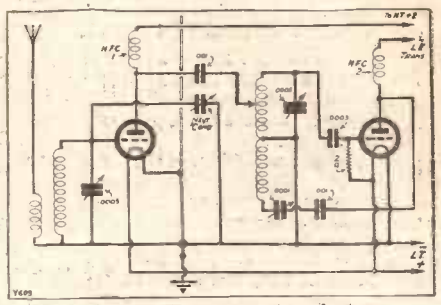




The tapping clip on the coil to the right governs selectivity and sensitivity on the short waves.

A very simple type of switch serves in at this point to short out a loading coil when working on the shorter waves, while when the switch is in the "open" position

(Continued on next page.)



This is the circuit arrangement on short waves.

POINT-TO-POINT CONNECTIONS.

L.T. + terminal to one side of the L.T. switch.

Other side of switch to one filament socket of each valve holder, and from the filament socket of V_2 to one side of the 2-meg. grid-leak holder.

Remaining filament socket of V_2 to the remaining filament socket of V_3, to the H.T. — and L.T. — terminals and to the copper screen.

Earth terminal to copper screen.

Grid of V_1 to bottom contact of neutralising condenser (C_7), to the top end of L_2 and to the fixed vanes of C_1.

"O" terminal on L_3 to the moving vanes of C_1, to the remaining filament socket of V_1 and to the copper screen.

Plate of V_1 to one side of the H.F. choke (1) and to one side of the ·001 fixed condenser, C_4.

Other side of C_4 to a tapping clip via a flexible lead. The tapping clip engages with the tappings on L_4.

The "216" terminal on L_3 to the bottom end of L_2 and to the top contact of S_1.

Centre contact of S_1 to the bottom end of L_1 and to a tapping clip via a flexible lead. The tapping clip engages with the tappings on L_1.

Aerial terminal to a tapping clip via a flexible lead. This tapping clip is for the tappings on L_1.

Top contact on C_7 to the "O" terminal on L_3, to the inside end of L_5 (reaction winding on broadcast-wave coil), to the moving vanes of C_2 and to the top contact of S_2.

Centre contact of S_2 to the copper screen.

Bottom contact of S_1 to the copper screen.

A tapping clip which engages with the tappings on L_6 is connected with the copper screen via a flexible lead.

Bottom contact of S_2 to the "216" terminal on L_6 and to the bottom end of L_4 (end nearest reaction winding).

Grid of V_2 to one side of the ·0003 mfd. fixed condenser and to the remaining side of the 2-meg. grid-leak holder.

Other side of the ·0003 fixed condenser (C_5) to the fixed vanes of C_2 and L_4.

Plate of V_2 to one side of the ·001 mfd. fixed condenser C_6 and to the top contact on the H.F. choke (2).

Other side of C_6 to the two sets of fixed vanes of the ·0001 mfd. reaction condenser C_3.

Moving vanes of C_3 to the bottom end of L_5 (reaction coil).

Bottom contact on the H.F. choke (2) to the IP contact on the L.F. transformer.

OP to the H.T. + 1 terminal.

Remaining side of the H.F. choke (1) to the H.T. + 2 terminal and to the L.S. terminal.

OS of the L.F. transformer to the grid of V_3.

IS to the G.B. — plug via a flexible lead.

Plate of V_3 to the L.S. — terminal.

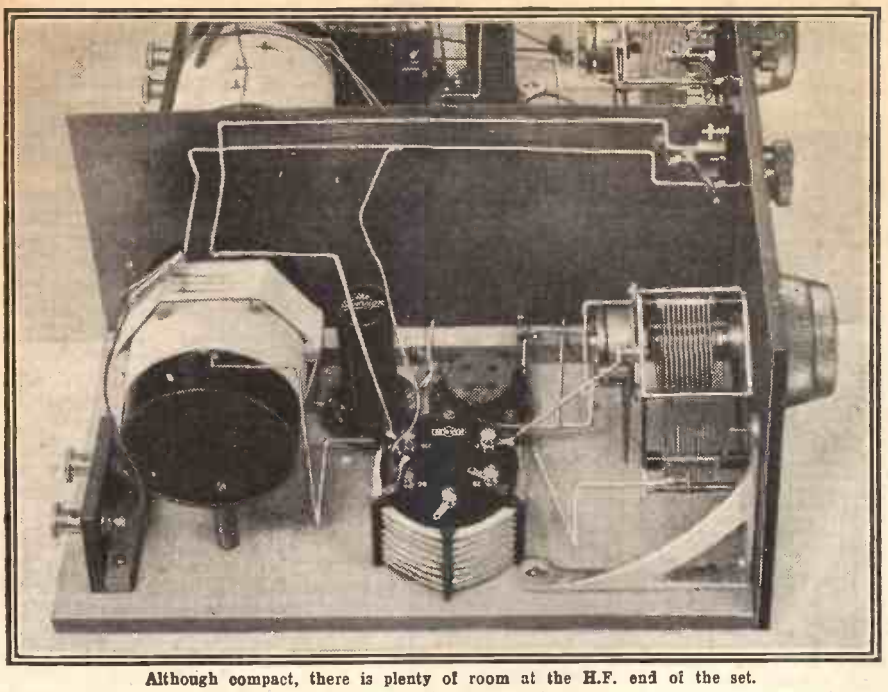
G.B. + plug via a flexible lead from the negative filament socket of V_2. This completes the wiring.

THE "DERBY" THREE.

(Continued from previous page.)

it automatically brings in the coil and also increases the number of turns in the aerial circuit, by bringing in an additional auto-coupling effect on the loading coil.

In the anode circuit of the H.F. valve is an H.F. choke, and from the anode end of this a lead goes off through a fixed condenser to the grid circuit of the detector, this being what is commonly called the "feed" lead. This lead carries a tapping clip upon its end, and this clip is placed upon a suitable tapping point on the detector grid coil. By choosing this tapping point carefully, a good degree of amplification and selectivity can be obtained with any given valve, and at the same time the set is stable without neutrodyning, since in addition to the stabilising effect of the parallel feed circuit, the set incorporates a moderate amount of screening.



Although compact, there is plenty of room at the H.F. end of the set.

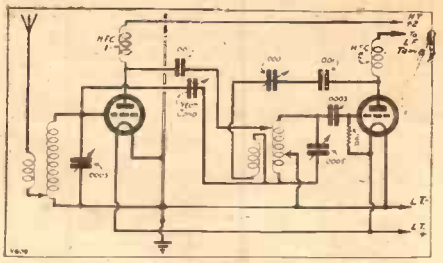
Long Wave Stabilising.

In this part of the circuit there is again a simple piece of switching, very similar to that in the aerial and secondary circuits. This time, however, the switch not only brings in a loading coil or cuts it out, but also on the long waves brings into play a tapping on the loading coil rather like the one on the aerial coil, but this time it introduces Hartley reaction to supplement the Reinartz reaction which is used alone on the shorter wave band.

Two separate diagrams are provided, one showing the H.F. and detector part of the circuit as it is used on the shorter waves, and the other the connections for the long waves, and these two will help you to understand the switching scheme. It should be added that on the long waves it was found desirable to add a simple neutralising scheme, since when the loading coil is switched in the feed tap automatically becomes rather high up on the grid circuit, and the set would no longer be stable. The neutralising scheme is automatically cut out when switching over to the shorter waves, where it is not needed.

If you find all this rather difficult to understand, don't conclude that the set is too complicated for you, but simply follow out the instructions, and you will find the set quite easy to make and handle.

Now for practical matters. First, there is the question of screening. You will see from the photos that a simple vertical copper or aluminium partition is fitted across the baseboard, and this, together with careful placing of the coils, is quite sufficient to ensure stability and freedom from interaction.



The circuit employed for long-wave reception.

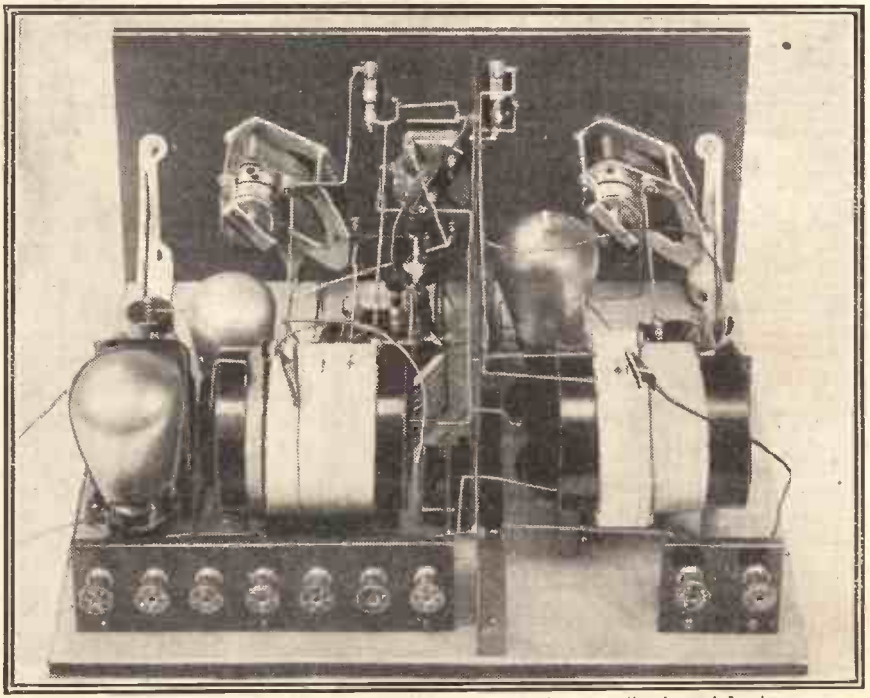
This screen is very easily made and fitted, since it can be of quite thin metal, and there are very few holes in it for the passage of wires. The sizes, positions for holes and method of mounting can be gathered from the wiring diagram and photos, while those who do not wish to make it for themselves should note that it can be obtained ready cut from Messrs. E. Paroussi, who can also provide the coils ready wound (also available from Messrs. Burne-Jones).

Making the Coils.

The coils are exactly the same as those used in the "Quick-Change" Four, and so you will find they can be bought ready made if desired. To make them yourself you will need two pieces of good insulating material, 3 in. diameter and 3½ in. long (Pirtoid tubes were used for the original set). The aerial unit carries a main winding of 60 turns of No. 24 D.C.C. wire, and over the top of this is the aerial winding, consisting of 25 turns of the same wire and in the same direction, with tappings at 10, 15 and 20 turns.

This winding is placed over one end of the secondary, and is spaced up above it by putting six or seven pieces of wooden rod of about ¼ in. diameter between in the way the photos show. If you cut these pieces of rod (the packing stick from a packet of Glazite provided the original material) about 1¼ in. long, and secure them in place

(Continued on next page.)



This photograph and the one above shows how the screening separation is carried out.

THE "DERBY" THREE.

(Continued from previous page.)

with a rubber band, you will find it quite easy to put the aerial winding on and then remove the band.

Leave all the ends free when you finish them off, with about an inch projecting, and then start the next coil.

This is the detector grid-circuit coil, which is wound on a similar tube, and consists of a plain winding of 60 turns of No. 24 D.C.C. wire with tappings at the 10th, 15th, 20th, 25th and 30th turns. Against the end of the coil nearest to these tappings is wound on in a single layer 30 turns of No. 34 D.S.C. wire in the same direction as the main winding, this being the Reinartz reaction winding for the shorter waves.

The method of mounting the coils in the necessary horizontal position is very simple. To each end of the tube a little piece of wood is secured with a brass screw passing outwards through a hole in the wall of the tube, and these wooden blocks or pillars are in turn secured to the baseboard. This is easily done by passing screws upwards through the baseboard into them. The height of the pillars, by the way, should be about 1½ in.

The loading coils are rather tedious things to wind, and you will probably prefer to buy them ready-made (see list of components).

The remainder of the work is of a very straightforward nature, and the only point requiring mention is this: the L.T. on-off switch is not very accessible when the set is complete, and therefore it is best to attach the necessary two leads to it before fitting the reaction and neutralising condensers in place.

Suitable Switches.

Just a word as to the wave-change switches required. The type required are those in which there is a central insulated plunger and two separately insulated side springs. Examples are the Lissen, Lotus and L. & P. "on-off" switches, the Lotus being actually used in the original set. With these you will find that you can make connection to the central portion by clamping the wire under the one-hole fixing bush, but it is very desirable also to solder a little piece of flex from here to the actual tip of the moving centre piece.

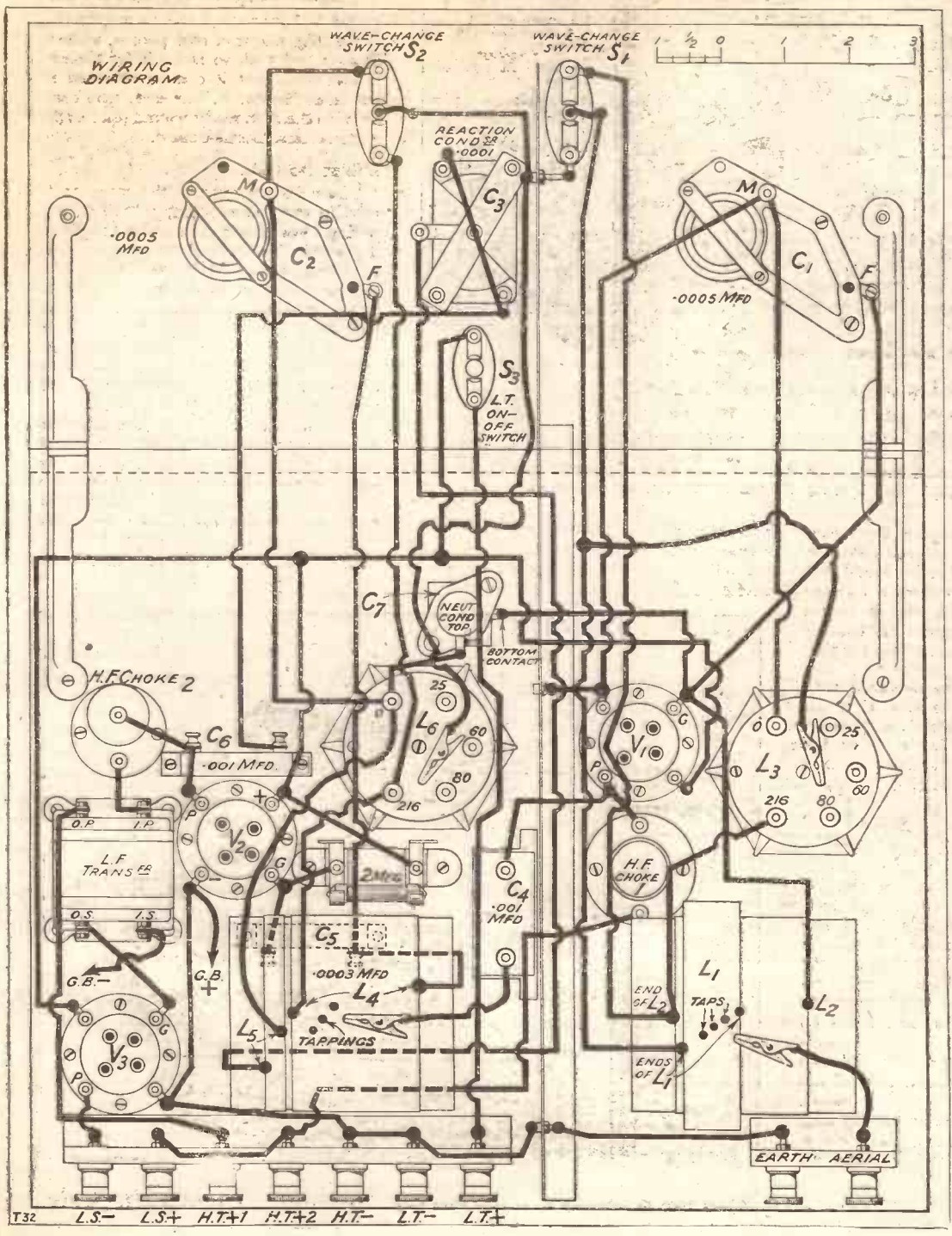
Now for operating details. First, you will want two valves of the H.F. type in the first two sockets (H.F. and detector) and one of the L.F. or small power in the last socket. Anode voltages will be about 45 to 60 volts on H.T. + 1, and 100 volts or a little more on H.T. + 2.

For the first test, place the aerial clip on one of the tapping points (or the end, of course) on the short-wave aerial winding. This governs the selectivity on the shorter waves. Next put the auto-coupling clip on the 60- or 80-turn terminal of L_3.

Now put the feed tap clip on the 10-turn point on the short-wave detector grid coil (L_4) and the tapping clip on the end of the flex lead from a point on the copper screen to the 60 or 80-turn terminal on the other loading coil (L_6). This governs the amount of reaction obtainable on the higher waves.

Now put the wave-change switches in the "on" position and test the set out on the low waves and determine the best position for the aerial clip and the feed clip for selectivity, volume and stability.

For the long waves, put the switches in the "off" position, set the reaction condenser at minimum, and adjust the neutrodyne condenser, starting from minimum, until the set is just nicely stable over the whole tuning range.



STOPPING POPPING

Do you know what "motor-boating" is? Further if your set "motor-boated" would you know how to cure the trouble? This article answers both questions and instances one particular and interesting example.

By H. J. BARTON-CHAPPLE, Wh.Sch., B.Sc. (Hons.).

IT really is surprising how small things in themselves can bring about most disturbing results as far as receiver performance is concerned. That being the case, it is incumbent upon every wireless experimenter, before *jumping* to any conclusions, to thoroughly overhaul his "accessories" and ascertain whether they are in perfect working order and that no defect has crept in since they were last employed. After this, attention can be focused upon the receiver in question, and, as a case in point, the following occurrence which happened to me is set forth to indicate to readers the importance of the preceding remarks.

A two-valve receiver employing specially designed apparatus had been constructed and was connected up on the test bench to undergo preliminary trials. Apart from the new ideas which had been incorporated, the set was essentially a detector valve with Reinartz reaction to which a low-frequency valve had been transformer coupled.

After running over the connections to ensure that nothing was apparently amiss the battery power was switched on. Instead of the anticipated reception on the loud speaker, however, the only sound that came through was violent popping noises, or what has been termed motor-boating, and the sound was sufficient to drown any signals from the broadcasting stations. I was convinced that the set had been wired correctly, but, to make doubly sure, every lead and connection was gone over again and found to be quite in order.

What is Motor-Boating?

Now, as some readers are doubtless aware, motor-boating is caused by a low-frequency reaction which can be produced by a high internal resistance (even a few hundred ohms) in the H.T. battery or the potentiometer in an H.T. eliminator which forms the common return path for the impulses from all the valves in the receiver. The tendency to motor-boating is usually at a low frequency, although actually these popping noises may appear at intervals of about one second, each pop comprising a group of frequencies which may be in the neighbourhood of a hundred cycles per second according to the characteristics of the particular circuit employed.

In those cases where one is using an inferior amplifying device which does not amplify the very low frequencies, motor-boating may be removed as far as audible sounds are concerned. Since the effects of such a tendency are present, however, they must, and actually do, affect the shape of the overall amplification curve of the receiver. This has been proved by investigations carried out at various times by research workers.

A Greater Tendency.

Furthermore, motor-boating has a greater tendency to occur in those receivers in which the first stage is resistance coupled, and this may be due to the fact that in such sets the signal on the plate of the detector valve is in the opposite direction to that on the plate of the output valve at the same instant, whereas if both stages are transformer coupled the signal is in the same direction.

For this reason, if one reverses the secondary connections of the transformer, the normal condition as regards signal direction is produced, but one is bringing into force a kind of low-frequency reaction which may alter the shape of the amplification curve, so that whilst this method is comparatively satisfactory it is not always to be recommended.

In the case of the set undergoing the tests mentioned previously, it was found that a reversal of the secondary connections of the transformer certainly stopped the motor-boating, this although there was not an R.C. stage preceding it.

Preventing Motor-boating.

It will be appreciated from the foregoing that motor-boating is usually the outcome of a defect in the source of the H.T. supply, and, while this may be minimised, and in many cases avoided, by the provision of large by-pass condensers, preferably more than 2 mfd. capacity, between each H.T. tapping and earth, it may sometimes arise that the internal resistance of the condensers used is sufficient to cause the trouble. To get a really satisfactory result many receiver designs are adapted so that the voltage to each valve is dropped to a suitable value by means of a series resistance, all the voltages being taken from the maximum tapping either of the battery or the eliminator when this device is employed.

Now, in the case of the two-valve receiver under review, a common H.T. was not employed, there being a separate H.T. tapping for the detector and the output valve, but no by-pass condensers were included in the circuit. At first the high-tension battery was not suspected. In this instance the battery was one which had been doing yeoman service for the past four or five months, namely, a Sac Leclanché H.T. battery. It was a large size model, capable of giving up to 30 milliamps without polarisation.

Above Suspicion?

Periodic examinations had shown that there was a complete absence of creeping or corrosion and a perfectly steady current supply was always available. The drop of voltage at the last examination was only 8 volts on the 108-volt battery, and it was for this reason that the fault was not attributed to the battery. It was then recalled, however, that since its last use the battery had been moved, and, wondering whether this had in any way affected its performance, a voltmeter was procured and readings taken. Terminals had been fitted outside the cabinet and tappings made so that voltages from 50 to 108 could be secured in steps of about 10 volts. From 0 to the 50 tap the voltmeter registered almost zero, whereas between 50 and 108 normal readings were shown.

Matters Rectified.

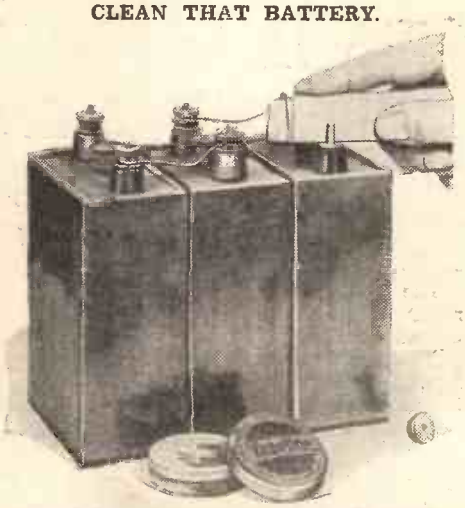
The battery cabinet was accordingly opened and an individual inspection of each actual unit made and the trouble was at once brought to light. One of the glass cell jars had somehow received a knock when moving the battery, with the result that it was cracked and the electrolyte had run away leaving the sac and zinc elements nearly dry. Apart from the voltage failure as a result of this it will be plain that a very high internal resistance had been introduced into the battery and this had undoubtedly caused the motor-boating.

While the occurrence can in no way be cited as a defect in the battery, being merely the result of a slight accident, the circumstance is interesting in emphasising the necessity of looking before you leap to conclusions.

The Cure.

A replacement of the damaged container immediately rectified matters, the previous low internal resistance and normal voltage of the wet battery were restored and the set undergoing tests was completely exonerated, giving excellent results as far as signal reception and general performance were concerned.

CLEAN THAT BATTERY.



The creeping, corroding acid will do dire damage to terminals on and the connections to your accumulator if you do not take simple precautions against the acid's action. Keep the terminals clean and bright, using sandpaper if necessary, and maintain a film of vaseline over all their metal parts.

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

"MOTOR-BOATING"

RESISTANCE AND CAPACITY—VALUE OF THE RESISTANCE AND CONDENSERS—SIMPLIFYING SCIENTIFIC REFERENCES, Etc., Etc.

"Motor-Boating."

I WAS writing the other day in these Notes about the well-known oscillating effect which often arises with mains-supply units and familiarly known as "motor-boating." Judging by the number of letters received it would seem that "motor-boating" is a trouble very commonly experienced and, therefore, it may not be out of place to give some further suggestions which have come to hand for a simple method of overcoming the trouble.

The tendency of amplifiers to motor-boat is generally due to interaction or coupling between stages, due to common coupling in the plate-supply unit. If a system of condensers and resistances is interposed between the plate-supply unit or mains-supply unit and the positive detector terminal, the motor-boating may be eliminated. The effect apparently is to reduce, or cut out altogether, coupling effects at the low frequencies at which such effects are the most troublesome.

Resistance-coupled amplifiers generally show a tendency to motor-boat, and the resistance and capacity arrangements which I am going to describe have been found to work satisfactorily with resistance-coupled amplifiers as well as with other types of amplifier.

Resistance and Capacity.

It is quite a simple matter to introduce the necessary resistance and capacity to any existing receiver. All you need to do is to connect a resistance between the positive detector terminal on the supply unit and the positive detector terminal of the receiver. There will be, of course, a direct connection between the negative terminal on the H.T. supply unit and the negative H.T. terminal on the set. Two condensers are then bridged across from the conductor which joins the two positive terminals to the conductor which joins the two negative terminals; one of these condensers bridges the two condensers at the other end of the resistance. If you like we can express it as follows: Connect the negative terminal of the H.T. supply unit direct to the H.T. negative terminal of the set; connect the positive detector terminal of the H.T. supply unit to the positive detector terminal of the set but through a resistance; connect a condenser across the H.T. negative and positive detector terminals of the set; and connect a condenser across the negative terminal and the detector terminal of the supply unit. It is found preferable to place the resistance close to the radio receiver rather than close to the supply unit.

Value of the Resistance and Condensers.

The value of the resistance depends to some extent upon the characteristics of the set and also those of the supply unit. In some cases 10,000 ohms will be found to be satisfactory, whilst in other cases 50,000 to 100,000 ohms will be necessary to prevent motor-boating. A value of about 50,000 ohms is generally satisfactory in most cases. The condensers should preferably be of about 2 microfarads capacity.

Simplifying Scientific References.

Everyone who has carried out any research work of whatever kind will have realised the difficulty of tracing references to published papers or accounts of previous investigations on similar subjects. It is obviously of the greatest possible advantage to a scientific investigator that he should equip himself with full knowledge of what has been previously discovered in the field to which he proposes to devote his labours, so as to avoid overlapping.

At the present day, owing to the immense amount of research work of all kinds which is going on in different parts of the world, and to the fact that the records of such research work are published in many different languages, the investigator finds it increasingly difficult to keep himself posted even on his own particular subject, let alone on other subjects which may be directly or indirectly related to it.

Scientific men during the past few years have repeatedly urged the great desirability of establishing a system whereby records of published papers may be made readily available, so that the difficulties of the scientific research worker may not be unnecessarily great.

A Dictionary of References.

It is, therefore, very gratifying to learn that a guide to sources of specialised information in Great Britain and Ireland is being published (and will be published by the time these Notes appear in print) which gives full references and cross-references to all manner of technical and other information. The work is known as the Aslib Directory and is edited by Mr. G. F. Barwick, formerly Keeper of Printed Books at the British Museum. Introductions are by Sir F. G. Kenyon, a Director of the British Museum, and Sir Ernest Rutherford, the late President of the Royal Society. The work is published with the financial assistance of the Carnegie United Kingdom Trustees, and is available from the Oxford University Press at the price of £1 1s. nett. As stated in the introduction, "It is to be hoped that scientific men as a whole will take an active interest in this important development, for the ultimate usefulness and success of the undertaking depends largely on the co-operation of all classes of the community."

(*Continued on page 523.*)

DRY BATTERIES IN PARALLEL.

The long strip of the flash-lamp battery is the negative terminal, and the short strip is positive. To connect two batteries "in parallel" the like strips are joined together. The total voltage remains the same (4½v.) but the capacity is doubled.

NEWS FROM SAVOY HILL. FROM OUR OWN CORRESPONDENTS.

SIR JOHN REITH FOR CANADA?

THE POLITICAL SHIMOZZLE—B.B.C. WEAKENS ON VIVISECTION, Etc., Etc.

Sir John Reith for Canada?

The Government of Canada has announced its decision to reconstitute Canadian radio on British lines with unified public service control. Newspapers in the Dominion have already begun to discuss the possibility of a raid on the B.B.C. staff. Naturally it is Sir John Reith who is wanted, if only for a temporary period. It is not known whether anything will come of this proposal. Savoy Hill is silent.

The Political Shimozzle.

The storm that has broken out over Party political broadcasting is a token of worse troubles ahead. The B.B.C. ought never to have agreed to any conference. If Savoy Hill had been properly advised it would have known that no Party conference would accomplish anything except a subsequent newspaper "dog-fight."

The B.B.C. has not announced its intentions under the inevitable "administrative order" system. It would be welcomed by listeners if advantage were taken of the present difficulties to wash-out the frequent broadcasts contemplated, and replace them by about four a year. This

(*Continued on page 522.*)

HOW TO MAKE A "LO-NOTE" LOUDSPEAKER

You can drive this easy-to-make loud speaker with quite a small set, but you will be surprised by its extraordinarily faithful reproduction and the bass notes it can handle. It is just the speaker you want for out-of-doors work.

By BERTRAM MUNN.

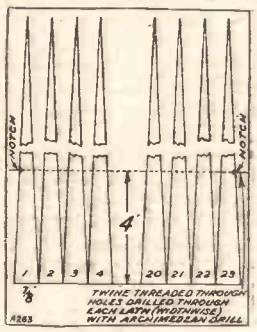
MANY people are getting tired of the loud speaker with the little trumpet. Hoping for better things, they turn to the cone. The cone is good. Of all types of loud speaker on the market at present it seems to hold the monopoly in low notes. Its chief disadvantage is that it tends to exaggerate them at the expense of the high notes. For a given output from the receiver its volume is considerably less than that of the horn loud speaker.

The trouble with the latter type is the horn itself. A low note of 50 cycles has a wave-length of nearly 22½ feet. But a high note of 5,000 cycles has a wave-length of less than 2¾ inches. The latter will undergo many reflections and reinforcements in an ordinary horn of 20 to 30 in. length, but the former wave will not.

Eight Feet Long.

Furthermore, the column of air in a small horn is insufficient to give good loading. As the horn is lengthened and increased in diameter, both the output and the low notes increase up to a limit. We are not, however, concerned with that limit—it means too big a horn for normal, homely purposes—all we modestly ask for is a reasonable compromise. We want some of those low notes and some of that extra volume.

About eight feet is a very nice length. It is neither too big nor too little. If it consists of a 6 ft. horn and a 2 ft. detachable bell, or flare, then we have an instrument which may be used in the garden in the summer and put away under the bed in the winter. Conversely, it may be used at the local club or dance hall in the winter and stood in a corner of the garage in the summer when motoring becomes the principal hobby.

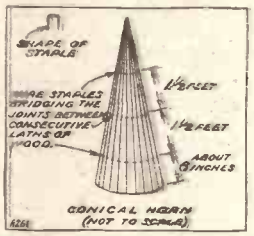


An 8 ft. horn is not the sort of thing one would—even if one could—purchase in the city and take home by bus and train. It is far safer and cheaper to make it oneself. The total cost of such a horn, made of wood and finished as shown in the illustrations, is under ten shillings, plus the unassessable value of one small and old tea plate.

Vast Improvement.

Remember, too, that the finished product will not only be the envy of all the neighbours, but also a source of justifiable pride to the maker and user. With even the cheapest unit attached it will give more volume and depth and fullness of tone than any commercial loud speaker you are likely to hear. That is, assuming the same output from the receiver.

Some idea of the vast difference made by adequately loading a diaphragm will be gained from the fact that, with a Brown reed-type *earpiece* attached to this horn, speech can be heard in the open air clearly over 100 ft. away. This, too, without overloading the earpiece, which would obviously rattle badly if as much power was used as is normally done in the case of the ordinary gramophone attachment type of unit. (In passing, it may be mentioned that the extra load of a 6 to 8 ft. horn greatly diminishes the tendency to diaphragm rattle or resonance).



You will require the following raw materials, tools and implements:

	s.	d.
25 6 ft. wooden laths, 1 in. wide (planed), i.e. ⅞ in. actual width. From a timber yard at 2s. 3d. per 100 ft.	3	4
1 tin of plastic wood	1	3
1 sheet of ⅛ in. strawboard, 30 by 40 in.	1	3
½ lb. of sheet glue (Scotch) and tube of Seccotine		11
2 bricklayer's lines (strong, thin twine) at 4d.		8
1 9 in. square of thick plywood		6
Coarse and fine sandpaper		6
Screws and small staples		6
Rubber ball, 4 in. in diameter		9
An old tea plate, 5½ in. in diameter.		
Total	9	8

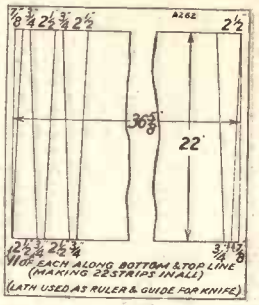
Archimedean drill, sharp pocket-knife, screwdriver, several pieces of thick broken glass, fretsaw (optional), Marpel stapler (advised).

Although you have 25 laths of 6 ft. each in length, you will actually require only 12 for the cone and 8 for the bell. But it is wise to buy the extra. Some of the laths will suffer from a surfeit of knots, others will be chipped or splintered, and others will be damaged during the process of manufacture.

Pick out the 12 laths most free from knots, or splintered or uneven edges, and cut each diagonally lengthwise, using one lath as a guide, which is laid diagonally over the lath to be cut. The cutting is done quite easily, for the wood is soft, if only you use a sharp, small-bladed knife and do not press too heavily. The secret is to take time and cut through the wood for a third to one-half of its length at a time.

Triangular Strips.

You have now 24 long triangular strips of wood, with a base of ⅞ in. and a length of 6 ft. The one side of the triangle is, of course, slightly longer than the other, but the difference is negligible. You require 23 of these strips for the conical horn. Discard the least desirable one. If necessary, you may cut a few extra ones out of the surplus laths, in order to replace any which may have been badly cut.

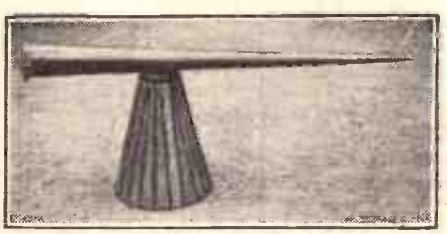


This is most likely to have happened where you have tried to cut through a knot and left a slight *protuberance* on the one side of the triangle. Slight indentations on a side do not matter, as these can afterwards be filled up with plastic wood. Smooth off the edges with sandpaper.

Threading the Laths.

With a small Archimedean drill (or, if you wish, with a red-hot darning needle) make a hole *widthwise* through each triangle at a distance of 4 in. from the base. Again, do not hurry and do not exert too much pressure, and the work can be done quite easily without splitting the wood.

The bricklayer's line (or strong, thin twine) is waxed at one end and threaded through each of these holes. Slide the strips of wood along to touch each other and leave about 12 in. of twine projecting at each end of the "necklace" of triangles. Seccotine is now run along each edge of each strip of wood. Also, on the twine, which is



The first section of the loud-speaker horn completed.

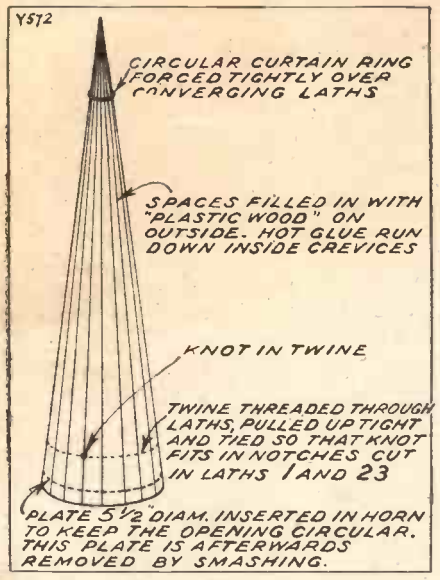
(*Continued on next page.*)

HOW TO MAKE A "LO-NOTE" LOUDSPEAKER.

(Continued from previous page.)

drawn backwards and forwards through the holes to draw the glue into them.

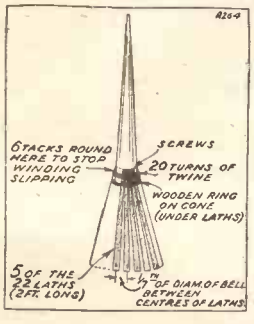
Obtain the aid of an assistant who does not mind a little glue on his hands. A roughly formed conical horn is now made by bunching together the pointed ends of the triangular strips of wood, while the bases are also drawn together by means of



the twine, which is pulled up as tightly as possible and tied in a knot, which must on no account afterwards slip.

Fixing the Cone.

Bind the apex of the cone with some string (not the bricklayers' line). The rubber ball (of 4 inches diameter) is now dropped down the mouth of the cone and pushed in firmly enough to force the strips of wood very slightly apart and, of course, to make them form the circumference of a circle. String is bound round the point where the ball comes to—about half-way along the cone—sufficiently tightly to pull the strips of wood into intimate contact. The resilience of the rubber will allow this. If not, remove the ball and try again.



In the large end of the cone is now forced the old 5½-inch tea plate, so that it is at right-angles to the axis of the cone. It should be a reasonably tight fit, to make the mouth of the cone circular. If the twine has been pulled up and tied rightly there is no fear of the strips of wood being forced apart.

Coming now to the smaller half of the cone, the string at the apex is wound so that the individual strips of wood may be eased into position *at a point about 1½ feet from the apex*, the object being to see that none of them sag or bend inwards. When this has been done a curtain ring about 2 to 2½ in. internal diameter is forced firmly over the outside of the cone in order to grip it together at this point. Failing the ring you can bind it with string. The ring is better, as it does not "give" like string.

The points should then be arranged and string wound round the apex and at several other points about 1½ ft. apart.

If you examine the individual strips of wood which make up the cone you will find that they gape a little on the outside but touch on the inside of the horn. It is advisable to run Seccotine along the joints, not to fill them up completely, but to ensure that the whole of each length of wood is well glued. Or, hot liquid glue may be painted along the crevices. But see that it is really hot and thin, and do not let it flow over the string bindings or the curtain ring, for you will want to remove these later.

Extremely Rigid.

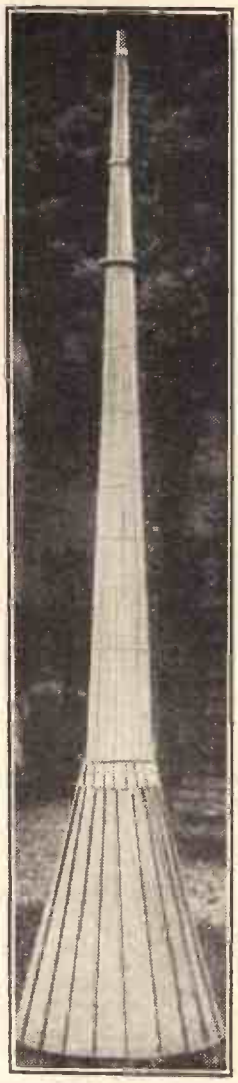
At this point, or even before, you should be agreeably surprised at the rigidity of the cone and its comparative symmetry.

Give the cone a day to set, and then fill up the crevices with plastic wood, using the blade of a knife to smooth it into place. The plastic wood, by the way, should be soft and moist and reeking of "pear drops." If it is not you have bought old stock.

At the end of the second day, when the wood should be firmly glued and the plastic wood well hardened, remove the curtain ring and the bindings and, with a razor-edged piece of broken glass, scrape along the joints. Shavings will come off and the surface will begin to assume an even contour. It is best to try scraping first one way and then the other according to the way of the grain, so as to raise as few splinters as possible. Finish off with coarse and then fine sandpaper.

Sufficient wood should now be sawn off the apex of the conical horn to leave an *internal* diameter of just over half an inch.

Describe an 8-in. circle on the square of 3-ply wood. In the exact centre of this circle stand the cone, base downwards, marking with a pencil the exact shape of its circumference (which will not be a perfect circle, but slightly polygonal). A mark should also be made on the side of the cone and on the circle for registration purposes later.



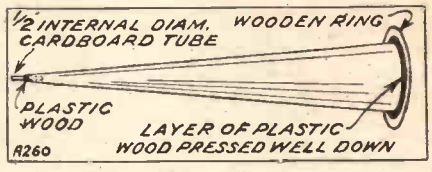
This photo of the speaker, taken before it was given its finishing touches, clearly shows its method of construction.

Further Treatment.

A wooden ring, about 1 in. wide, is required to fit tightly round the large end of the cone, therefore cut with a fretsaw round the inner and outer circumferences marked on the plywood. Any carpenter or cabinet maker can do this job if you haven't a fretsaw. The inner circle should be cut slightly *inside* the pencil line, in order to ensure a tight fit.

Procure a poker, smash the plate, put your hand down the cone and pull out the rubber ball.

The wooden ring is now Seccotined and forced over the outside of the cone so that



it fits closely and as near to the base as possible. If the cutting has been correctly done, the pencil marks on the cone and ring will show you the exact position to obtain the firmest and most accurate fit. Half a dozen fine steel screws are screwed from the inside of the cone into the edge of the wooden ring and a layer of plastic wood is moulded round the joint.

Tie a piece of sponge on the end of a lath, soak it in very hot and fairly thin liquid glue for a few seconds (to heat the sponge thoroughly), and coat the inside of the horn liberally with glue, so that cracks and crevices are well filled. When you do this keep the base downwards so that no rivulets of glue run down into the small end. Keep the sponge soaked in hot glue as much as possible, otherwise as the glue cools on the wood it will be apt to peel up or form into little blobs. The glue coating not only strengthens the horn, but also renders the wood less absorbent to sound.

Making the Flare.

A cardboard tube of ½-in. internal diameter for the input end is made by winding a strip of Seccotined brown paper (about 3 in. by 2 ft.) round a stick. It is then glued into the small end of the cone and well packed round with plastic wood. See that the glue and plastic wood are well set before attempting to attach a loudspeaker unit.

Before making the bell or flare, try the cone itself as a horn. It should be an immense improvement on your present horn, but when fitted with the bell it should reach down into the lower notes to the extent of another one or two octaves.

The framework of the bell is composed of twenty-two laths each 2 ft. long. A hole is drilled widthwise through each of these laths at a distance of 1¼ in. from the one end. They are then threaded on twine, slid along to touch each other, the twine Seccotined (as before), and then tied with a knot which will not slip.

The cone is held base downwards and the necklace of 2 ft. pendants slipped over, so that when they reach the ring they spread outwards.

(Continued on page 522.)

THE B.B.C. THROUGH AMERICAN EYES.

The Editor, POPULAR WIRELESS.

Sir,—I am sure we should all be grateful to you for putting Dr. Henderson's views before us, though we cannot—all of us—be expected to agree with all that he writes. I must confess I do not understand what he means when he says that its most enthusiastic supporters do not listen to the B.B.C. programmes, while his Puritan enthusiasm for its Sabbath fare leaves me gasping! I agree that most of the dance music is beastly, but 99 per cent. of it hails from America, anyway!

It is very gratifying to hear his views on the Sports Commentaries and on the general level of excellence of the London programmes and of the orchestral and band items. One ventures to hope that Lieutenant Walton O'Donnell will not be "sold" to the U.S.A. by the Corporation. One ventures also to hope that the B.B.C. will not let "those bright boys the Announcers" loose a bit—it is a matter largely of national temperament, and would not "go down" here at all well.

As regards drama I am hardly competent to express an opinion, as I never listen to it—for precisely the reason given by Dr. Henderson—but his strictures on the news bulletins are dead on the nail—they are by far the weakest feature of the whole programme.

Lastly, Education—our American college don must remember that over here this is still rather a sore point, and many folk object strenuously to being forcibly and consciously educated. The American, on the other hand—if one may say so without offence—has a passion for absorbing (without necessarily assimilating) vast quantities of very superficial knowledge, a process which radio is very well fitted to assist.

Thank you, Dr. Henderson, though I personally don't want "dignified, emotional, back to the homestead uplift" on Sunday via radio. Luckily the Continent is available for "them as wants it."

Yours faithfully,

G. M. PART.

Surrey.

HOME BROADCASTING.

The Editor, POPULAR WIRELESS.

Dear Sir,—Re the letter of "VERY PUZZLED," Manchester, who thought it necessary to speak into a microphone before speaking could be heard. It may be interesting to him and others to know that if a loud speaker is connected in one room to the input terminals of a one or two-valve amplifier in another room, conversation can be carried on.

Every word and sound made in Room One can be heard in Room Two where the amplifier is installed, by this method.

No set or anything else is needed, just an amplifier.

Connect the low tension, high tension and grid bias to the amplifier in the usual way and connect the extended leads from the loud speaker to the input terminals on amplifier. It will be found that about 60 volts or less is ample.

I am a regular reader of POPULAR WIRELESS, and I look forward to it every week, and enjoy every page of it.

C. G. BAYNE.

Walworth, London, S.E.

CORRESPONDENCE.

THE B.B.C. THROUGH AMERICAN EYES

HOME BROADCASTING—A FOUR-VALVE UNIDYNE.

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 FOUR-VALVE UNIDYNE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have been very interested in the letters which have appeared in POPULAR WIRELESS about the Unidyne sets. I built the three-valve Unidyne which appeared in your issue of Dec. 12th, 1925, keeping the lay-out just as you described it, using the Thorpe-K4 valves, and 6-volt accumulator. It gave very good results, but I found very little amplification with the L.F. valve.

Some six months ago I tried the Aneloy Products valve, which takes ·09 ampere 30 ohms resistance, and 6-volt accumulator. My rheostats were 15 ohms, so I fitted 15 ohms fixed resistance, total 30 ohms. I found when I used these valves that the amplification on the last valve was greater, so I built it into a four-valve H.F., Det., and 2 L.F., Aneloy Products valves, 6-volt accumulator, and 2 L.F. transformers. All the old parts out of the old set were used. When I tried out the set I had amazing results. The set is now the three-valve as you described it, with one more stage of L.F. using another transformer.

With this four-valve set I can pick up Daventry, 5 X X, Hilversum, Zeesen, Radio-Paris, etc., loud-speaker strength, 5 G B, Langenberg, Stuttgart, Hamburg, Manchester, Newcastle, and most of the stations of reasonable power at loud-speaker strength. I also use a Brown's amplifier worked with 6-volt Leclanché battery (no valves) for weak stations when necessary. As Mr. F. W. White's letter in your May 5th issue states that to constitute a Unidyne no H.T. is used, I myself have no H.T. at all, only the 6-volt accumulator. I intend to experiment further with the set before building up finally. This information I thought would be of interest to Mr. F. W. White and others. Wishing your paper every success.

Yours faithfully,

R. N.

York.

THE "HANDYMAN" TWO.

The Editor, POPULAR WIRELESS.

Dear Sir,—I am writing to tell you of the splendid results I have had with the "Handyman" Two, described in "P.W." of February 25th. At first I eyed the ·0005 secondary condenser with suspicion, and I did not think it would tune down to 20 metres on the short waves. I have given it a thorough test on both short and broadcasting waves. I have now scrapped my old short-wave set.

A few nights ago I got 5 S W and P C J J at such good strength that they were able to be heard on the loud speaker. I do not say the strength was loud, but it was well worth listening to. On the broadcasting band the local station (Cape Town) comes in at very loud loud-speaker strength (it overloads an Amplion A.R.15). J B (900 miles) and Durban (900 miles) come in at fair headphone strength. This is not so bad considering I have a very poor aerial.

I have tuned in 5 S W several times in broad daylight.

Yours faithfully,

G. V. N.

Cape Town, South Africa.

THE "ALL-PURPOSE" THREE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I got the "P.W." yesterday and hooked up Mr. Thomas' "All-Purpose" Three.

Daventry, Hilversum, and Paris (1,750 metres), with another station on the long waves.

Glasgow (30 miles distant) on the loud speaker, with seven continentals and more than a score others on the 'phones.

I wrapped five turns of bus-bar on a coil former. With seven turns 30 D.C.C. as a reaction coil, have received P C J J, 2 N M and several amateurs. Somewhat sceptical, I turned below 2 N M to-night and found a transmission of music coming through fairly strong. I did not think it could be anyone outside Great Britain, but I was agreeably surprised when the announcer gave the information that I was listening to 3 L O, Melbourne!

I would now state that this reception is on two valves only. I hadn't the necessary parts handy to complete the second stage of amplification!

Best of success to "P.W."

Yours truly,

Q. V. S.

Dunblane, Perthshire.

The Editor, POPULAR WIRELESS.

Dear Sir,—Hearty congratulations to Mr. L. H. Thomas on the "All-Purpose" Three; very successful on all waves. I especially congratulate him on the coils; their simplicity is their great recommendation after, as he says, "spending hours making elaborate air-spaced coils."

It's easily made, cheap, and efficient. I used a ·0003 variable, plus a ·0003 fixed for tuning, and a ·00001 for the aerial instead of the C.A.V.

Best wishes to Mr. Thomas, and more power to his arm, and to "P.W."

Yours faithfully,

"OLD READER."

Essex.

BUILDING YOUR SET.

IF you are building up a set from merely a theoretical diagram, here are some hints.

I think that it is generally accepted that the "panel and baseboard" system of mounting is the best. As to the thickness of the actual panel, ¼-in. ebonite may be preferred for technical reasons; but it will be found that, for all practical purposes, $\frac{3}{16}$ in. is easier to use. Incidentally, it is always advisable to obtain ebonite of some recognised brand.

"That Way Oscillation Lies!"

It is, I find, a good plan to arrange the components loosely on the baseboard before screwing down, to find the best positions as regards wiring. Now, *don't* put the aerial and earth at one end of the baseboard and the H.F. valve at the other. It is no use trying to arrange a baseboard symmetrically, with the valves all in a nice little row and the wires running side by side. That way oscillation lies!

I have found that one of the best plans for wiring is to fix the terminal strip on the right-hand side of the baseboard, the tuning condenser on the right-hand side of the panel, and the H.F. and Det. valves in any convenient place behind the condenser (at a suitable distance, of course). This lay-out will result in short A, E, and H.F. leads, especially if the coil holder is placed still further back, behind the H.F. valve.

Finally, don't forget to allow plenty of room for the actual valves while wiring up.

Some Wiring Hints.

The position of the L.F. transformer recommends itself when the input side can be directly facing the Det., and the output is just by the L.F. valve.

Small items, such as fixed condensers, grid leaks, and so on, can generally be supported by their own wiring. With reference to the coil holder, as it is frequently inconvenient to have flexible leads spreading all over the baseboard, a good "stunt" is to solder a *short* flexible connection from the coils to the wires which run to them.

Don't use more wires than are necessary.

Do keep those H.F. leads short. If you do this, and keep your coils a respectable distance apart, the plan will speak for itself in no uncertain terms.

ITEMS OF INTEREST.

DIFFICULTY in obtaining reaction effects where resistance coupling is used is often due to the fact that a by-pass condenser of about ·0001 mfd. capacity may be necessary, one end of the condenser being connected to the H.T. and the other end to the junction between the reaction coil and the coupling resistance.

* * *

In a few years' time the standard electrical voltage for the British Isles will be 230 volts A.C. (50 cycles).

* * *

The valve tubing supplied for ordinary bicycle tyres makes an excellent cover for slipping over the ends of wires where the insulation gets frayed and untidy.

* * *

Any ordinary receiving set can easily be converted for short-wave reception by the provision of the "Antipodes Adaptor."

* * *

Liquid flux is extremely handy for cleaning a soldering iron, though generally it cannot be used easily for set-wiring, owing to its tendency to "splash."

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

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

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

QUESTIONS AND ANSWERS.

THE "ANTIPODES ADAPTOR"—STAR MODEL.

A. S. F. (Charlton).—"I am very interested in the 'Antipodes Adaptor,' but should like to know if the American and Australian stations are easily get-able at this time of the year, or only in the winter?"

The American stations "roll" in on almost any evening after about 11 or 12 o'clock, but this can hardly be said of the Australians just at present. They can certainly be heard, but atmospherics are on occasions very troublesome. Do not, however, let that deter you—there is always something interesting to hear below 60 metres.

The Melbourne Station which transmits on Sunday evenings between 8.30 p.m. and 10.30 p.m. B.S.T., and most of the Americans, which can be heard almost any evening of the week, will probably be found, as was the case in the original adaptor, between 20 and 30 degrees on the tuning dial.

Given reasonable conditions, you will not have much difficulty in logging quite a host of stations.

As a concluding remark it would perhaps be as well to mention that this adaptor can be used successfully with *any* straight set provided it has got one or more L.F. stages. The fact that there may be one or more H.F. stages preceding the detector in your set does not matter in the least, and the plug from the adaptor should be taken direct to the detector valve's socket.

PORTABLE EARTH FOR THE "SUMMER" ONE.

L. W. (Orpington, Kent).—"I am making up the 'Summer' One which was described in 'P.W.,' No. 312 (May 26th issue), but I am a bit puzzled about the earth. What is a handy method of obtaining an earth connection for a portable set? I suppose there is no way of carrying the earth *inside* the case, is there?"

If you are picnicking near to a stream with a portable set an excellent earth is obtainable by connecting a lead to any fair-sized piece of metal and throwing this into the water. A tin can, kettle, or similar utensil will serve excellently.

One of the handiest portable "earths" is a metal rod, such as a stair rod. This should be pointed at one end so that it can be pushed down into damp soil, the other end carrying the earth wire.

An earth-pin of this type could easily be carried inside the case of the "Summer" One, and if you will refer to the photograph illustrating the original article (see page 453) you will see that there is plenty of space available for a short rod inside the case behind the head-bands of the 'phones.

Don't forget that with such an earth it is important to make a good contact (preferably soldered) between the flex lead and the earth pin. The earth pin should, of course, be driven into soil as damp as it is possible to find. It goes in easily there and the contact is a better one.

(*Continued on page* 516.)

APPARATUS TESTED

THREE-VALVE SHORT-WAVER—A USEFUL GADGET—WELL MADE BATTERIES—NEW MULLARD P.M. VALVE.

* *

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

THREE-VALVE SHORT-WAVER.

WE recently received a Selector Short-Wave Three Receiver from Selectors Ltd., 1, Dover Street, London, W.1.

The set comprises a grid-leak detector circuit, followed by two transformer-coupled L.F. stages. The aerial, grid tuning, and "Reinartz" reaction coils are all wound on one former, which is of the low-loss skeleton solenoid type. The former upon which these three coils are wound is arranged to plug into a special low-loss base, and is interchangeable; thus a wide range of wave-lengths can be covered with this receiver.

The detector stage is well arranged and is screened all round.

The front of panel appearance of the set is very pleasing. Two handsome slow-motion dials are placed one on the left and one central; while on the right a jack, which automatically switches on the filaments, is provided for 'phones or loud speaker. The actual panel, which is of metal is finished off in brown, and gives the whole set a pleasing appearance.

The set is primarily designed for the loud-speaker reception of distant stations, but it is of course impossible to guarantee consistent L.S. reception of short-wave stations on account of the constantly changing conditions.

The actual tests of the set have lasted over a considerable period, during which time the set has given consistently good results, and countless short-wave stations have been heard. On the majority of nights upon which tests were made, almost without exception it was found possible to hear one or more of the powerful American stations such as 2XAF, 2XAD, and KDKA, on the loud speaker.

With regard to the Australian stations, several of these were heard during the tests, and on occasions it was found quite possible to hear them, particularly 3LO on the loud speaker.

For anyone interested in short-wave reception, this set is certainly an attractive proposition. It incorporates good components, and, used in conjunction with a loud speaker, it is quite simple to operate. Contrary to the usual run of short-wave sets, this set would make a worthy addition to the furniture. When telephone receivers are worn, some capacity effects are noticeable, but, having the two stages of L.F., the majority of stations can be tuned in direct on the loud speaker with little trouble.

The price of this short-waver is £14 10s., which appears to be, in the circumstances, a reasonable price.

(*Continued on page* 520.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 514.)

FOREIGN STATIONS ON THE "INDUCTO-CRYS."

L. W. S. (Thornton, Leicestershire).—"I have been a constant reader of POPULAR WIRELESS from almost the very first number. I thought you would be interested to hear from one who has not written before. It concerns the crystal set described in 'P.W.,' dated April 7th, the 'Inducto-Crys,' for which I thank you very much indeed.

"I built it on the Saturday following, on the Monday I tried it out. I received 5 N G, 5 G B, 5 X X, then later on in the evening I got five (5) German stations, two of them were Langenberg and Frankfort. I could not identify the others.

"But wait, more to come. On Saturday night, April 28th, I was listening to one or two of them again. I understood the announcer to say something about New York, so I waited.

"At last it came (about 12.50), 'Please stand by. This is W G Y calling at G.E. Co., New York." And then he said they were going over to the Ritz Carlton Hotel to hear the speeches at a large gathering. And after, I gathered from the speeches heard that it was the reception of the Atlantic airmen, (the two German airmen and Captain Fitzmaurice).

"I believe I should have heard every word had it not been for the German station fading now and again. Would you please tell me which station it was that relayed it? It must have been one of high power. My aerial is only 20 ft. high, and screened by trees and a large house. Is this unique for a crystal set at such a distance? Thanking you again for such a splendid circuit, and wishing 'P.W.' every success."

From the reports of this transmission we think that the station you heard was Stuttgart which, together with several of the other German stations, successfully relayed the proceedings from W G Y (Schenectady, New York). Other readers in the Midlands noticed how well received was Stuttgart, though we think you are the only one who reported picking him up on a *crystal set*. Congratulations!

NEUTRALISING A TUNED ANODE.

L. T. H. (Rugby).—"How can I neutralise a tuned-anode set? (I might say that I might have saved myself a lot of trouble and recriminations if I had asked you that question a week ago. I was not very clear about the connections, and in trying to do it myself, I burnt out a valve!) If possible, I want to use an ordinary neutralising condenser and a plug-in coil."

The holder for the plug-in neutralising coil should be mounted close up to the holder for the tuned-anode coil so that when the coils are plugged in they are coupled close together. The neutralising condenser should be mounted near to the neutralising coil, and then these two should be joined together by a short wire.

The only remaining connections are (a) a lead from the free side of the neutralising condenser to the earth-filament lead, and (b) a lead from the remaining neutralising coil-holder terminal to the grid of the tuned-anode H.F. valve.

Neutralising is carried out in the ordinary way, but it may be necessary to reverse the leads to the neutralising coil (or, if more convenient, to the anode coil, as these two must be in correct relation to each other).

OVERCOMING HUMMING.

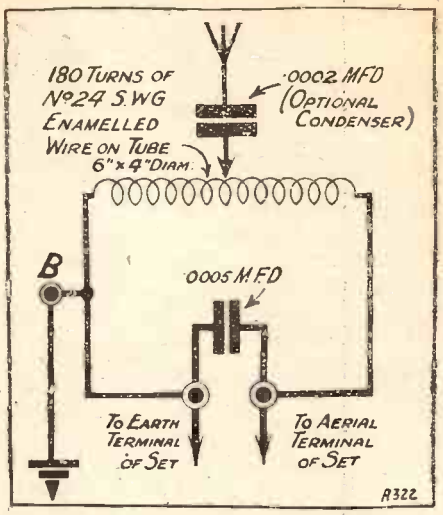
Sometimes the questions asked and answered in the "Radiotorial" columns remind readers of experiences of their own, in which they discovered for themselves unexpected remedies or results.

Such experiences may be extremely helpful to others, so in this connection we are glad to publish below a letter to the Editor from a Hornsey reader, who solved his interference problem very ingeniously by means of the balancing-out effect obtainable with an ordinary old-fashioned tuning coil and slider.

The letter states: "I have been a keen and interested reader of 'P.W.' for many months now, and I have noticed from time to time from your 'Radiotorial' Queries and Answers that quite a number of readers experience rather unpleasant interference from near-by tramways or other electrical pieces of apparatus, more especially from the electric light in their own houses.

"In this latter case, interference is usually in the nature of a hum, which quite spoils the reception. For quite a time I myself experienced this form of interference, perhaps more

(*Continued on page* 518.)



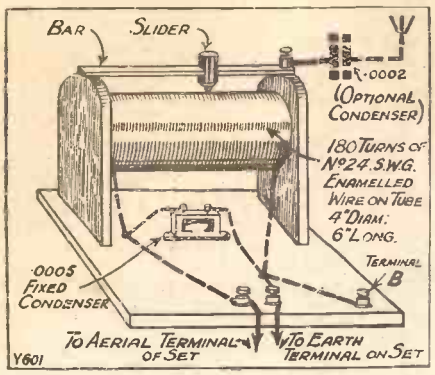
RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 516.)

so because I use an indoor aerial, and I am so placed that it is impossible to erect an outdoor aerial, owing to large, outspreading trees.

"But one day, whilst experimenting with my most recent set (1928 'Chitos' 1 valve) I discovered that by employing an old 'coil and slider' I was able to cut out interference of this sort completely, whilst at the same time the apparatus acted as a very efficient wave-trap.

"I thought that such an apparatus, simple though it is, might be of use to your readers, so I enclose diagrams herewith. Trusting that



these diagrams might be of use to your readers, I remain, yours faithfully, R. N. C. D. (Hornsey)."

The diagrams given above are self-explanatory, and R. N. C. D. mentions in a postscript that for the ordinary broadcast band of wavelengths the slider is usually about two-thirds from one end, but the best position must be found by trial. For 5 X X the slider is adjusted about half-way along the coil.

SHOCKS FROM THE TELEPHONES.

A. J. B. (Saltley, nr. Birmingham).—"I have two pairs of telephones, wired in parallel to the set, and from the first of these I can always get shocks by touching with the finger, if I am standing on a particular part of the linoleum covered brick floor near the receiver. I have taken the earpieces from the headpiece, and find that these shocks can only be obtained from one particular earpiece.

"I have examined this, and find nothing wrong with it. Furthermore, similar shocks are experienced if earth or aerial terminals are touched while wearing telephones, with set working. But the other pair of telephones if fitted in this same position do not give shocks at all.

"A few nights ago I was unpleasantly surprised to receive a violent shock in the head, and also saw a distinct flash (I suppose I saw the reflection on the valve). This led me to take my telephones to the local wireless dealer and he is of the opinion that the shock in the head was due to lightning, which he avers was about at just the time I received this.

"Regarding the shocks always experienced from the telephones (these take the form of a tingling sensation when telephones are on the head, and the right spot of the floor is stood upon) he says these are normal, and that there is no fault in telephones.

"I should like your opinion on this point."

Although you have examined the telephone and find nothing wrong with them there is little doubt that the insulation of that one particular earpiece is faulty. The fact that the shocks only occur when you are standing on one particular part of the linoleum is due to one of two things:

(a) In that particular position the lead is hanging in a particularly favourable position to give shocks; or,

(b) The connection between your feet and the earth is particularly good at that particular place (so that a heavier current flows when you are standing there than flows in any other position.)

Regarding the violent shock in the head and the distinct flash which you saw, we are inclined to agree with the dealer that this was lightning. Probably the flash was not across the valve, as you suppose, but across one of the condensers in the set.

In this connection we would remind you that it is unwise to use a set when there is lightning in the immediate vicinity, the proper procedure at such a

(*Continued on page* 520.)

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

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

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

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

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

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 518.)

time being to have the aerial connected to the earth outside the house. A very convenient way of doing this is by means of an earthing switch, which can be very easily fitted and operated.

The presence of lightning in the immediate vicinity nearly always means that loud clicks and grinding noises (atmospherics) can be heard in the telephones when such storms are near, so that anyhow there is very little pleasure in listening at such times.

THE "SYDNEY" TWO DE-LUXE.

"OBSTINATE" (Yeovil, Somerset).—"I have heard so many good things about this 'Sydney' Two that in the end I decided that although I already had my other set, I would make it up. As a matter of fact, I did not really feel *determined* about it until I tried to get the description in 'P.W.,' and then found that the issue was out of print; and a friend I knew who had made this set, and would have helped me, has since moved away. So, being obstinate, I am determined, hook or crook, to make up that set somehow. Where can I get particulars?"

You will find there is a full description of the "Sydney" Two de Luxe in the June issue of "Modern Wireless." As this is a complete constructional article with photographs, diagrams, etc., we recommend you to build this later model rather than the original one, which was so popular that the issue of "P. W." containing particulars was rapidly sold out.

An extra advantage of this later model in "Modern Wireless" is the fact that it is suitable for use on the ordinary wave-lengths as well as on the short waves, this making it one of the most handy and acceptable sets that has ever been described.

THE "LO-NOTE" LOUD SPEAKER.

In response to our request for further details of the Marpel Stapler, the author of "The 'Lo-Note' Loud Speaker," gives the following particulars additional to those in the article appearing in another page of this issue of "P.W."

"The Marpel Stapler is a small, cylindrical gadget with a spring plunger. A wire staple is inserted in the one end (which is held firmly against the wood), the other end is given a sharp tap (or a thrust with the hand), and the staple is driven cleanly and neatly home. It is particularly handy when constructing the bell, as there is far less danger of the wood splitting than when tacks or brads are used. It also affords additional security to the conical horn itself if staples are driven into it so as to form "bridges" across the joints between every two consecutive laths, thus making a ring of (disconnected) 'bridges' round that particular part of the circumference. Three of these rings about 18 in. apart will be sufficient.

"The writer found considerable difficulty in obtaining this stapler, which is handy for a large variety of jobs (such as bell wiring, telephone or loud-speaker extension leads, stapling down lino, stapling together pieces of three-ply wood, etc.).

"Ordinary ironmongers do not appear to stock it, but Messrs. Bentalls, Ltd., of Kingston-on-Thames, Surrey, supply it at 4s. 6d., post free (together with three boxes of staples). It is well worth the money, both for this and for many other wireless and non-wireless jobs."

SPANISH SHORT-WAVE STATION.

"SENOR" (London).—"Can you tell me what is the wave-length of the new Spanish short-wave station?"

The Madrid station E A M now transmits upon a wave-length of 30·7 metres.

WHAT IS "DX?"

V. L. L. (Runcorn).—"In view of my enquiry, it is hardly necessary to explain that I am a complete novice in radio matters, but I am very keen. Although I have not been taking 'P.W.' for long, I often see references that puzzle me, such as 'DX.' What is DX?"

DX is simply an abbreviation standing for long distance. In this way "a good DX receiver" means one which has a good long distance range, and similarly, "DX reception" is the reception of signals from long distances away.

APPARATUS TESTED.

(*Continued from page* 514.)

A USEFUL GADGET.

One of the neatest little gadgets yet put on the market to tempt the radio amateur is the Time Saver Log marketed by Adsigns, 265, Strand, W.C.2. This comprises a neat black metal plate containing on a roller a linen chart 10 in. long by 3 in. wide. On this is very clearly tabulated the principle broadcasting stations of the world, together with such details as their wave-lengths and power. Opposite each station is a space for jotting down the dial readings of from one to three condensers. The gadget can be fixed to the front of the panel or the side of the cabinet of a set. The retail price of this attractive device is 2s. 6d.

WELL-MADE BATTERIES.

Mr. Smith-Thomas, of Water Lane, Cotton, recently sent us two batteries representative of the type he manufactures under the well-known England-Richards process. The 60-volt H.T. battery, including wander plugs, retails at 10s. 6d. It is known as the Radiolene-Zincium dry cell battery. It is provided with a hard wax filling and there are tappings at every 3 volts from 18 to 60 volts.

The voltages are plainly marked in gold lettering. The sockets are deep and take the wander plugs snugly and tightly. We found the battery slightly exceeded the guaranteed short circuit amperage of 5 amperes. It has been giving some 10 milliamps for a very fair period without noticeable voltage drop and the indications are that its life will be a long and useful one. The 4½-volts flash-lamp battery which retails at 8d. appears, too, to possess a high order of efficiency.

NEW MULLARD P.M. VALVE.

A new valve is shortly to be placed on the market by the Mullard Wireless Service Company. It will be known as the P.M.4D., and has the following characteristics. Filament volts, 4; filament current, ·1 amperes; amplification factor, 12·5; impedance, 6,000 ohms; mutual conductance, 2·1. While we can only view with some alarm the addition of yet one more 4-VOLTER to the already very cumbersome list of available valves, we cannot at the same time but extend our congratulations to Messrs. Mullard for the production of a remarkably efficient new type.

As will be noticed, the P.M.4D. has a very low impedance with a large amplification factor, thus giving an extremely steep slope. It is primarily a detector and a most excellent one at that, operating on either the anode-bend or grid-leak principle. But it can also be used as a small power valve where it will give excellent results with very large amplification. It is also noteworthy that the grid bias necessary is less than that for the usual power valve.

Used preceding a Mullard P.M. L.F. transformer, it provides a high order of amplification and excellent quality. All the bass notes being faithfully reproduced without the shrillness of peak effects on the higher register. In conclusion, if we are doomed to a continuance of the 4-volter, then we can only trust that this middle range is to be enriched by more Mullards of the quality of the P.M.4D. The P.M.4D. will retail at 12s. 6d.

HOW TO MAKE A "LO-NOTE" LOUDSPEAKER.

(*Continued from page* 512.)

The diameter of the bell should be 19 to 20 in. Force the skeleton bell tightly enough against the wooden ring to make it attain this diameter. A small screw is now put through the end of each lath (¼ in. from the end) into the cone itself.

Measure the diameter of the bell at several points, to obtain a fair average. The circumference will be 22/7 of this. As there are 22 laths, the distance between the *centres* of any two consecutive *ends* should therefore be $D \times \frac{22}{7} \times \frac{1}{22}$, that is 1-7th of the diameter of the bell. (E.g.: 2·7 in. for a 19 in. diameter bell.) Space the laths equally, using a pair of compasses set to this length, or a bit of wood cut to this length. As each one is spaced from the preceding one it should be held in position by tapping a thick pin through the lath and into the edge of the wooden ring. The pin need penetrate only far enough to hold the lath in place. (Gramophone needles are better than pins, but do not knock them in too far.)

Completing the Bell.

Bind round the smaller end of the bell about twenty turns of seccotined bricklayer's line or strong, thin twine, commencing the winding about ½ in. from the smaller end and working, with a firm pull, towards the larger end. Before doing this it is advisable to tap in half a dozen small tacks to prevent the twine slipping as it is wound.

The sheet of strawboard is now cut as shown so that 22 pieces are obtained of the shape given in the diagram. Any rough edges are smoothed off with fine sandpaper. These strips are seccotined and stapled to the laths so as to form the complete bell. As each one is placed in position it should be stapled at the small end of the bell first.

A flat iron, or something similarly efficacious, should be used to take the force of the blow when inserting the staples in the middle and at the large end of the bell. Three staples at the small end, one in the middle, and one at the large end, should be used on each edge of each strip. Most of this work can be done with the horn standing on its twenty-two "legs" on a table or the floor. Afterwards, run a little stream of fairly thick hot glue down each joint of wood and strawboard.

Strong Construction.

When the glue is set, the screws and pins are removed, and the bell may then be slipped off the cone. Placed mouth downwards on the floor, a 10-stone man may sit on the small end without damaging either himself or the bell.

Used with the cone, the bell will normally keep in position by the wedge action of the cone and wooden ring; but, if desired, a couple of screws may be used for giving additional security.

The appearance of the horn is greatly improved by a coat of stain (such as dark oak "Stainex" with a dull, wax-polished finish. The bell is best painted with Berlin Black. A cheap wooden camera tripod makes a convenient stand.

If your receiver is of the "Purity First" type, this horn will prove a fitting reward for your industry and patience.

There is only one "but." The writer disclaims all responsibility for any annoyance which may be caused to the neighbours when an 8 ft. horn is being used in the open!

[NOTE: A note concerning the Marpel Stapler referred to earlier in this article will be found in the "Radiotorial" columns.]

NEWS FROM SAVOY HILL.

(*Continued from page* 510.)

would be ample Party politics for the average listener.

B.B.C. Weakens on Vivisection.

There has been some amused comment in the lobby concerning the skilful way in which the Ministry of Health is now avoiding any blame for some of the forbidden medical subjects on the B.B.C. lists. There was a time when the Ministry of Health was pleased to share both the praise and the blame on the health talks put out from Savoy Hill. But the blame has been increasing and the praise waning. Hence an adroit withdrawal from associate responsibility.

But Savoy Hill should be able to turn the new situation to good account. For instance, there is now no insurmountable obstacle to active debates on such subjects as vivisection, thyroid glands, bone-setting, and birth-control. Let the B.B.C. loosen up in this direction, and there will be tremendous interest awakened in the new series. It is understood that the attitude about vivisection is more open than it was.

Parliament and the Governors.

Members of Parliament are wondering what has happened to the first annual Report of the Governors of the B.B.C., which the Postmaster-General promised to bring down before the end of March. If and when this ever sees the light of day, it will come in for very close scrutiny.

The salaries of the Governors is a subject which will be threshed out in the light of their qualifications for handling one of the biggest entertainment factories in the world.

St. George's Chapel Relay.

There are many reasons why the broadcast service on Sunday, June 17th, which is to be relayed from St. George's Chapel, which is in the precincts of Windsor Castle, is of exceptional interest. Most important, perhaps, is the fact that in founding the Order of the Garter, Edward III provided stalls in the Chapel where Knights and Canons could sit side by side alternately, thus demonstrating the idea that true national service must rest on prayer and worship.

The music at the service will be in charge of Sir Walford Davies, the organist of the Chapel, whose forceful personality long ago stamped him as one of the great masters of the microphone, while the address will be given by the Very Rev. A. V. Baillie, the Dean of Windsor. The opening and concluding sentences of Scripture will be sung to inflections set by John Marbeck, once "organist and singing man" of the Chapel, who was condemned to the stake for heresy for his leanings towards the Reformation, but who was subsequently pardoned in consideration of his great musical gifts.

TECHNICAL NOTES.

(Continued from page 510.)

Radio Beam.

Another interesting book which has just been published is one of the Reports (No. 6) of the Department of Scientific and Industrial Research. This particular report, which was published on May 24th, is entitled "An Investigation of a Rotating Radio Beam" and is by Dr. R. L. Smith-Rose and Mr. S. R. Chapman, the well-known radio engineers. The purpose of the investigations described is to ascertain the reliability, especially for modern navigational purposes, of wireless bearings taken with the aid of a beacon under a variety of conditions. The great advantage of this system is that it requires only an ordinary wireless receiver and a suitable watch to enable a ship to take bearings, and it is therefore likely that the system will prove of considerable value in the application of wireless to modern navigation. The price of the handbook is 2s. 3d. net, and it may be obtained from H.M. Stationery Office, Adastral House, Kingsway, W.C.2.

Useful Polefinder.

I have received recently from Messrs. New Wilson Electrical Manufacturing Company one of their "Rapid" polefinders for determining quickly the polarity of any D.C. source of electric supply.

This polefinder is a very neat and simple little device and consists essentially of a glass tube in which is a bubble of air (not unlike the glass tube of a spirit level) with suitable screw-terminals attached at the two ends and electrodes from these terminals projecting within the liquid inside the tube and being visible through the glass.

On connecting the two metal end caps or terminals of the device to a source of D.C. supply the electrode inside the liquid which is connected to the negative terminal immediately acquires a purple colour and thus gives an indication of the polarity. Of course, if the device is connected to a source of alternating supply, *both* electrodes will appear purple, and the fact that the supply is alternating is at once indicated.

After the little device has been used it is only necessary to shake it, so that the bubble of air passes over the electrode which has been rendered purple, and the electrode immediately loses its purple colour and the device is ready for use again.

A particularly useful point about this indicator is that it may be used on voltages from 1 volt to 250 volts. According to the makers, it may be used tens of thousands of times without deterioration, although naturally this is a test to which I have not submitted the sample!

Which Way Does a Current Flow?

Beginners in radio are often puzzled by the fact that the direction of flow of an electric current is always assumed, in ordinary diagrams, to be from the positive terminal of a battery (for example) through the circuit and back to the negative terminal, whereas in a wireless valve we know that currents actually consist of negative electrons which proceed from the filament to the plate, in other words, in the *opposite* direction to that conventionally indicated.

This has frequently led to the enquiry as to whether there are two kinds of current—positive current and negative current.

(Continued on next page.)

TECHNICAL NOTES.

(Continued from previous page.)

The simplest answer (although not the complete answer) to this question is to say that the conventional method of indicating the direction of flow of a current is physically incorrect. In the vast majority of cases (for instance, in the case of the flow of electric current along a copper conductor) the current actually consists of a flow of negative electrons and these are moving *from* the negative terminal *towards* the positive terminal, that is, in the opposite direction to the so-called direction of the positive current. In the metallic conductor the current consists entirely of electrons and therefore there is no positive current at all.

In a Thermionic Valve.

The same applies in the case of a hard wireless valve, the current passing through the valve consisting of negative electrons emitted from the filament and passing towards the plate.

Of course, it does not matter in the least what is actually happening in the circuit, so long as we are content to adopt a definite convention and stick to it, and people got along just as well with the conventional "positive current" long before electrons were discovered.

Before concluding these remarks I should, however, say that in certain special cases there *is* such a thing as positive current. For instance, in a discharge tube containing a certain quantity of gas (for example, a "soft" wireless valve) the current is carried partly by electrons (with perhaps a few negative ions) all moving away from the negative electrode and towards the positive electrode, and partly by positive ions moving away from the positive electrode and towards the negative electrode. In a particular case of this kind it may be said, in one sense, that we have positive current flowing in one direction and negative current flowing in the other direction.

But this is a special case which does not often arise in ordinary experience and, as I have already said, in the great majority of cases in common practice you must regard the flow of electricity simply as the flow of negative electrons away from the so-called negative terminal and towards the positive terminal. If we choose to reverse our designations of negative and positive, calling electrons particles of positive electricity and calling the negative battery terminal (for instance) the positive terminal and vice versa, then our conventions would be in accordance with physical fact. In the days before the nature of electricity was as well understood as it is to-day, it was necessary to adopt some convention with regard to positive and negative and, of the two possible ways of using these terms, it is perhaps a little unfortunate that the (physically) wrong one was chosen.

"THE WEEKLY TELEGRAPH" GUIDE TO HOLIDAY RESORTS.

WHEN winter is at last gone by, when summer time and the lengthening days with their golden promise are already here, and when Nature has begun to smile a comely welcome, this is the time when work-a-day folk begin to dream of summer skies and the earth's pleasant places. Here begin the difficulties of selection and the more practical consideration of accommodation. Happily these problems are brushed aside by the timely appearance of a compendium that sorts out as if by magic all these and kindred tangles. "THE WEEKLY TELEGRAPH" Guide to Holiday Resorts is to be found everywhere at the modest price of sixpence. The fact that for thirty-three years this publication has made its appearance each time in a more comprehensive and improved form should be sufficient recommendation to anyone in doubt as to a really reliable source of holiday information; it is accurate; it is concise; it covers all the ground; it gives accommodation lists that suit all purses. It is 450 pages of unrivalled reliability.

Mullard

THE VALVE WITH THE WONDERFUL MULLARD P.M. FILAMENT

Gives you the fullest value for your money and improves any radio receiver. Be safe; ask for Mullard P.M. Valves.

Mullard

THE·MASTER·VALVE

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. Registered as a newspaper for transmission by Canadian Magazine Post. Subscription Rates: Inland, 17/4 per annum; 8/8 for six months. Abroad, 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.; and for Canada: The Imperial News Co. (Canada), Ltd. Saturday, June 9th, 1923.

N/R

POPULAR WIRELESS, June 15th, 1928. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THE RADIO PAPER WITH THE LARGEST CIRCULATION

Popular Wireless

Every Thursday PRICE 3d.

No. 315. Vol. XIII. INCORPORATING "WIRELESS" June 16th, 1928

THE "SCEPTICS' THREE"

Full Details Inside!

EVERY SET SPEAKS FOR ITSELF!

Mr. K. D. Rogers shows Mr. P. R. Bird, who is evidently playing the "sceptic's" role, exactly what a "P.W." receiver is capable of doing. Of course our Assistant Technical Editors were equally enthusiastic about the set after it had shown what it would do—and so will you be if you build it!

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RADIO NOTES AND NEWS.

The March of Commerce—Marriage Vow Up to Date—Listeners' Likes—Sets for the Blind—"P.W." the Globe-Trotter—The Radio Sceptic—Sir Oliver Lodge.

The March of Commerce.

FROM time to time I have reproduced letters received from overseas which show me that the instinct for commerce is strong in Britain's coloured citizens. But this letter is the sky-blue limit. It comes from the Gold Coast. "Dearest Messrs.,—My excellency beg applying for exclusive representation in continent of Africa for Marconi stations beam or elsewhere and otherwise. Greatest of testimonarials from H.B.M. Consols and/or Wisleyan Missionary at this metropolis, not saying the Bank. Terms were c.i.f. and send you gold when if sold, minus total highest discount not less of sixty the hundred and free samples to all your wares non-returnable."

Marriage Vow Up to Date.

BOY: "Mother, where is daddy?" Mother: "On the short waves, I believe." Boy: "Why don't we ever see him?" Mother: "Because he has not got 3 L O." Boy: "But, mother—" Mother: "Thattledo, son. I took him for better or for Morse."

Listeners' Likes.

I BELIEVE it is a fact that the B.B.C. has never appealed to its patrons as a whole to state what kinds of items they prefer. A ballot of licence-holders, conducted with the aid of the Post Office, would show the B.B.C. pretty clearly how the public wants the programmes to be made up. It would only have to be done once every few years, and would clear the air enormously. I fear there is a tendency on the part of the B.B.C. to provide what they think the public *ought* to want. Let's have one great ballot and settle the matter for the next five years!

Literal Broadcasting.

THAT hot spot, 3 L O (Melbourne), construes its functions in a literal manner, with the result that it has been broadcasting the seeds of flowers and vegetables—not, of course, by pouring them into its transmitter and thus flinging them out via its aerial, but by post to all applicants. Every 3 L O programme has something in it about how the seeds should be used. A pretty and an excellent idea. But just imagine the B.B.C. uncles doing up little packets of cauliflower seeds!

Afghanistan Chooses French Radio.

I WAS greatly exercised as to the outcome of the visit of King Amanullah as it affected the wireless interests. Being British, I hoped he would select a British system, but I see that a French firm, of whom I have never before heard, secured the contract to fix up Afghanistan with a wireless system. Never mind, a friendly "buffer" State between India and a possible invader is worth a hundred contracts.

Nature Note.

I AM informed that as a result of the willingness of the nightingale to come forward and whistle for the B.B.C. engineers, applications for work have been received from (1) a naturalised cuckoo, (2) a laughing jackass, who escaped from the Zoo last year, and (3) a man who sells "bird warblers" in the Strand. The Board of B.B.C. governors are said to be hopelessly at variance on the subject and are proposing to compromise by giving the job to the head messenger-boy of the Berkeley. It is thought that he will accept, but will reserve his American and gramophone rights.

QUEEN OF SPAIN MEETS MARCONI.

The Queen of Spain chatting with Senatore Marconi and his wife during their recent visit to Seville. It was recently reported that Senatore Marconi had further improved his radio beam system to provide a revolving "light-house" effect, so that vessels with simple apparatus could take their own bearings and thus make navigation even easier and safer than it is at present.

An Australian Acknowledgment.

S. E. B., who hails from Tottenham Hale, sends me a very nice letter he has had from Australia about his recent direct reception of broadcasting from Melbourne.

"I prize it very much," he says; "and it also pays

(*Continued on next page.*)

NOTES AND NEWS.

(*Continued from previous page.*)

the 'Sydney' Two a tribute, for it was on this set that I received the whole of the transmission from 3 L O."

This letter certainly forms a very fine "scalp" to add to S E.B.'s collection, and incidentally it mentions that 3 L O's experiments are still being carried out from 18.30 to 20.30 G.M.T. on Sundays, wavelength 32 metres.

Barrier Reef No Barrier.

WHEN the Orient liner "Ormonde" left Tilbury a few weeks ago, she carried a party of ten, forming a scientific expedition which is going to survey and explore the Great Barrier Reef, that stretches for 12,000 miles along the coast of Queensland.

The party will be quartered in huts on the reef for about twelve months, and they have taken with them a short-wave wireless set. The idea is to tune in music from 5 S W (Chelmsford), and dance to it, thus getting exercise and diversion.

The Director General.

NOT long ago, Sir John Reith, Director-General of the B.B.C., speaking frankly to listeners, said that there were times when he couldn't get across the room to turn his set off quickly enough. And he knew "the Children's Hour was sometimes dreadful!"

Now comes the good news that a son and heir has been born to Sir John and Lady Reith With my felicitations I venture the prophecy that in future the Children's Hour won't seem so bad, after all.

Sets for the Blind.

CRUISING down the Borough High Street the other day I saw a certain well-known radio manufacturer looking distinctly pleased with himself. As you all know, I am of an inquisitive turn of mind, so I naturally ups and asks him why the smile? He told me that his company had just received the order for a hundred receiving sets from the Derbyshire Association for the Blind. (I expect you can guess the name of the firm when I say that thereupon we went and had a "Magnum" together.)

A Merry Christmas.

WHEN you come downstairs on a Thursday morning, feeling all blue and bleary, and you find your "P.W." waiting on the mat, or when you walk up to the bookstall, put down your threepence, pick up your "P.W.," and find exactly the very set you were looking for—well, ain't that grand and glorious feeling?

But has it ever occurred to you to wonder about those brother "P.W."-ites who, living under palm or pine, are still looking forward to their last Christmas Number? It's a safe bet that if I entitle this paragraph "A Merry Christmas" that greeting will arrive at Spotted Island or San-Jose-de-Luxe, or somewhere, just in time to cheer up some far-off "P.W." reader next December!

"P.W." the Globe-trotter.

I AM reminded of the way that "P.W." trots around the globe by a letter I have just received from a reader who lives more miles than I should like to foot it on the wrong side of the Arctic Circle. Like the good fellow that he is, he does not blubber about the local Esquimaux, but spends his spare time taking notes on the effect of the Aurora Borealis on short-wave signals. He concludes his letter "With all good wishes to 'P.W..' which I get in batches with the infrequent dog-teams."

So if this paragraph meets your eye in Patagonia, Honolulu, or Way-Back, consider yourself shaken by the hand and slapped on the back by all we stay-at-home "P.W.-ites."

SHORT WAVES.

NOISING IT ABROAD.

The wireless fan who plastered his trunk with labels of all the foreign stations he had reached.—"Sunday Pictorial."

* * *

Sweet Young Thing: "Isn't it simply wonderful how these sets operate without aerial or earth, and even with all the doors and windows closed?"

Her Hero: "Well, you see, the waves come down the chimney."

* * *

Extract from letter: "I am inclined to believe, however, that jazz, soap, and storage batteries mix quite well."—"Daily Express."

Father thought ours would mix well with the contents of the waste-basket last week.

* * *

"Dear B.B.C.—The interference about which I wrote a fortnight ago continues, and, summing the matter up, it is precisely what the admiral is alleged to have said about the bandmaster."—"News of the World."

* * *

The Woolworth Tower looks big and bold,
It stories are many and high;
But more and taller the stories told
By the one-tube DX guy.—"A. W."

* * *

ATMOSPHERIC.

The absent-minded wireless fan who mutters "Atmospherics again?" every time he winds up the clock.—"Sunday Pictorial."

* * *

Little Girl: "Daddy, are there loud speakers in heaven?"

Henpecked Father: Yes, dear; with wings on!"

* * *

When after reaching home at night
From City toil and rush,
I'm met with fingers lifted up
And frantic cries of "Hush!"

And when I try to listen in,
Instead of chants or psalms,
Its simply tinkle, tinkle, tinkle, tink,
At Chopin or at Brahms. . .

The old, old fun with little kids
Has been completely ended;
They've substituted ants for aunts;
The whole thing must be ended.

The highbrow stuff is ladled out;
I simply dread to-morrow,
For listening-in has now become
A night of doubt and sorrow.
—"Bromley District Times."

Number Nine!

I WILL say one thing for the B.B.C.—they are whole-hoggers. Finding that two studios were better than one they have been extending this principle ever since, and now they have no less than nine studios at Savoy Hill.

The last one is built in the basement of what was formerly a Turkish bath. (The funny thing is that when I went down to see it the chap who was broadcasting a violin solo from there thought it was still a Turkish bath. Certainly he seemed to be feeling more perspiration than inspiration.)

The Radio Sceptic.

THAT Bernard Elston, the radio sceptic chap, has been at me again. Seeing the recent announcement that the Technical Department will build us a set which will convert him, he writes to warn me that eight quid is his limit, and no set that costs more is going to convince him.

I told the Technical hounds, and they have evolved a complete answer in The "Sceptics' Three," a really convincing low-cost receiver, full details of which will be found in another page of this issue.

Four Just Men.

MAY I take this opportunity of thanking the Four Just Men, who, unknown to each other, sent me the cutting from the "Evening News" dated May 22nd? They all refrained from any comment on it—so will I! But here is the cutting:

Television.

"IN the Commons this afternoon Sir William Mitchell-Thompson, the Postmaster-General, said his department had been kept informed of the progress in the development of television, but he was advised that this invention was still in the experimental stage and did not consider that the time had yet arrived for arrangements to be made for the provision of a public service."

Healthy Radio.

IF some dismal Jeremiah comes up to you with a long face and a miserable yarn about the way that broadcasting is falling off, don't give him a couple of right hooks to the jaw, or a quick half nelson, or mark your disapproval by murdering him on the spot and depositing his wretched carcase in the nearest dustbin. Just tell him that according to the Postmaster-General the total number of licences in force on May 1st was 2,482,455! By the time these lines are in print I suppose there will be over two and a half millions of us.

The "Sydney" Two.

YOU will have to excuse it, but try as I will I cannot help that "Sydney" Two cropping up in these Notes again. I don't want to mention what it can do, or anything like that, but in self-defence I feel I must say that I have *no* copy of "P.W." left with details of this set. Moreover, the back number department sold out all their copies months ago. But for the sake of those still intent upon building it, there is one ray of hope that I can mention.

A full description of the "Sydney" Two de Luxe appears in the June issue of "Modern Wireless" (now on sale), so if you simply must build this set, take my tip and get a copy of "M.W." before it is too late.

Sir Oliver Lodge.

DO you wear a cap, or a bowler, or a straw hat, or a mortar-board, or a silk hat, or just an old tile? It doesn't matter which, for in any case you ought to take it off, take off your hat to Sir Oliver Lodge, who celebrated the 77th anniversary of his birthday this week. Born way back in 1851, England's G.O.M. of Radio has won not only the admiration and regard of scientific men the world over, honours innumerable, and world-wide reputation, but the affectionate regard of all radio listeners.

In an especial degree this is true of the readers of POPULAR WIRELESS, the *only* radio journal which is honoured by having Sir Oliver Lodge as its Scientific Adviser.

ARIEL.

The "Hush-Hush" Van at Clapham

The B.B.C. engineers have been at work for some time on a wonderful travelling studio which can also be used as a portable observation post. Full details of this and other important technical developments are given in the following article.

By OUR SPECIAL INVESTIGATOR

DOWN Clapham way, where the B.B.C. has taken a commodious house which, in the days before the speculative builder turned the locality into what is called a residential area, boasted the distinction of being a country mansion, standing in its own spacious grounds, a "hush-hush" job is nearing completion. Avenue House—that is its name—is now the headquarters of the research and development sections of the technical side of broadcasting, and here Captain Eckersley's capable assistants carry out their tests and experiments well away from administrative and programme staffs.

But to get back to the "hush-hush" job which is going on at Avenue House. You will never guess it is, or at any rate it would take you a long time to guess that it is, a travelling studio. Yes, and more than that, because in addition to the studio there is to be a portable observation post, and a control point. Let us explain it in greater detail.

For Outside Broadcasts.

Some of the most interesting and important parts of the radio programmes are outside broadcasts, that is items which originate outside the studios, such as church services, music from cinemas and hotels and running commentaries on sporting and social events—the Boat Race, the Derby and a dozen and one others which occur from time to time.

Some of the outside broadcasts are quite simple affairs to carry out. They are included in the programmes quite regularly. The lines between the selected spot and Savoy Hill are permanent installations, the microphone may always be in position, whether broadcasting is being done or not, and the control point, where the engineers fix up their amplifying apparatus, is well selected to give the minimum inconvenience to everybody concerned. The Savoy Hotel is a case in point.

Many Difficulties.

But there are other outside broadcasts which are not so nice to write about. The disposition of the microphone may give hours of anxiety, and the control point, which *must* be found somewhere, may be out in the cold, perhaps in a draughty cellar, or in a noisy garage. Sometimes days of scheming and planning have to be done in order to give listeners fifteen or twenty minutes of programme. The broadcast comes over well, but from the point of view of the "O.B." Department it is not quite good enough, and something ought to be done about it. That is why someone had a brain-wave about the "hush-hush" van.

The van is now almost ready for use. Perhaps it will be finished in time for the Aldershot Searchlight Tattoo on June 19th. If all goes well, it will be used for broadcasting a running commentary on the Royal Air Force Display, which takes place at Hendon on Saturday, June 30th, and for another commentary on the final shoot off for the King's Prize at Bisley a fortnight later.

Tremendous Advantages.

The advantages it will give over the present cumbersome system are tremendous. No amplifying gear or batteries to unpack and assemble, and no microphone to rig up. The gear will all be screwed and permanently fixed in the van, always ready for use, and the engineers will be certain of working in comfort. There will not be much room to spare in the van, but it will be much less irksome and tedious for the engineers to work under conditions that they understand and appreciate, than in the holes and corners such as they do now or in tents which blow down, like one did in a blizzard during the night before the St. Leger at Doncaster. All they will have to do by way of preliminary arrangements will be to link up the van with the end of the Post Office cable connecting them with Savoy Hill and start right away.

An engineer installing loud speakers and a microphone at Wembley preliminary to the broadcasting of a big sporting event (Marconiphone).

As an observation-post the van will be ideal, since within reasonable limits it can always be driven to the most advantageous point for witnessing any event on which a commentary is being given. A microphone will be placed on the roof, and the broadcaster will be able to sit or stand in a railed off portion and describe whatever is happening without having to beg accommodation in an already overcrowded Press stand, or at some office window. How much better it will be for broadacting the arrival of some foreign dignitary at Victoria, or the Lord Mayor's Show and events of that kind.

Another Application.

It sometimes happens that broadcasts are done by people who have just taken part in some big sporting event. There are some others which are crying out to be done but cannot be undertaken under existing conditions. "How I won the golf championship," suggests one of a score of things which listeners would be delighted to hear immediately the event is over, yet they cannot because the person concerned must first be taken to a broadcasting studio.

The "hush-hush" van will alter all this by taking the studio to wherever the champion happens to win his title. There, in the van he will find a compact little studio, complete with microphone, suspended and adjustable to fit champions of all sizes, a reading desk and, of course, a desk lamp. The acoustics will be perfect; in fact, the studio is to be an exact replica of those at broadcasting stations, and equally efficient. The idea bristles with fine possibilities. Why not take the van to Southampton and meet Mr. Charles Chaplin when he arrives from America and all the other notabilities when they come to visit us, or for that matter when they leave.

Eye-witness Accounts.

The travelling studio will also come in very useful for giving eye-witness accounts as distinct from running commentaries. Under the present arrangements these have to be given from a studio, usually some hours after an event has taken place.

Yes, the advent of this "hush-hush" van is long overdue. If all goes well it will put some much-needed "zip" into the programmes, and we shall soon be taking off our hats to the people who devised it.

It will fill one of the most urgent needs that have been felt by the B.B.C.—and that means also by the listener.

Although it is not everyone who can obtain a transmitting licence, a study of the working of a typical transmitter should be of value to the receiving amateur. This article, explaining various parts of the "'Popular Wireless' Experimental Station," should, therefore, be of particular interest to experimenters and provide a means of picking up many useful "tips."

By THE ENGINEER-IN-CHARGE.

DESIGNED for a smaller output the power supply at 2 D A would make a very useful H.T. mains unit for any receiver, but, as it is at present, its size and the fact that it is not economical when used for low-power work, makes it unsuitable for use in conjunction with a receiver. There are, however, many points about it which could conveniently be applied to ordinary mains units.

For instance, in the diagram of the part of the transmitting circuit (Fig. 1) is shown a variable iron core choke (Ch1) used as a "power regulator." This choke consists of

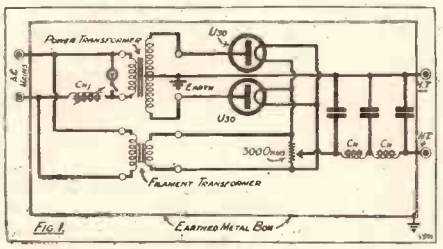


Fig. 1.

several hundred turns of fairly thin wire wound on a 6-inch bobbin. By arranging a short length of iron gas-piping to slide in and out of the bobbin, the inductance of the choke is readily and smoothly variable.

Excellent Power Control.

When the iron pipe is fully withdrawn from the bobbin, the inductance of the choke is practically negligible, and the only opposition to the current is the ohmic resistance of the wire. As the pipe is slid through, so the inductance increases until, when fully in, it is about 25 henries. Connected in the leads of the power transformer, this gives a very fine control of the power and can be used to drop the 200 volts A.C. input to practically zero.

An A.C. voltmeter is connected across the terminals of the transformer so that by taking the step-up ratio of the transformer and the value of the various resistances in the rectified side, it is possible roughly to calculate the output voltage so long as the current flowing is known. Unfortunately, this method of calculating the voltage is not very accurate unless a "power factor" correction is made on account of the inductance in the primary.

Another point which could be applied to an eliminator is one that is used at 2 D A to prevent undue induction. Much of the "hum" apparent in receivers using eliminators is not due to poor smoothing but induction from the alternating-current circuits.

Eliminating "Humming."

Something akin to this was experienced at 2 D A, for it was found that however efficient the actual filter was, an appreciable proportion of A.C. hum always got through into the transmitted wave. This was eventually overcome by putting the whole of the power supply into metal biscuit boxes which were earthed. An ebonite panel with the meters and controls is arranged just in front of the tins, and any wires having to be brought out are lead-covered on the outside and earthed.

Any listeners having "humming" eliminators would do well to fit them up into biscuit tins like this, as not only are the tins cheap—any grocer will supply them at a shilling a time—but when painted over or enamelled black, they have extremely smart appearances.

By connecting the centre tap of the power transformer to the metal box and thereby earthing it, much is done towards avoiding breakdowns causing fire, or risks of shocks.

The remote control system used at 2 D A is extremely simple. Since the transmitter is adjusted and left set for one particular wave-length and power, the only requirements to work it from a distance are something to switch on the power and the filament of the transmitter valve, and some method of keying.

The matter is quite easily arranged by means of three relays, wired as shown in Fig. 2. The relays are each very small, and all three are placed in one box. By these means the transmitter is operated from about 20 yards away in another building altogether.

The Earth Used.

Contrary to usual practice on short waves, 2 D A employs an earth for both transmission and reception. It has been found that an earth is often to be preferred

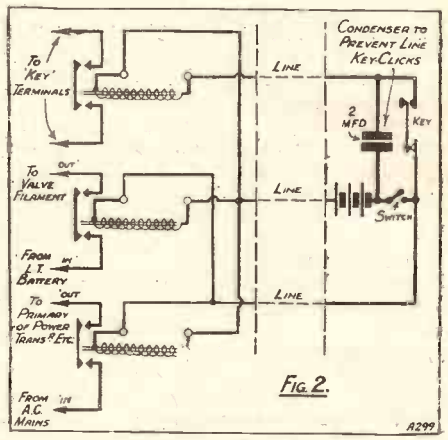


Fig. 2.

to the counterpoise arrangement, providing it is a really good one. Moreover, the use of an earth has the added advantage of stability and lends itself more readily to the avoidance of capacity effects between the operator and the apparatus.

The actual earth consists of a six-foot length of ordinary iron piping driven into the soil and with a soldered earth-lead at the top end. For the first 12 inches below the surface of the soil the iron pipe is enclosed in a porcelain tube so as to prevent any electrical connection between the ground and the pipe at depths less than a foot.

SOME USEFUL HINTS.

Crackling noises and clicks are often caused by the creeping of the electrolyte of an H.T. accumulator.

* * *

When H.T. positive leads are carried through holes or very near to a screening box, they should be provided with extra insulation besides that provided by the insulation covering the wire, or there will be great probability of short-circuits.

Complaint that a wave-trap is inefficient is very often due to the fact that its variable condenser has not been adjusted with sufficient patience and accuracy, especially in the case of the small compact variable condensers that are now so popular.

* * *

To remove the layer of scale on a neglected soldering iron, heat the iron until it is red hot and then plunge it into cold water when the deposit will flake off quite easily.

* * *

Probably the best method of determining whether an iron is hot enough for soldering is to hold it near to the face, the correct condition being readily recognised after a little practice in this method.

MAKING LOUDSPEAKER CONES

Anyone can now make a loud speaker. There are several very good and very cheap loud-speaker units on the market, such as the "Lissenola," and additionally one needs only a cone and a simple bracket arrangement. Full details for making cones and other important details are given in the following article.

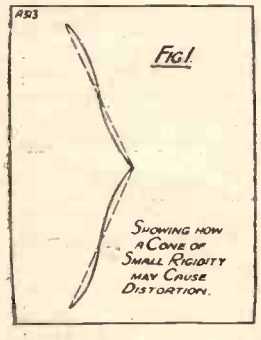
By M. C. PICKARD.

SEVERAL years ago a home-constructed loud speaker was a rarity, one that worked satisfactorily almost a phenomenon. The advent of the cone type of speaker has, however, changed this, and the amateur of to-day can not only make up a loud speaker as easily as he can make up a set, but can make one capable of giving really adequate musical reproduction.

The ideal speaker must possess the following qualities: (*a*) an even response over the whole musical scale, and (*b*) good definition. A modern cone type of instrument possesses the first quality to a fairly satisfactory degree, but the second quality is not easy of attainment, and is absent in many of the leading makes upon the market.

Two Essentials.

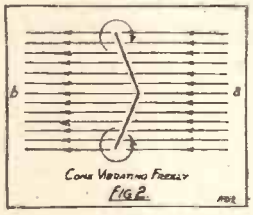
Most amateurs are familiar with the muffled, indistinct, enunciation of many cone speakers. Every cone speaker consists of two essential parts, the cone itself and the driving mechanism. For the purpose of this article it is assumed that the experimenter has in his possession a perfectly satisfactory driving unit; since imperfections in this mechanism cannot be dealt with here, and in any case the construction of the unit is beyond the scope of most amateurs.



Must Be Rigid.

In the cone itself the sharpness of definition depends upon two factors, weight and rigidity. If the cone is heavy its inertia will be so great that it will not respond immediately to the electrical impulses passing through the unit, and the reproduction will be muffled. If the cone is not rigid (the aim of the conical shape is to enhance the rigidity without increasing the weight) it will not vibrate as a whole but will tend to form nodes, i.e. the rim of the diaphragm may be moving in one direction when the apex has already reversed and commenced to travel in the other. This will tend to happen upon the more rapid vibrations to a greater extent than upon the slower ones, and as a result the high notes will not be properly transmitted. The effect is shown diagrammatically in Fig. 1.

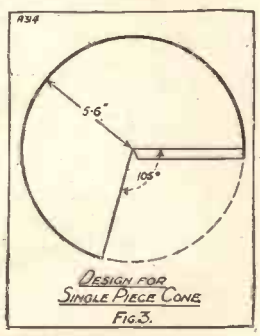
So far then we see that from this point of view, in order to achieve good definition and an accurate response to the high tones a cone must be both as light and as rigid as possible. What factors determine the extent to which the deep tones will be transmitted?



Imagine a cone, suspended freely in air, to be in vibration, and suppose that, at any moment, the direction of motion is from *a* to *b* (Fig. 2). Now the air on one side of the cone is being subjected to compression, and that on the reverse side to rarification; this being so, it is obvious that there will be a tendency for air currents to flow from one side to the other, round the edge of the cone. These currents represent loss of energy; if the cone is vibrating slowly there will be a greater lapse of time for them to flow in, and more energy will be lost, than if the cone were vibrating rapidly. The result will be loss of the deep tones.

Why Baffles are Used.

To remedy this fault it is necessary to isolate the two sides of the cone from one another. The most perfect method of doing this would obviously be to cut a circular hole in the wall of the room in which the speaker is to be used and to suspend the cone in this opening, filling the space between the rim of the cone and the edges of the hole with an "apron" of thin sheet rubber. The purpose of this rubber suspension is to complete the isolation of front from back without impeding the free motion of the cone's rim. The wall will then form what is known as a "baffle."

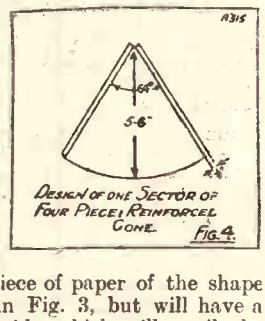


Few wireless amateurs, however, are in a position to resort to this kind of thing to isolate the sides of their cone, and, as a matter of fact, complete isolation is not necessary. Satisfactory results can be obtained by simply providing as great a leakage path between the front and the back as possible.

A board baffle, as used with coil-driven speakers, consisting of as large a square of plywood as convenient with a circular central hole for the cone, may be used, or for the sake of compactness the baffle may take the form of a cabinet. In each case it is essential that a rubber suspension or something similar between cone and baffle be used.

Most Efficient Method.

The ideal of rigidity combined with lightness is most nearly approached in paper, and of all papers ordinary drawing paper is probably the most suitable. The cone when made, should be coated with shellac varnish and baked in a warm oven until the varnish is quite hard.



The most satisfactory angle at the apex is 90 degrees in my experience, a suitable diameter (projected) at the rim being eight inches. A cone of this nature may be made from one piece of paper of the shape and size shown in Fig. 3, but will have a seam down one side which will spoil the symmetry, and may, as has been suggested, mar the results.

A much superior method of construction is the four-piece construction, a cone design that has not, to the writer's knowledge, been previously described. Four paper sectors, shaped as shown in Fig. 4, are required. The tabs, marked *a* and *b* in the diagram, are bent up at right angles to the main body of the sector. Then tab *a* on one sector is glued to tab *b* on the next, and so on until all four are glued together, with two tabs left free.

Symmetrical and Strong.

At this stage it is necessary to allow the glue to set. Then the free tabs must be glued together, pulling the sectors into a cone formation to allow of this, with the four ribs formed by the tabs for preference on the convex side of the cone. The cone should be varnished and baked quite hard in the ordinary way.

Such a cone has four radial ribs, running from apex to periphery, substantially reinforcing the whole construction. Moreover, the design is quite symmetrical. The rigidity is considerably enhanced without materially increasing the weight, and the extra crispness of the tone can be heard immediately a reinforced cone is substituted for one of the ordinary type.

THE "SUMMER" ONE ON TOUR.

An account of a week-end adventure in the New Forest with the small "P.W." portable, the construction of which was given last week.

By A. S. CLARK.

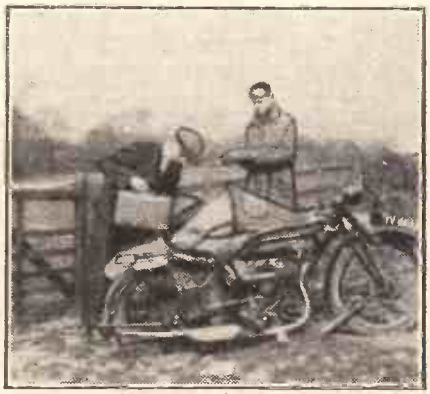
HAVING arranged to spend the week-end in the New Forest, my friend and I decided we ought to take a wireless set with us. So I wandered into the "P.W." Research Department with intent to beg, borrow or steal one. The last, however, was out of the question, as the Chief of Research was very much "at home." Still, he had a single-valve portable receiver which, he said, worked well, and which I could borrow providing I returned it intact, as it had yet to be photographed prior to publication.

When we arrived home, we connected up the set to the permanent aerial and earth just to make sure it really did work! Not only did it work, but results were every bit as good as those usually obtained with a single-valver. There was, therefore, obviously no loss of efficiency due to the very portable nature of the set.

Successful Results.

The next step was to dig out the junk box in the hope of finding some suitable wire for a portable aerial. However, the only help this much-valued store could produce was some 22-gauge D.C.C. wire. We decided this would have to do and cut two pieces, one about 9 ft. long for the "earth," and the other about 27 ft. long.

Slinging the longer piece across the room by the ever useful picture rail, and laying the other along the floor, we donned headphones and in came 2 L O at full strength.



"The next morning the set was packed, together with other luggage, in the back of a sports sidecar."

A little knob twisting and there was 5 G B quite pleasantly loud. We then tried shortening the aerial wire, and continued until the two wires were merely coiled on the floor by the side of the set. Good signals still came in from 2 L O, about nine miles distant.

Optimistically we now removed both aerial and earth wires, and although the transmission from 2 L O could not be properly resolved, it was easy to tell that the station was modulating. That night we listened to the dance music from 5 G B with the metal window frame for an aerial and the spring mattress as a counterpoise.

The next morning the set was packed, together with other luggage, in the back of a sports sidecar. As the journey to the New Forest was accomplished very quickly those who are used to motor-cycles will appreciate the jolting the set received. It was, therefore, with misgivings that the set was removed at the end of the journey, for portable sets, in common with such things as eggs and glasses, require careful handling. On opening the lid, everything was found in order, even the coil was still *in situ*, and the only thing that seemed to have happened was the spilling of a little acid. But, then, the set had been on its side all the time. (The accumulator was only the semi-unspillable type.)

The bungalow on the farm where we were to stay was about twelve miles from the Bournemouth Station. Therefore, after fixing the aerial across the room and laying the earth wire on the floor, we expected to get good results. We could only get very weak signals, however, and after trying everything we could think of, we gave it up in disgust.

That evening we discovered the explanation. We were standing out of doors listening to the cows imitating an L.F. howl, when, turning to look at the sunset, we noticed a brilliant reflection from the top of the bungalow. Closer observation showed that the almost flat roof was of corrugated iron, neatly earthed through water pipes and water tanks! So indoors we went, and connected the set to an aerial and earth which had been erected for a crystal set. The aerial had not, however, been used for some time as the cat's-whisker holder had conceived a dislike for the rest of the crystal detector and parted company with it.

The result was good signals from Bournemouth with 5 G B pleasantly audible. Imagine our surprise, therefore, to find that the aerial wire ended outside the lead-in tube, and to see the down lead swaying about above our heads. With pleasurable anticipation we hurriedly joined these wires and returned to the set. 2 B M did not seem a great deal louder, but 5 G B came in at really good strength, and several continental stations were also heard.

A "Popular" Set.

Unfortunately, further experiments now became out of the question, as the people of the house and their friends took possession of the set until we left.

The lower aerial taps were only used on proper outdoor aerials, direct coupling giving best results with other pick-up arrangements.

"The journey was interrupted for a while in order to listen to a little music."

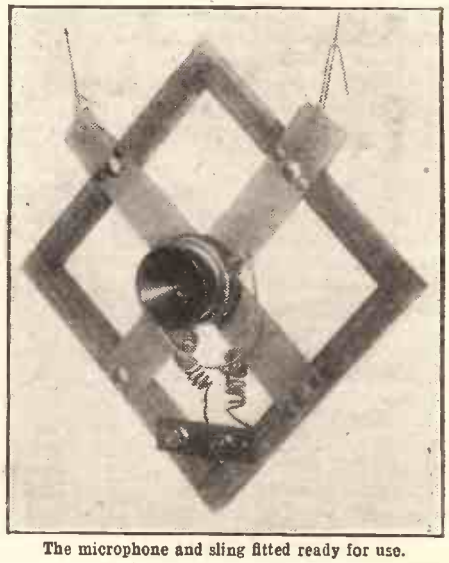
My companion suggested that, as a formal test, we should bring the set home strapped on the carrier of the motor-cycle. Remembering the remarks of the Chief of Research, re returning the set unsoiled and without a scratch, I decided that such drastic treatment was not fair to any portable receiver—no, not even to this sturdy little "P.W." set.

A MICROPHONE SLING.

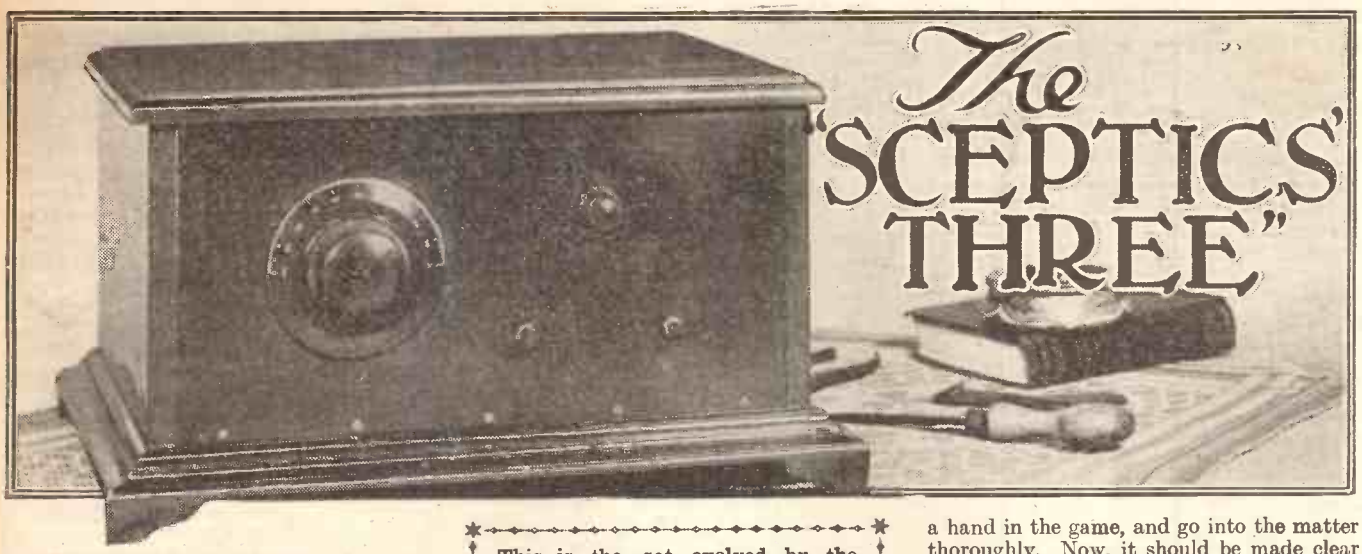
LISTENERS frequently express the wish that they could arrange a means whereby it would be possible to reproduce their own voices on their loud speakers. It is possible to do this, and quite a cheap telephone microphone may be successfully employed. A wooden frame should be arranged approximately 9 in. square and made of fairly substantial wood, 1 in. square is a suitable size.

Easily Made.

Two strips of fairly thick motor-cycle inner tube are stretched across the frame and allowed to project 1 in. or so. These small, extending pieces allow the microphone to be suspended by string from the ceiling. The microphone is fixed securely to the centre of the frame, and two flexible leads are taken to a terminal strip mounted on the frame. A microphone transformer is obtainable from any large electrician's for a few shillings. The primary of this transformer is connected in series with a 2-volt battery, and the microphone transformer secondary is connected directly across the grid and filament of the first amplifying valve in place of the ordinary L.F. transformer secondary.



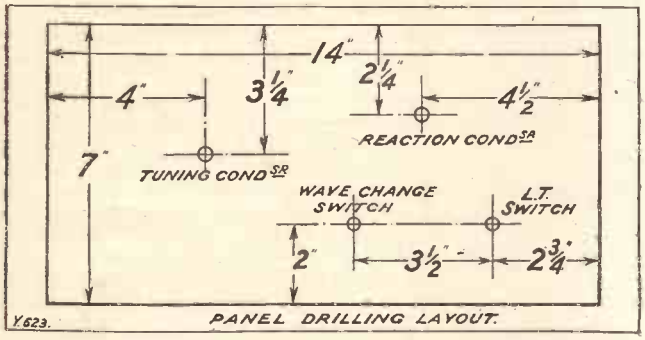
The microphone and sling fitted ready for use.



The "SCEPTICS' THREE"

This is the set evolved by the "P.W." Technical Department in response to a friendly challenge made by a sceptical reader. With loud speaker and all accessories its cost is below £8, it is equally suitable for medium or long waves, and it DOES get plenty of programmes in addition to "the local" without the necessity of changing coils.

A CERTAIN cheerful doubter who writes us sceptical letters from a northern centre has recently stirred up something of a pother by expressing his strong conviction that no ordinary "det. and L.F." type of set was genuinely capable of bringing in those strings of stations on the loud speaker so dear to the heart of the enthusiast, this assertion being subject to certain qualifying clauses.



The qualifications were, in the main, capable of being summarised thus: It was assumed that by the expression "ordinary det. and L.F. receiver" was meant the kind of set which the average family man *can* build and which he can afford to build. Within this limit, the sceptic maintained that if the set were used upon a merely average aerial by an ordinary unskilled operator it would *not* bring in more than just the local station, 5 G B and 5 X X. The actual price limitation which he laid down was a figure of £8 at the very most, and preferably only £7, *for the complete installation*, including valves, batteries, and loud speaker.

Heresy!

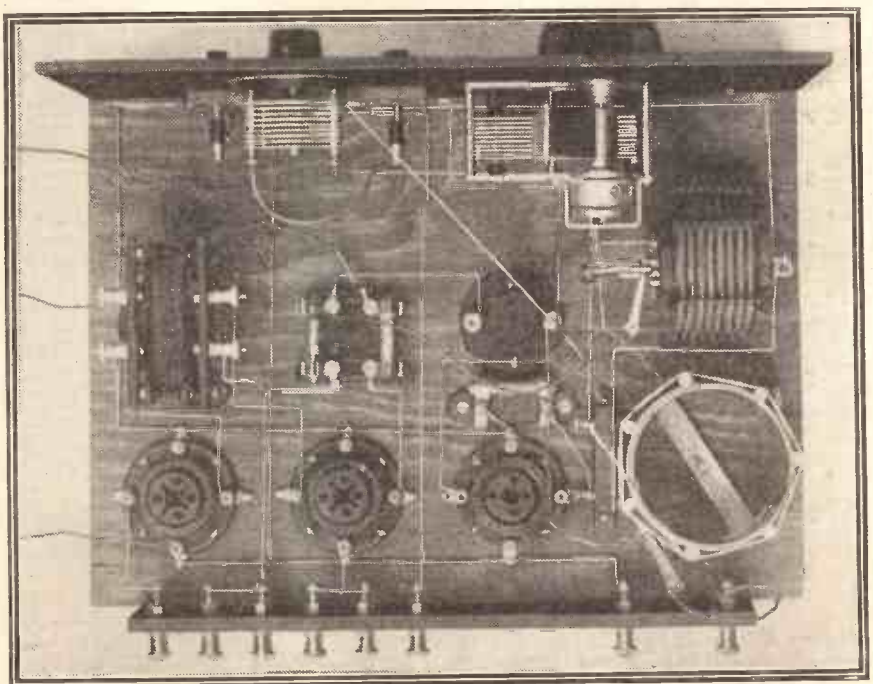
These heretical views provoked certain enthusiastic correspondents to pen some burning epistles to the doubter, who has remained so far entirely unconvinced, with the result that quite a number of confirmed "DX hounds" now seem to feel that he must be converted at all costs, by the methods of the Spanish inquisition if necessary! A number of letters from stout supporters of the "det. and L.F." as a distance-getter have appeared in our "Correspondence" columns, as the reader will no doubt remember, but it should be explained that these were only a selection, and there has really been quite a spate of extremely vigorous correspondence on the subject of the exact capabilities of the average set of this type.

The question was so obviously one of general interest that it was decided that the "P.W." Research Department should take a hand in the game, and go into the matter thoroughly. Now, it should be made clear right away that the problem is a much more difficult one than many of the stout champions of the simple set seem to have realised, and it may as well be confessed that it has caused some considerable racking of brains and running to and fro among the Research Department staff. The fact is that many of our enthusiastic correspondents failed to realise the extremely stringent nature of the limitations laid down by our cheery sceptic, who may be suspected of imposing them with a certain degree of skill!

Severe Conditions.

First of all, the set, to meet his challenge, must be capable of giving the results claimed by the opposition when handled by an unskilled and non-technical operator, and this means two things—(*a*) specially sensitive but tricky circuits are ruled out, and (*b*) a slow-motion drive on the tuning control is practically essential, and this adds to the cost.

(*Continued on next page.*)



As this photograph shows, particular care was taken with the baseboard lay-out in order to ensure the highest possible degree of efficiency.

THE "SCEPTICS' THREE."

(*Continued from previous page.*)

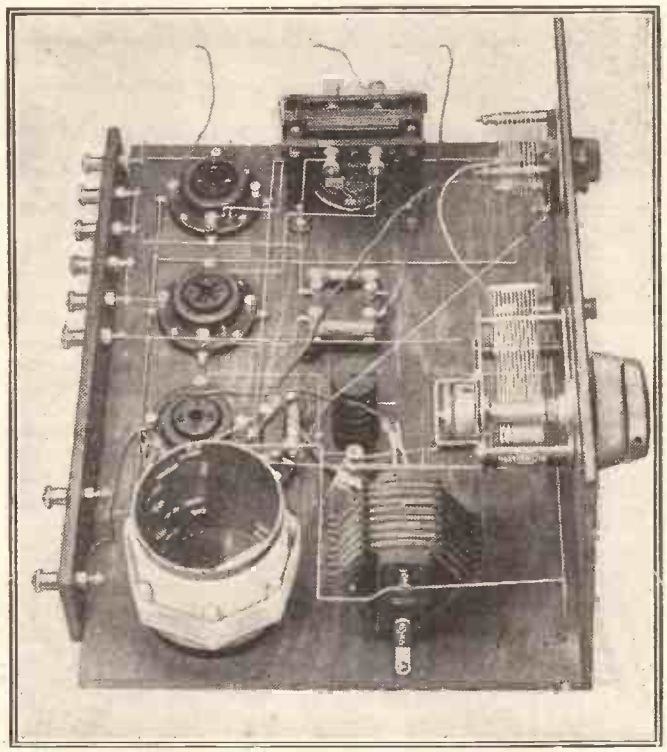
And now what about the price? That figure of £8 is a much more serious limitation than one would at first think, and how serious it is one only discovers when a little simple arithmetic is done with the list of necessary accessories. Just consider them. The H.T. battery will cost, say, 14s.; three valves (assuming British ones), say, 31s. 6d.; the L.T. battery can be got down to perhaps 5s. or 6s. by using one of the 2-volt glass-cell types, and the loud speaker will obviously have to be a pretty cheap one costing about 25s. or 30s., on top of which there may be another 1s. 6d. for a grid-bias battery.

Cutting It Down.

It is evident that something like half our £8 must be set aside for accessories, and this figure will be very difficult to reduce appreciably. By using a Lissen 100-volt H.T. battery we can reduce the outlay for this item to 12s. 11d., and dispense with the separate G.B. unit, since provision is made for using part of this battery for grid-biasing purposes.

Again, the cost of the loud speaker can be got down somewhat by purchasing one of those surprisingly good little "Lissenola" units, which cost 13s. 6d., and building for oneself a simple type of cone speaker. This is quite an easy job, and the additional cost of materials need be only a few shillings, but it is a little doubtful whether our friend the sceptic will regard this as quite a fair method of complying with his innocent-looking price limit.

Whatever is the final decision about the accessories, it is pretty obvious that it would be necessary to fix a fairly definite limit of about £4 for the complete parts and materials for the set itself, and it is when this fact is realised that one begins to have just a *faint* suspicion that our sporting sceptic was, perhaps, not quite so guileless as he seemed!



This view from the "aerial" end of the set shows exactly how the coils are placed—an important point to watch during construction.

A Critical Figure.

When you come to work it out you will find that somewhere nearer to £5 than £4 comes the dividing line between the inselective and not very sensitive cheap type of three-valver using crude tuning circuits, and the one using high-efficiency coils which would obviously be needed to meet the sceptic's requirements, and the question is whether by any fair means one of the latter class can be got down to the £4 level.

This was the problem which was put up to the Research Department when it first occurred to the Technical Editor that "P.W." itself might well take up the sceptic's challenge, and it would be idle to pretend that the task was undertaken with feelings of unmixed joy! However, the job has been done, and the result is the "Sceptics' Three," a set of which the designers are proud, as will, we think, be every constructor who makes it, for not merely is it possible to build it for the specified £4, but it is a really good set into the bargain, with special features of its own, and nothing cheap and nasty about it anywhere.

We have achieved our end by following up three main lines of approach, namely, the design and construction of the coils, the rigid limitation of the number of components to just those which are really necessary, omitting such superfluities as filament rheostats (quite unnecessary with nearly all modern valves), terminals for grid bias (flex leads and plugs are really more convenient) and so on, and lastly, the careful choice of components of reasonable price but satisfactory quality.

Easily Made Coils.

It was early realised that in any sensitive and selective set the high-efficiency coils needed were some of the more expensive items, and we have accordingly taken great pains to ensure that those finally adopted are such as any handyman can really wind

(*Continued on next page.*)

COMPONENTS AND MATERIALS REQUIRED TO BUILD THIS SET.

1 Panel, 14 in. × 7 in. × $\frac{3}{16}$ in. (any good branded material, the prices vary very little).

1 Cabinet to fit, and baseboard 12 in. deep (prices of the different makers vary considerably here, but if you are content with a moderate degree of finish it can be bought for less than twenty shillings).

1 ·0005 mfd. variable condenser, with slow motion (Dubilier K.C. in original, which only costs 12s. complete with vernier drive and dial. Other good makes are, of course, available at reasonable prices).

1 ·0001 mfd. miniature type reaction condenser (Cyldon, Ormond, Peto-Scott, etc.).

1 L.T. on-off switch (Benjamin, Igranic, Lissen, Lotus, etc.).

1 Push-pull type on-off switch for wave-change switching (L. & P., Lissen, Lotus).

3 Valve sockets. One (that for the detector) should be of the sprung type, such as the Benjamin, Bowyer-Lowe, Burne-Jones, Igranic, Lotus, W.B., etc., but the other two can, if desired, be of the plain type, such as the Igranic or Lissen, which only cost 1s.

1 R.C. coupling unit, with anode resistance of ·5 meg. and grid leak of 2 meg. (Lissen in set, costing 4s. complete).

1 ·0003 mfd. fixed condenser (Lissen in set. Any good make, Clarke, Dubilier, Igranic, Mullard, T.C.C., etc.)

1 2-meg. grid leak and holder (Lissen in set. Any good make, Dubilier, Igranic, Mullard, etc.)

1 H.F. choke (home-made, by winding a Redfern choke former according to the instructions on the box. This is quite easy and a decided economy, but if desired any standard make of choke can be used).

1 Standard loading coil former ("M.W." and "P.W." type), and 4 oz. of No. 26 D.S.C. wire, or if desired a ready-wound loading coil (Wearite in original set). (Burne-Jones, Paroussi, Wearite, etc.)

1 L.F. transformer, fairly low ratio (a number of good types are available at prices as low as 15s., e.g. the R.I. & Varley "General Purpose" type. This is largely a matter of the constructor's taste).

1 Terminal strip, 12 in. × 2 in. × $\frac{3}{16}$ or $\frac{1}{4}$ in., and 8 terminals.

1 Piece of tubing, 3 in. diameter and 3½ in. long, for short-wave coil (any good insulating material, Pirtoid, Radion, etc.).

4 oz. No. 24 D.C.C. wire and 1 oz. No. 32 D.S.C. wire.

Small quantity of bare tinned copper wire for wiring up, flex, G. B. plugs, 3 tapping clips, sundry small pieces of wood, screws, etc.

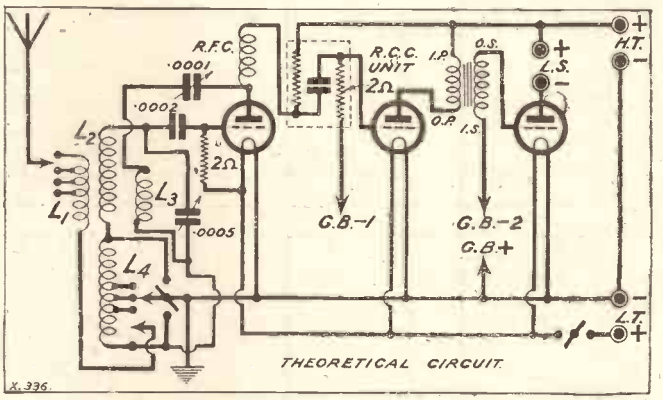
THE "SCEPTICS' THREE."

(*Continued from previous page.*)

for himself quite easily and without any special tools. So, dear reader, please do not give way to the feeling of panic which afflicts so many people at the mention of home-wound coils! There is nothing at all difficult about these, and all you will need is just a little patience. Further, if you like to spend a few shillings more you can obtain the larger one (for long waves) ready wound, from at least three different firms (see list of parts).

The circuit chosen for the set was necessarily of a straightforward type, but it incorporates some special features which are rather interesting, and confer its particularly good sensitivity on the receiver, in conjunction with efficient coils and a carefully designed lay-out for the parts. The L.F. side is of quite a normal type, with one resistance and one transformer-coupled stage, no comment being called for here.

The tuning circuits, however, are distinctly novel in some of their details, notably in that by a special combination of coils a very simple switching scheme becomes possible which enables you to go over from the shorter wave band to the longer in a highly efficient manner.



This scheme is rather similar to that used in the "All-Programme" sets, but the advent of our standardised loading coil enables it to be carried out in a still simpler way, and further means that you can buy the coil ready-wound if you wish. If cheapness is the main consideration, of course, you can buy the former ready cut and prepared, and wind it for yourself (quite an easy matter, since the wire is quite roughly wound in slots).

Efficient Switching.

The switching scheme is a specially effective one, since it overcomes one of the main difficulties experienced with such circuits, namely, poor selectivity on the long waves. How it does this you will see quite clearly in the circuit diagram with the aid of the explanations which follow.

On the shorter wave panel the aerial is inductively coupled to the usual tuned secondary circuit, and Reinartz reaction is used. When the loading coil is switched in, however, the circuit is changed somewhat, and by a special arrangement of the tappings which are provided on the standard coil the aerial becomes auto-coupled, while an additional "Hartley" reaction effect is introduced.

The final result is a set of very excellent performance, the sensitivity being well up to the best "det. and 2 L.F." standard. As an example of its powers, we will quote the fact that on a good suburban aerial it has brought in 9 distant stations at proper loud-speaker strength in the course of a single evening.

The selectivity, too, is quite useful, but the constructor must realise here that such sets as this only incorporate a single tuned circuit, and he must not expect in the ordinary way to cut out the local station

(*Continued on next page.*)

POINT-TO-POINT CONNECTIONS.

Earth terminal to one filament socket of each valve holder, to the H.T. — and L.T. — terminals, to the earthing-plate terminal on the ·0001 mfd. reaction variable condenser, to the centre arm of the wave-change switch via a flexible lead, and to a tapping clip which engages the high-wave coil L_4, also via a flexible lead. This clip is known as the filament tapping clip.

L.T.+ terminal to one side of the L.T. switch.

Other side of switch to the remaining filament sockets of the valve holders and to one side of the 2-meg. grid-leak holder.

Remaining side of 2-meg. grid-leak holder to the grid of V_1 and to one side of the ·0002 mfd. fixed grid condenser. Other side of the ·0002 mfd. fixed condenser to the top end of L_2 and to the fixed vanes of the ·0005 mfd. variable condenser.

Left-hand contact on wave-change switch to the terminal marked "216" (or some makes marked "out") on the L_4 coil and to the bottom end of L_2.

Aerial terminal (via a flexible lead) to a tapping clip which engages with the tappings on L_1. This is known as the aerial tapping clip.

Bottom end of L_1 to a tapping clip which engages with the tappings on L_4, the clip being known as the long-wave tapping clip.

Right-hand end contact on the wave-change switch to the moving vanes (frame) of the ·0005 mfd. variable condenser, to the "0" terminal (marked "In" on some makes of coils) on the L_4 coil and to the top end of the L_3 reaction winding.

Bottom end of L_3 to the moving vanes of the ·0001 mfd. reaction variable condenser.

Fixed vanes of same condenser to one side of the H.F. choke and to the plate of V_1.

Other side of H.F. choke to the "P" terminal on the R.C. unit.

"H.T." terminal on R.C. unit to the "I P" terminal on the L.F. transformer, to the H.T. + terminal and to the L.S. + terminal.

"G" terminal on R.C. unit to the grid of V_2.

"L.T." terminal on R.C. unit to the G.B. — 1 plug via a flexible lead.

Plate of V_2 to the "O P" terminal on the L.F. transformer.

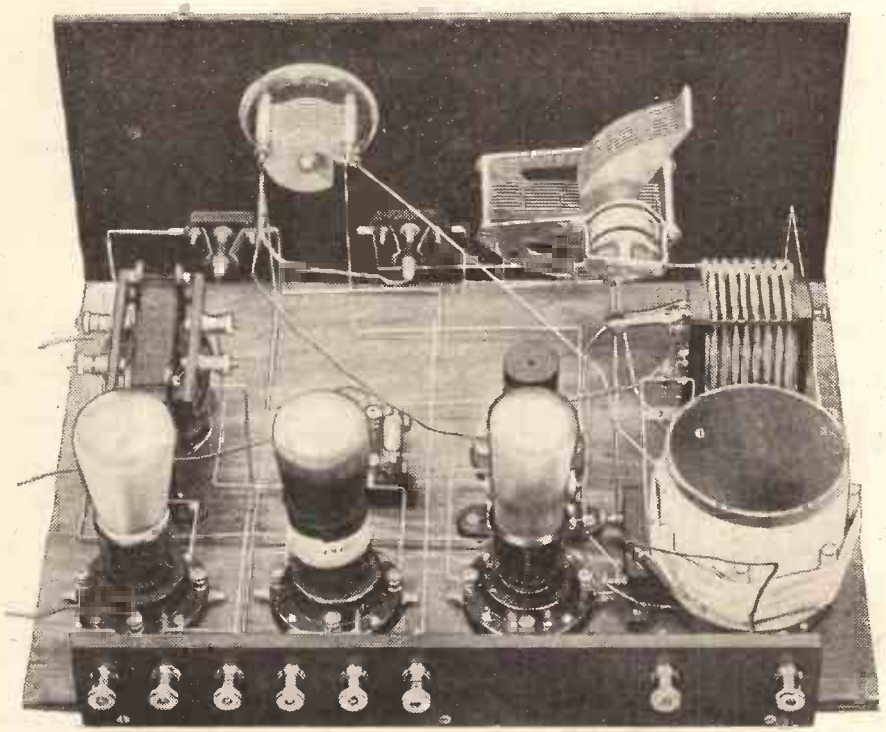
"O S" of transformer to the grid of V_3.

"I S" to the G.B.— 2 plug, via a flexible lead.

Plate of V_3 to the L.S. — terminal.

G.B. + plug via a flexible lead from the negative filament socket of the valve holder V_3.

This completes the wiring.



Here the valves are shown inserted, and the connections to the switches on the panel are clearly indicated.

THE "SCEPTICS' THREE."

(Continued from previous page.)

at a distance of a few miles and receive the foreigners. To do so with a simple set of this type it is best to abandon the idea of getting very high selectivity from special circuits and to use instead a wave-trap of one of the modern reliable types, which can be assembled for perhaps 5s., and converts the outfit into one of very high "special selectivity."

So much for general details. All the information you require to build the set concerns the construction and mounting of the coils, since the rest of the work is very simple indeed. The ordinary wave coil is wound on a piece of insulating tube 3 in. in diameter and 3½ in. long, any good insulating material being suitable, In one end of this tube a small wooden cross piece is fixed by means of two little brass screws, and the finished coil is secured in place by passing a screw down into the baseboard through the cross-piece in question.

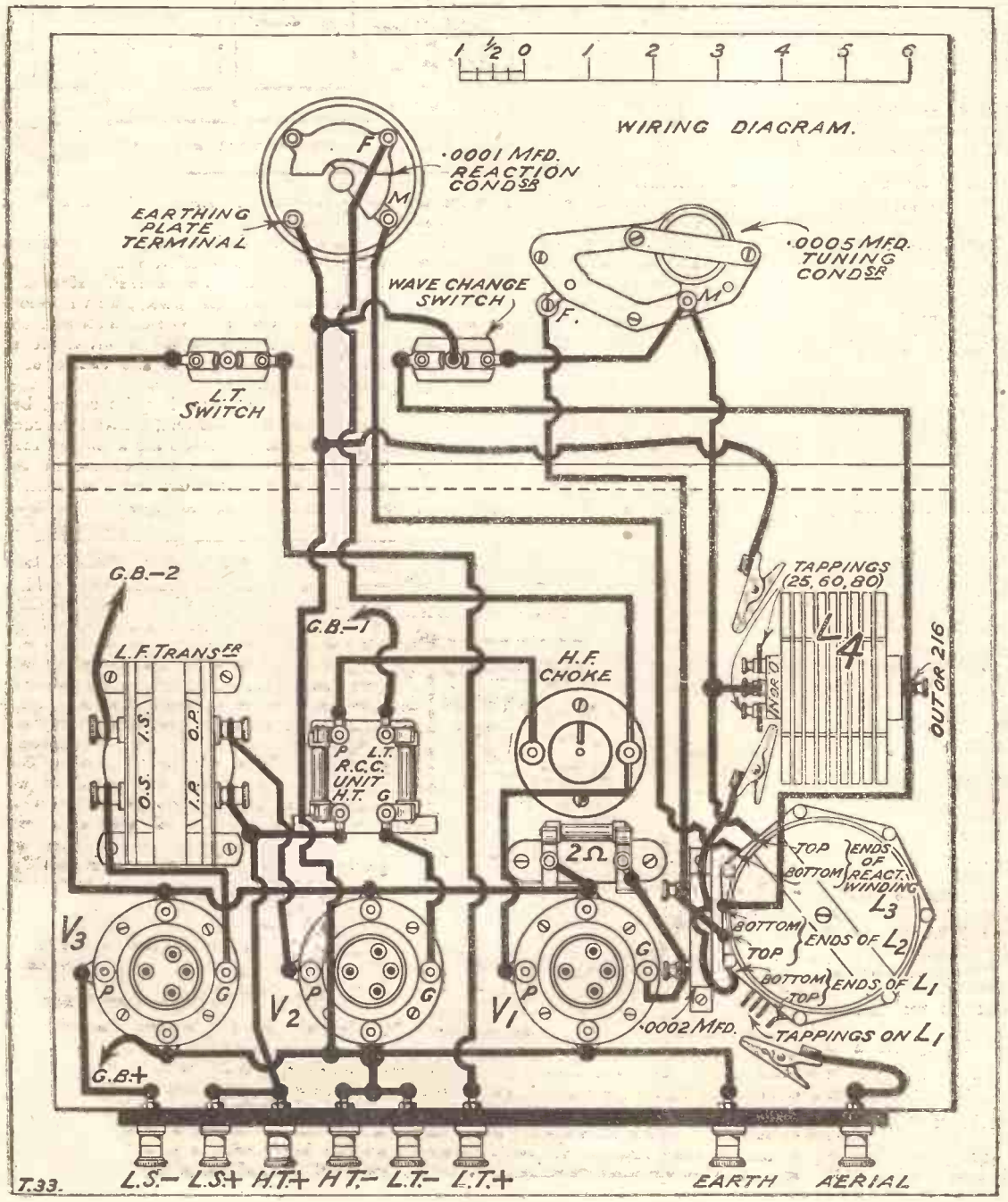
Easily Wound.

Starting at the lower (cross-piece) end of the tube, wind on 30 turns of No. 32 D.S.C. wire in a single layer, securing the start and finish by passing the end of the wire through a couple of little holes in the tube, with a dab of sealing wax, or in any other way that appeals to you. Now leave a space of about $\frac{1}{16}$ inch and commence the secondary winding, which runs in the same direction as the reaction winding, i.e. as though it were a continuation thereof, and consists of 60 turns of No. 24 D.C.C. wire. This will occupy nearly the whole of the remainder of the tube, leaving only about ⅛ in. unoccupied at the end.

The aerial winding consists of 25 turns of No. 24 D.C.C. wire, with tappings at 10, 15 and 20 turns, and this is wound on over the top of the secondary coil at the lower end, i.e. nearest to the reaction winding. To get the best results, this winding should not be put directly on top of the secondary, but should be lifted up a little so that there is a small space between, and this can be arranged for in various ways.

For example, in the original coil we arranged seven pieces of wooden rod (the packing stick from a packet of "Glazite") at equal intervals round the secondary, and then wound the primary on top of these. These wooden spacers should be about ¼ in. in diameter and 1¼ in. long, and they can be held in place temporarily with a rubber band until you get the wire on.

By the way, the various windings are marked for identification on the wiring diagram as follows: L_1 is the aerial winding (or primary), L_2 is the secondary, and L_3 the reaction coil. The direction of L_1 is quite immaterial.

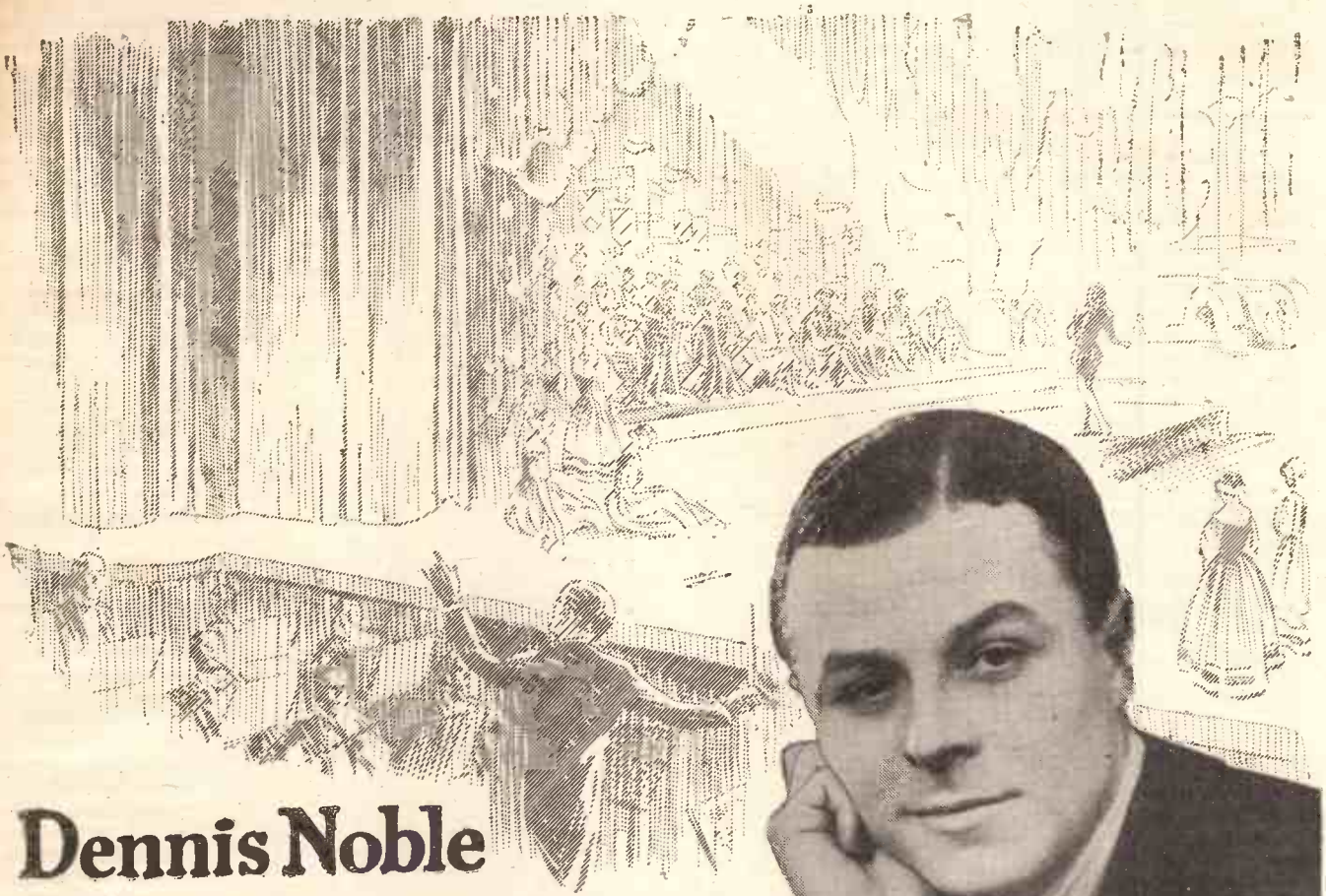


The Loading Coil.

Now for the loading coil. If you obtain one of the standard formers ready for winding, you will find it has a series of saw cuts in the ribs, which form slots for the winding, and in each of these you should wind in 27 turns, making 216 in all, of No. 26 D.S.C. wire, with tappings brought out in any convenient fashion at 25, 60 and 80 turns, counting from the beginning, which should be labelled "0," the finish being marked "216." These indications are to help you in working out the connections on the wiring diagram, and should be observed whatever the positions of the terminals on the former or complete coil which you use. (The arrangement illustrated is actually that of the "Wearite" version of the coil.)

The rest of the constructional work requires no explanation, for the diagrams and photos give all the aid you will need in so simple a set, but it should, perhaps, be mentioned in passing that the "wave-

(Continued on page 540.)



Dennis Noble who sang to you in the Meistersingers

You heard the voice of Dennis Noble in the "Meistersingers" from Covent Garden—he sang to you in the broadcast "Proms." If you appreciated his voice then, you will appreciate it still more if when next time he broadcasts you are using a Lissen New Process Battery in your set. For the pure current of this battery will keep every word clear, every note distinct. The fine voice will come to you with a truth of tone that will delight you. For there is a fine power in the Lissen Battery, put there by a secret process, and a new chemical combination which is known only to Lissen, and which you can get in no other battery.

The large cells are packed with energy which is sustained throughout the longest programme and lasts throughout months and months of use. The current flows noiselessly all the time—pure, steady D.C. always. You will never find better power for radio.

The Lissen Battery is obtainable at any one of 10,000 radio dealers. You will get extra power and added clarity if you ask next time for a "Lissen New Process Battery," and show plainly by the way you ask that you mean to take no other.

60 volts (reads 66) - -	7/11
100 volts (reads 108) - -	12/11
60 volts Super Power -	13/6
9 volts Grid Bias - -	1/6
4½ volts Pocket Battery (4/6 per doz.)	5d. each

LISSEN LTD., 8-16, Friars Lane, Richmond, Surrey.

Managing Director: Thomas N. Cole.

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

ELECTROLYTIC CONDENSERS

A.C. OR D.C. OPERATION—OUTPUT TRANSFORMER—BAFFLES—LOCAL INTERFERENCE, ETC., ETC.

Electrolytic Condensers.

I MENTIONED in these Notes some few weeks ago the so-called "dry" electrolytic condensers which were being used in America. I now have samples of these condensers, sent to me direct from the United States, and I have been experimenting with them for the past few weeks.

The particular feature of an electrolytic condenser is that it develops a large capacity for a comparatively small compass; that is, as compared with an ordinary condenser of the laminated type.

For Smoothing.

Electrolytic condensers have, of course, been known for very many years, but it is only recently that any serious work has been done upon them. Attention has been particularly concentrated upon making electrolytic condensers of large electrical capacity and small volume for use in "mains supply units," especially the low-tension supply unit, where a very large smoothing capacity is required. The samples which have been sent to me vary in capacity between 1,000 and 2,000 microfarads, and are no larger than, say, a half-pound tobacco tin. You can put one of these condensers in your coat-pocket.

As the inventor has sent me a large amount of technical information in strict confidence, I am unable to make any public statement as to the internal construction of the condensers or the materials which are employed.

Soon Available for Experimenters.

The proprietors of these condensers (which are already in commercial use in the United States) have asked me to make all necessary arrangements for the condensers to be made available for the British radio public, and before very long you will be able to purchase the condensers and so verify all their useful qualities for yourself.

The capacity of the condensers is so large that charging them up is like charging a small accumulator, and when they discharge they do so over quite a long period.

There are many other very interesting properties of these high-capacity condensers, but I will deal with these, together with methods of using the condensers with low-tension mains supply devices, at an early date.

A Simple Form.

While on the subject of electrolytic condensers, perhaps some of my readers may not be familiar with the older examples of this type of condenser. Perhaps the earliest and best-known electrolytic condenser consists of a number of aluminium plates dipping into a solution of sodium sulphate or various other liquids. Suppose there are six plates arranged parallel to one another after the fashion of the plates of a lead accumulator, and plates Nos. 1, 3, and 5 are connected together to form one pole of the condenser, whilst plates Nos. 2, 4, and 6 are connected together to form the other pole.

A condenser of this kind is suitable for A.C. operation, and its capacity is due to the formation of a thin layer of gas (which may be hydrogen) in extremely close proximity to the metal. In other words (making a rough comparison with the operation of an ordinary condenser), the very high capacity of the electrolytic condenser is believed to be due to the extremely small distance between the metal and the gas layer.

A.C. or D.C. Operation.

For direct-current operation (such as smoothing of the D.C. output of a low-tension eliminator) all the aluminium plates may be connected together and, in addition, a lead or other "neutral" electrode may be introduced into the electrolyte. A condenser of this kind also acts as a rectifier. It allows current to enter it in one direction, but not in the other, and is therefore specially suitable as a low-tension smoother.

Breakdown Voltage.

Condensers of this kind, like other condensers, are limited to a certain critical voltage; this is the voltage at which the gas layer or film breaks down. However, if a breakdown occurs, the electrolytic condenser is not put permanently out of action, and it only takes a short time to form a new film, when the condenser is again in its original condition.

Amongst the various solutions which may be used as electrolyte are the following: Potassium permanganate, ammonium chromate, ammonium bicarbonate, sodium silicate, ammonium phosphate, ammonium citrate, and borax. The amount of these compounds to be introduced into the solution is usually very small—about 1 per cent.

Output Transformer.

I am often asked questions as to the advisability of using an output transformer between the loud speaker and the output of the receiver. Everyone knows, of course, that this is sometimes done for protection purposes; but, apart altogether from that, it has in many cases definite technical advantages.

If it is possible to match the impedance

(*Continued on page* 551.)

GERMAN FLIERS SPEAK TO BERLIN.

Fixing the special microphones in a room of the Ritz Carlton to enable the German Transatlantic fliers to speak home to Berlin via the radio telephone service. It will be remembered that the two German airmen and Major Fitzmaurice landed on Greenly Island after a hazardous transoceanic flight.

NEWS FROM SAVOY HILL. FROM OUR OWN CORRESPONDENTS.

A COUNCIL OF WAR?

THE GOVERNORS—RISING TALENT AT SAVOY HILL—THE LISTENERS' COMMITTEE, ETC., ETC.

A Council of War?

IT appears that, just after Whitsun, there was a great assembling in London of B.B.C Station Directors and other officials. The secrecy of the meeting was carefully guarded, and it is only some weeks later that news emerges and from a provincial source. It is stated in this way that the meeting was called to consider heroic measures for the solution of the heterodyning difficulty. It is not clear what, if anything, emerged. This much is known, however, that there are to be some improvements in the autumn—in itself some compensation for the numerous distressed listeners to relay stations up and down the country.

The Governors.

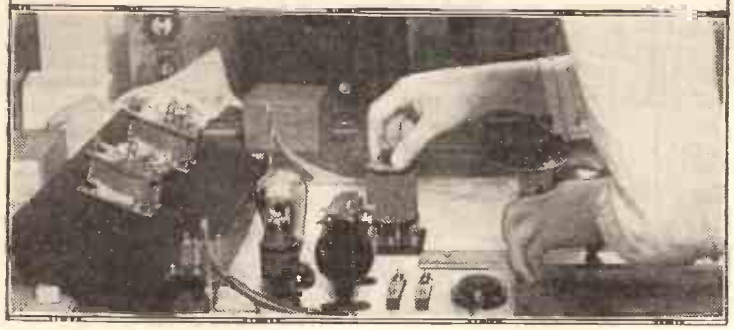
No anxiety is manifested at Savoy Hill on account of the rumour that the governors are contemplating the suspension of their meetings until the autumn. By the way, where is their report to the Postmaster-General?

Rising Talent at Savoy Hill.

A discerning student of B.B.C. personnel picks the following as recent discoveries in talent and possibilities—Gerald Cock (who manages Outside Broadcasts); V. Wellington (who is responsible for Programme Balance); and T. Lockhead (who has earned the reputation of financial wizard). It is believed that these three will go far.

(*Continued on page* 550.)

IS YOUR SET SELECTIVE?



Some simple suggestions for eliminating interfering stations and increasing the sharpness of tuning of simple sets.

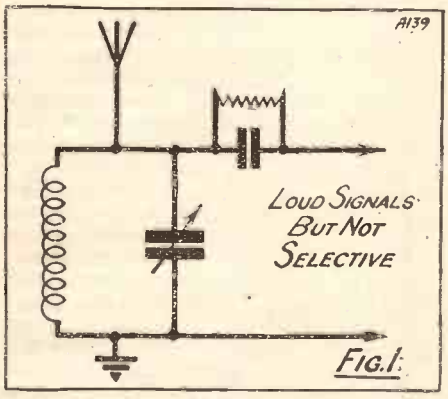
By T. P. BLYTHMAN, B.Sc.

MANY listeners living within a few miles of a broadcasting station have difficulty in cutting out their local station when wishing to receive more distant stations. This lack of selectivity is due to several causes which we can enumerate as below.

1. The method of coupling the aerial to the grid circuit.
2. The use of tuning coils having a high radio-frequency resistance.
3. The damping introduced by the valve and grid-leak detection.

Each of these causes will be dealt with in turn, and we shall arrive at practical means of overcoming each as far as possible.

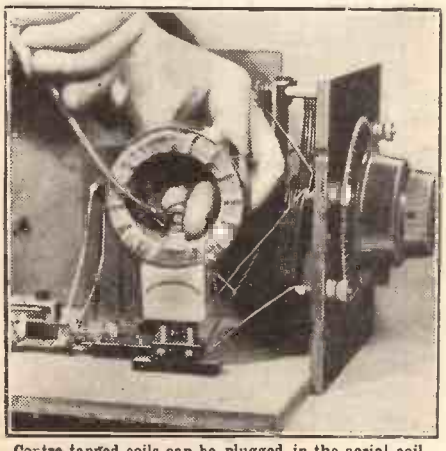
In many of the older sets employing one tuning coil in the grid circuit, the aerial is connected directly to the grid end of the coil. While giving more volume, this is the least selective method of all. If the aerial be connected to one terminal of a ·0002 or ·0001 condenser, a great improvement in



selectivity will be noticed, while the signal strength will be only slightly diminished. A slightly larger coil will be necessary to tune over the same range.

Tapped Coils.

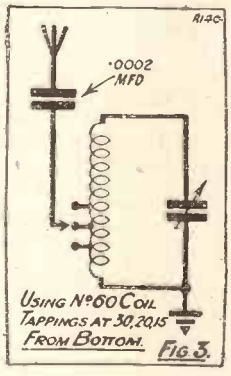
Still greater selectivity can be obtained by using a tapped coil and connecting the aerial to a point half-way down the coil, or by having a series of tappings and using that which gives greatest selectivity without too great a loss of signal strength.



Centre-tapped coils can be plugged in the aerial-coil holders of most of the older types of sets in order to improve their selective qualities.

Usually the best tapping will be about one quarter from the bottom of the coil. (See Fig. 3.)

A better arrangement is to use a separate coil for the aerial. This coil should have 20 or 25 turns, and the amount of coupling between this and the tuning coil can be varied if a two-way coil holder is used. The best position for this coil can be found by trial. The earth end of the aerial coil is connected to the earth end of the tuning coil, as in Fig. 4. With this arrangement there should be no difficulty in cutting out the local station entirely within a few degrees of the condenser scale.



If the tuning coil has a high radio-frequency resistance, the selectivity is poor. The high-frequency resistance of a coil can be kept low by careful winding and the use of a suitable gauge of wire. Where possible the turns should be spaced to keep the self-capacity of the coil low. The thickest wire which can conveniently be wound into the space available should be used. For the ordinary broadcast range, No. 22 or 24 are the best, while for the long waves nothing finer than No. 30 or 32 should be used.

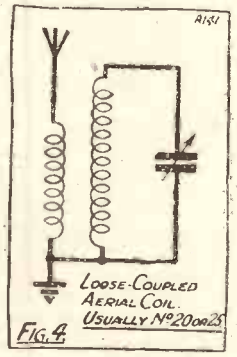
Use of Reaction.

If a slight expense is immaterial, good litz wire is better than single wire. This consists of many strands of wire, each one insulated and, providing each strand is connected at the ends of the coil, it will have a very low resistance, as all the strands, though of high resistance individually, are connected in parallel, a total resistance of only a few ohms will result.

The use of reaction in a receiver overcomes to some extent the resistance and damping to the aerial and the detector valve. By its careful use we can make our set very selective when it is just on the verge of oscillating, but care is needed not to allow the set to break into oscillation, or quality and our nerves will suffer.

Lastly, we must have an efficient earth connection. A poor earth will nullify any improvements we have made in our search for selectivity. An earth wire well soldered to a copper plate and buried in moist soil at least three feet is perhaps the best, but failing this a good connection to the water tap will give satisfactory results.

This article has been written with the object of enabling readers to "look to their sets" if they are not selective, and with the hope that they will profit by it. Do not forget, however, that selectivity and sensitivity are totally different qualities, and to achieve a high degree of the one does not necessarily mean that the other is automatically enhanced. It is no good striving after selectivity if your set is not sensitive enough to bring in the stations.



THREE USEFUL TIPS.

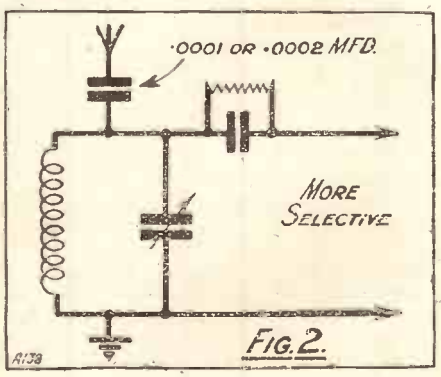
When drilling polished panels it is a good plan to observe the reflection of the drill in the panel, it then being possible to keep the drill upright by noting that the reflection is "in line."

* * *

A variable condenser which depends upon a pressure contact for the moving vanes can be improved greatly by soldering a pigtail connection between the spindle and the appropriate terminal on the condenser.

* * *

When an H.T. battery runs down it can be rejuvenated by making a small hole in the zinc container of each cell and squirting strong sal-ammoniac into it (after the sal-ammoniac has been inserted the battery should be left for a week or so before being returned to service).



WIRELESS WIREWORK

Useful radio appliances can be fashioned from wire at negligible cost and with but little skill.

From A CORRESPONDENT.

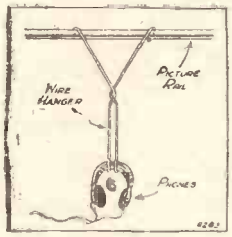
WIRE WORKING is a hobby in itself, and a very interesting one at that.

Advanced exponents of the art are able to fashion all sorts of things, from simple cake-stands to elaborate fire-screens, and so forth. Practically the only material used is a stout gauge of wire, and the tools employed are of the simplest character. In this article I am going to indicate how wire working holds possibilities for the radio amateur.

With practically no skill necessary, there are several contrivances of a very useful nature which can be turned out in a very short space of time. Thick copper wire is the easiest material to manipulate, but galvanised iron wire has the greatest strength, and phosphor-bronze wire lends itself more readily to ornamental work.

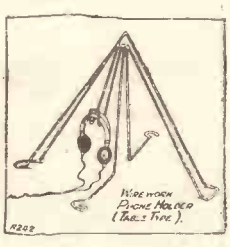
Simple 'Phone Hangers.

The tools required the radio constructor will already possess. These are a pair of round-nosed pliers, a pair of flat-nosed pliers, and a file. Where it is necessary to make joints, these can be of a neatly-twisted character. If the finished article is to be subjected to mechanical stresses, such joints must be strongly made. To take the two ends of the wire and simply to solder them together would not be good enough.



The first article I am going to describe is a very easily made 'phone hanger. The disposal of telephone receivers is always something of a problem. One can lay them on the table or on the top of a set, but this is neither a tidy nor a safe procedure. One should endeavour to avoid winding up the telephone cords, for this practice is conducive of kinks and consequential breakages.

With a few feet of stout wire an excellent holder for suspending them from the picture-rail can be made. This is illustrated in one of the diagrams. You will note that the wire is not shown double throughout, but it really should be; and the reason for this is so that there shall be no sharp extremities to catch into anything. Additionally, of course, this doubling of the wire gives greater strength to the holder.

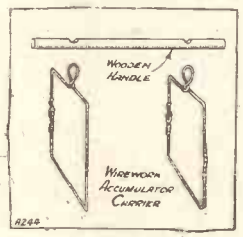


The two hooks at the upper end should be separated by at least a foot. The purpose of these is to prevent the device from swaying and causing damage by friction to the wallpaper. The farther apart these hooks are, the steadier will be the holder. The overall length of the holder will depend upon the height of the picture-rail and the height from the floor at which the constructor desires the 'phones to hang.

A multiple holder for several pairs of 'phones can easily be made on the same principle.

An Accumulator Carrier.

A refinement of the simple 'phone holder is to bend the bottom hook backwards slightly so that a kind of knuckle is formed. This knuckle will then be the only point of the holder which will touch the wall. Three or so inches of rubber tubing should then be pushed over the hook and up the stem of the holder, so that it just passes the knuckle. The rubber will protect the wallpaper, and will make a comfortable resting-place for headbands of the receivers.



Another simple wire-work article which will appeal to the radio constructor is a holder for a voltmeter, watch, or other such thing. It can be made on the lines of the telephone receiver holder for the table, which is illustrated in another of the sketches accompanying this article.

Naturally, if the stand is for telephone receivers, it will require to be somewhat larger than if it is needed for a voltmeter. When making such articles it is advisable to allow a somewhat greater length of wire than one would anticipate the task would take. Owing to the doubling the actual length used is rather illusionary, and one is apt to under-estimate it.

An accumulator carrier on the lines of the one shown in a third illustration will prove extremely useful, but it needs to be made with care, for an accumulator is a heavy object, and one that cannot stand being dropped. The carrier consists of three portions. First, two squares of wire, and then a handle. The squares of wire should both be of the same size, and large enough to slip easily over the battery.

If the design of the battery is such that there is any danger at all of the wire coming in contact with any of the terminals, then the carrier should be protected with thin rubber tubing. Each of the squares of wire has a loop bent in its upper side. For easy carrying and to give it the necessary strength, the handle should be at least ¾ in. in diameter. Good, hard wood, such as oak, should be used for this.

Ornamental Objects.

In the handle should be cut two small nicks at points where the wire squares are to be situated. One wire square is slipped under each end of the battery; the handle is then slipped into the loops. The moment the battery is lifted the loops tend to close up on the handle, and cannot possibly slip owing to the nicks. Similarly, the wire pulls up closely round the battery, and a fairly rigid holder results.

In the case of 4- and 6-volt batteries consisting of separate cells, it will be necessary to have a baseboard to prevent the wire slipping up between the cells.

A more rigid carrier can be made by introducing horizontal wires to build up a sort of framework, but the carrier should be removed from the accumulator when it is not required, as acid will attack metal and eat it away. There are, no doubt, many other devices which can be made quite as easily as the four mentioned merely with wire and a pair of pliers.

These four are all, you will notice, definitely of a useful character. But wire work lends itself very readily to the fashioning of articles of a purely ornamental nature. For instance, with a little practice the reader will find it a simple matter to turn out pleasing frames to hold station logs and other useful reference tables. But it is of course advisable to tackle only the simple articles first. There is a "knack" in wire working which is very easily attained.

A KING HEARS CROYDON CALLING.

The King of Afghanistan listens to Croydon giving the pilot directions by radio while flying at a height of 2,000 feet above London.

A selection of short articles of an eminently practical nature which covers all phases of radio receiver construction, operation and maintenance.

Placing the Rheostat.

RHEOSTATS are not much used nowadays in receivers, but it is sometimes useful to be able to control voltage from the L.T. accumulator. In view of this fact, the best place to attach a rheostat is on the actual crate of the accumulator, connection being made in series in the usual manner. One of the baseboard-mounting type is most suitable for the purpose. It should be variable from 0 to 30 ohms for general purposes. To find what resistance is required on any occasion, all that it is necessary to do is to subtract the voltage of the valve from the voltage of the accumulator and divide the answer thus obtained by the total amperage of the valves used in the receiver.

A Novel Switch.

A NOVEL switch which, at the same time, acts as a safety device can be made or incorporated in a receiver by employing an ordinary flash-lamp bulb and holder of any type, preferably for baseboard or panel mounting. The two terminal connections of the holder are joined in circuit in the same way as the ordinary "on-off" switch would be.

When the bulb is screwed into the holder the circuit is completed, while, at the same time, if anything is wrong the lamp burns out. To switch "off," it is only necessary to unscrew the bulb until the bottom contact is lifted from the contact of the holder. It cannot be used as an L.T. switch.

Making An Earth.

A CONVENIENT form of earth tube can be made from any kind of metal rod; the longer the better, providing it can be driven into the ground. For preference, it should be hollow, so that it will retain moisture. An old curtain-rail suits the occasion admirably. A good earth can also be made from a quantity of wire waste, such as most constructors have, and which is usually ultimately thrown away.

This should be buried at some depth in the ground, all tangled up, a lead being taken from the waste in the usual manner by soldering to an end of the wire. An earth of this type has a large surface area, and is efficient. Finally, old accumulator plates are very suitable for the purpose if joined together in series and buried in the usual manner.

Cleaning Panel Supports.

PANEL supports and other articles which happen to be made of copper or brass quickly become dirty and discoloured if they have not been lacquered, and, if the discoloration is allowed to remain for any length of time, such articles become very difficult to clean, even with the aid of metal polish.

A simply-made preparation for renovating articles of the above nature may be prepared by taking half a cupful of common salt and by saturating it with vinegar until the mixture has the consistency of a thin paste.

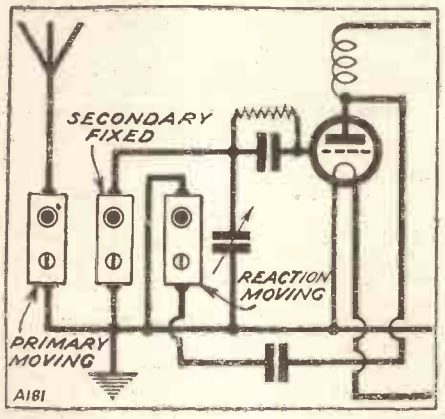
A rag dipped in this mixture and then vigorously rubbed over the surface of the metal article will quickly brighten the latter. Or, provided the articles are small enough, they may be immersed completely in the cleaning preparation for an hour or two, after which a slight rub with a rag and a subsequent thorough rinsing in clean water will have the desired effect.

After using the above preparation, always remove it from the metal articles by means of a damp rag, afterwards completing the refurbishing operation by going over the cleaned metalwork with a dry, soft duster.

Three-Way Coil Holders.

COIL holders are still popular amongst some constructors, but there sometimes seems to be doubt as to the correct method of using them with the Reinartz form of circuit. In most three-way coil holders all the pin elements are on one side, and all the socket elements on the other. This should be so in any case. The diagram shows how such a component should be connected in circuit.

The primary moving coil has the pin connected to earth via the pin element of the



secondary fixed coil. This is essential in the event of the secondary being used for direct coupling with a centre tap or X coil. The next thing to do is to be sure to connect the earth to the socket side of the moving reaction coil, taking the pin element to a fixed reaction condenser. In this way uniformity of direction in winding is maintained throughout.

An Accumulator Tip.

NO doubt from time to time readers experience trouble as a result of their accumulators spraying whilst on charge. While this is not generally a frequent occurrence, it is very objectionable when it does happen, as it is liable to cause damage if any of the "spray" should percolate through the vent and run over the side. There are certain anti-spray powders which can be purchased to cure the evil, but it is unnecessary to go to the expense of obtaining these, as amongst the customary accoutrement in the houshold there is generally the very thing to hand, viz., medicinal paraffin. Just pour a spoonful or two of the liquid into the accumulator and spraying, evaporation, and creeping will be almost eliminated.

Enamelling Cabinets.

IT is usual to finish cabinets by polishing, staining, or varnishing them; but possibly few constructors think of employing enamel for this purpose. A very fine effect can be obtained in this manner, providing the work is carefully carried out. The result is pleasing and original.

The essential thing to do is to use good enamel, and to apply it thinly, two or more thin coats being preferable to one thick one. The wood must be well-prepared first by sandpapering, a coat of flat paint being applied and allowed thoroughly to dry before applying the first coat of enamel. A black-enamelled cabinet looks well with a black panel, but very pretty art shades can be obtained by lightly tinting white enamel before using with ordinary oil colour, such as is supplied in tube form for artists.

* * *

The difficulty of holding in place an inaccessible screw and driving it with a screwdriver can be overcome by cutting off a cardboard strip of suitable length, pushing the screw through the end of it, and thus holding it steady at a distance while operating the screwdriver.

* * *

The ordinary voltmeter will not give accurate reading of the voltages derived from a Mains H.T. unit.

* * *

Twisted flex should not be used for long loud-speaker leads, as owing to its high self-capacity it has the same effects upon quality as a condenser connected across the loud-speaker terminals.

STORIES FROM AMERICA.

By THE EDITOR.

ONE can always depend upon America to supply the British newspapers with a wireless story which, when investigated, beneath the surface of originality, proves to be nothing very new after all. A few days ago it was announced to the world that electrical science once again promises to lend its aid to the world of medicine.

The story was to the effect that two American physicists have been investigating the value and properties of short-wave wireless broadcasting apparatus as a means for curing general paralysis.

It appears that the bacilli of this particular disease cannot survive when the blood is at a high temperature, and experiments made by Dr. Wagner von Jauregg of Vienna in connection with treatments for this disease by injecting malaria germs into the blood of the patient, with a view to killing the bacilli, have hitherto been regarded as the most up-to-date method.

A Six-Metre Tonic.

Now, according to news from America, with the new treatment, blood temperature can be raised and properly controlled at the same time. All this is due to an accidental discovery by men working in the General Electric Company's Works.

It appears that some of them became faint and ill when they had been operating for some time a six-metre wireless transmitter. On investigation the heating effect of the waves was tested with a solution and the discovery made that a six-metre wave-length gave the best results for producing a high temperature locally upon the skin. It must be borne in mind, however, that this so-called new treatment for paralysis has not yet been thoroughly investigated, although the Rockfeller Institute is now considering the matter.

Scientists in this country have been careful in their statements regarding the possibilities of this so-called new treatment, but all wireless engineers will bear in mind that for some time past now, especially in connection with Beam wireless, ultra short wireless waves have been known to have had curative, or seemingly curative, properties.

Bracing Broadcasting.

This story from America was published almost at the same time as a story to the effect that the inhabitants of Daventry were the healthiest and happiest community in the British Isles.

Some of the inhabitants seem to be emphatically of the opinion that their happiness and good health are due to the fact that 5 G B and 5 X X are located in their district!

The B.B.C. have been praised and cursed for many things, but perhaps the most curious compliment they have ever been paid is the fact that a percentage of the four thousand-odd citizens living in Daventry are convinced that their health and happiness are due to the wireless transmitting apparatus and the propagation of electro-magnetic waves from 5 G B and 5 X X!

Whether this health and happiness may be due to the exhilarating effects of 5 G B and 5 X X programmes, or whether living within the shadow of the transmitting gear of these two stations, and thus close up to the source of emission of electro-magnetic waves, really has anything to do with the health and happiness of the inhabitants, is a matter for some speculation.

But whether health and happiness can be obtained (in the medical sense) from proximity to a wireless station, or whether such health and happiness can be obtained by *believing* that the proximity of a wireless station has curative and healthy properties, are two different questions.

Ether Health and Happiness?

In any case, if people can be persuaded that their health and happiness are mainly due to wireless stations, we can see very shortly new spas springing up all over the country wherever there may be a wireless station, and perhaps one day we may enjoy the illuminating sight of invalids basking in the invisible rays from wireless stations and reclining in deck chairs beneath aerials, silently offering up blessings of thankfulness upon the beneficent heads of the B.B.C. engineers.

But, frankly, the legends which are growing up about the properties of wireless waves

Sir Oliver Lodge, F.R.S., Who is "P.W.'s" Scientific Adviser, reached the age of 77 on Tuesday (June 12th), and the birthday congratulations he received from all over the world will no doubt heartily be echoed by every one of our readers. Sir Oliver is shown above giving a Kelvin lecture at Birmingham.

these days should be taken with a grain of salt until competent investigation has decided whether there is anything in these theories or not.

We have already had it on the authority of Mr. A. M. Low, the well-known motor engineer, that wireless waves do probably have some effect on the weather; and we have it on the no less authority, probably the greater authority, of Sir Napier Shaw, the famous meteorologist, that wireless waves do not affect the weather. These arguments do at least serve to fill the newspapers during what is known as the "silly season."

THE "SCEPTICS' THREE."

(*Continued from page* 534.)

change" switch should be of the same type as that specified for all the previous sets using this general class of switching, namely, the "All-Programme" Three, "All-Programme" Two, and the "Derby" Three, that is, an "on-off" switch of a particular variety (examples are given in the list of components). To make sure of proper contact to the centre moving piece of the switch, it is best to solder a piece of flex direct to the metal knob of the plunger.

Operating details need not detain us long, for the set is a very simple one to handle. First you will want to know something about valves. The detector may be of the H.F. type (for the best quality) or the high impedance R.C. type (for the greatest volume), the second valve should again be of the H.F. type, and in the third socket a power or L.F. valve.

Use Plenty of H.T.

Only one H.T. positive connection is needed for this set, a voltage of 100 to 120 being advised if the full results are required. (Too little H.T. means poor quality on strong signals and unsatisfactory reaction effects.) Grid bias will obviously depend on the particular valves chosen, and the H.T. available, and you should go by the makers' recommendation. Usually it will be about $1\frac{1}{2}$ to 3 volts on G.B.—1 and $4\frac{1}{2}$ or 6 volts on G.B. — 2.

Working the set is very simple. Start off with the wave-change switch in the "on" position, which gives you the shorter waves, set the reaction condenser at minimum and see that the various tapping clips are placed as follows: the one on the end of the flex lead from the aerial terminal goes on one of the tappings on L_1 (these may be simply loops twisted up in the wire in winding and later scraped bare) and its exact position gives varying degrees of selectivity. The one on the lead from the end of L_1 goes normally on the "0" terminal of the loading coil, while the remaining one (the "filament" tap) goes on either the 60- or 80-turn tapping on the latter coil.

How To Search.

Now tune in the local station, and after finding that all is well (vary the volume by de-tuning) search for distant stations by bringing up the reaction condenser so that the set is kept in its most sensitive state *just* below the oscillation point and turning the tuning dial very slowly and carefully.

When you have satisfied yourself that the set really is what it should be on the shorter wave-band, put the wave-change switch to the "off" position and try the long waves. The details requiring adjustment here are, first, the position of the filament tap and secondly that of the clip on the end of the lead from the lower end of L_1 (the "long-wave-aerial" tap). The former will usually be best on 60 or 80, and you will find that it gives you a control of both selectivity and reaction.

The other clip will usually be on "0" (must always be here for reception on the shorter waves), but if you require specially high selectivity try it on 25.

TWO NEW H.T. SUPPLY UNITS

TYPE No 3002

TYPE No 3003

6 DIFFERENT ANODE VOLTAGE TAPPINGS

Philips H.T. Supply Unit Type 3002 for A.C. Mains covers every requirement with its wide range of voltages. As an example of its output it delivers a current of 50 mA at 120 volts. The choke coils and condensers are of heavy construction and absolute freedom from hum is maintained.

Price : Complete with full wave rectifying valve

£8.10.0

6 VOLTAGES AND 12 VALUES OF GRID BIAS

Incorporating all the facilities of type 3002 for A.C. Mains this unit also provides 12 different values of grid bias variable between 0 and 40 volts. Such a high maximum voltage is more than sufficient even for the most powerful last valve.

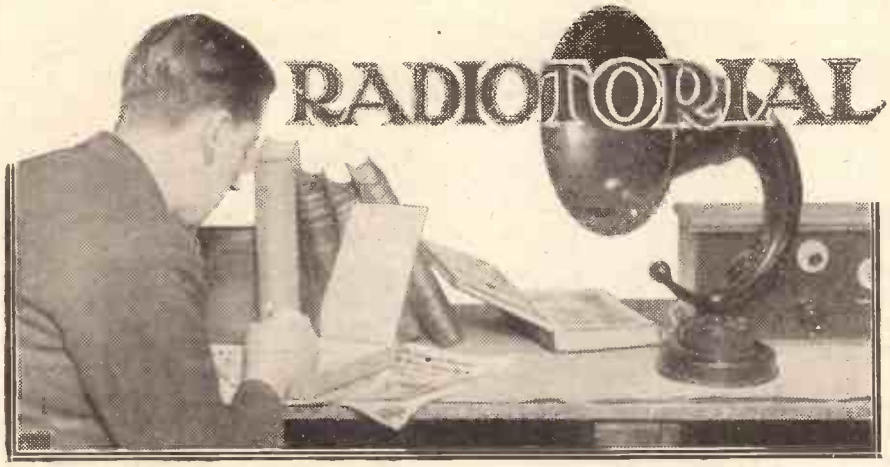
Price : Complete with valves

£10.10.0

Write for Leaflet No. 109.

PHILIPS *for Radio*

PHILIPS PHILIPS FOR RADIO



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

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

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

QUESTIONS AND ANSWERS.

RAINFALL RUINS RECEPTION.

M. W. H. (Manchester).—"It was about a month ago that I first noticed that every time it rains I had a crackling noise in my set. I had not the faintest idea why it is that rain should cause noises, but I do remember that about a year ago (I think it was) another Manchester reader had the same sort of trouble.

"I remember thinking at the time that 'anyhow, rainfall never troubles my set.' But now I wish I could meet that reader, because I have completely forgotten how he got out of his difficulty, and I am landed right in the same cart. Can you tell me a cure?"

If the crackling noise is troublesome *every* time there is rain falling there is little doubt that your aerial insulation is at fault. We have not been able to trace any record of a Manchester reader complaining of this trouble a year ago, but we have no doubt that if you thoroughly insulate your aerial, both where it is supported at the end, and also the lead-in arrangement, the trouble of which you are complaining will disappear.

FLASH-LAMP BATTERIES FOR H.T.

O. F. R. (Acton, London, W.3.).—"My ordinary set has no batteries in it, because it works off the electric-light mains. It works so well that, although it is my first wireless set, I have become very interested in the hobby, and I have endeavoured to make myself up a small portable wireless set for the holidays. I thought of using flash-lamp batteries, but I am so ignorant of things electrical that I do not not know which is the positive end of a flash-lamp and which is the negative.

"How many of these flash-lamp batteries should I want for 40 volts H.T.; how do I connect them up; which is the positive and which is the negative?"

You will find that flash-lamp cells are quite satisfactory in the circumstances, though they will not operate successfully for the supply of H.T. to a multi-valve set, which takes more current than a flash-lamp cell can provide.

Each of the ordinary flash-lamp batteries contains three separate units giving 1½ volts each, so that the total voltage of one ordinary flash-lamp battery is 4½ volts. These can be connected "in-series," which means that the voltage of one will be added to that of another, and as you want approximately 40 volts, you will need nine of the 4½-volt cells.

(*Continued on page* 544.)

APPARATUS TESTED

PHILIPS' H.T. SUPPLY UNITS—LEWCOS ACTIVITIES—A GRID-LEAK BASE—THE LATEST CLIX DEVICE—OSRAM VALVE BOOKLET.

* *

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

PHILIPS' H.T. SUPPLY UNITS.

IN order to derive H.T. current for a radio set from A.C. supply mains one has to employ a unit embodying both rectifying and smoothing elements. The smoothing is a standard sort of business; it is in regard to rectification that a wider variation of methods exist. The Philips' High-Tension Supply Units include thermionic valve rectifiers and, in the present stage of radio development, we are inclined to regard these as the most reliable. Certainly a fairly lengthy experience of them indicates that they are perfectly trouble-free and safe when incorporated in designs such as are due to firms of the calibre of Philips' lamps. Moreover, they are economical.

The Philips' Unit Type 3003 is in the way of being a rather remarkable production. First of all, it is most compact, the whole device being built into a metal casing and safety type plugs being provided for all connections. The two rectifying valves are accessible, but securely tucked away beneath a removable metal shield.

Six different anode voltages can be taken simultaneously and clear instructions are given as to the calculation of the voltages; always a fairly tricky task for the inexperienced amateur. The same unit provides three negative grid voltages, and each of these can be adjusted independently of each other at twelve different values, ranging from 0 to 40 volts. These variations are accomplished by means of a range of ingenious plug-switches, the main plugs do not have to be touched. The advantage of having an efficient and stable H.T. voltage supply of such an assured nature will not need to be stressed to "P.W." readers.

The unit gives ample current for the operation of even super-power valves; with an anode voltage of 150 the instrument supplies a current of 30 milliamps and with 120 volts no less than 50 milliamps.

And on test we found Messrs. Philips' claim that "a liberally designed and efficient smoothing equipment is provided for the suppression of any A.C. "hum" was by no means exaggerated. As a matter of fact, we consider the unit exceptionally quiet, for, using a four-valve set, there was a practically completely silent background, even when the reaction was moderately closely advanced. And the slight noises discernible were easily identified as atmospherics.

The above remarks apply equally well to the Philips' Type 3002 unit which provides only the six anode voltages. This instrument uses one valve against the others two.

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RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 542.*)

To make up the battery, connect up the long strip on one cell to the short strip of the next, and so on right through, until you have connected up all the batteries. When this has been done, you will have at one end of the battery a short strip, and at the other end of the battery a long strip, all the others being joined together. On each cell the long strip is the negative terminal and the short strip the positive, so that the long strip at the end of the battery will be H.T. negative and the short strip at the other end will be H.T. positive.

TROUBLESOME SCRATCHING NOISE.

H. E. (New Barnet).—"I have had no trouble with the set since it was put in, but its record of eighteen months without a single fault has now been broken, for it has suddenly developed a most horrible scratching noise. Generally there is a sort of 'plop' and then the scratching goes on, completely spoiling the programme, whether it is music or speech.

"It became such a nuisance that I began to talk about it, and one of the fellows where I work tells me that he had the same trouble, and he found it was due to one of the condensers in his eliminator. Apparently, in his case, he got it tested by a dealer, and the chap knew exactly what he was talking about, for as soon as this condenser was replaced the set was O.K. again. Well, I talked to my dealer, but he does not seem to know what an eliminator is, so I am wondering whether I could test the condensers myself. Is this possible?"

Yes, you can test it. Be very careful when you are disconnecting the mains unit, and make absolutely certain that there is no danger of the mains being left switched on after the wiring is disconnected. Take the mains unit on to a convenient table, and disconnect the various fixed condensers inside it.

Then run two flex leads from an H.T. battery and touch the ends of them to each condenser in turn, so as to charge it up. Having charged the condensers, leave them for half an hour and then see if they will give a spark when shorted by a length of bare wire. (The larger the capacity of the condenser the greater the spark which may be expected.) If one condenser is faulty it will fail to spark like the others, or the spark from it can be extracted only immediately after the condenser is charged, and not after an interval, like the others.

PURE CUSSEDNESS.

C. G. L. (Bournemouth).—"The set is a straight two-valver, and results have always been so good that I used to boast about them to all my friends. Perhaps I forgot to touch wood or something, but whatever the cause the set 'went back' on me.

"I cannot just say what is wrong with it, because it shows itself in many different ways. But the best way I can put it is to say that it seems to have an attack of pure cussedness. For instance, at one time it was free from hand capacity, but now its hand capacity is awful. I used to get distant stations with ease, now I can only get them for a few minutes and then sometimes they are as good as they used to be, and at other times they seem all uncertain and fluctuating.

"Even the settings of the tuning condenser are not quite what they used to be, but they vary a little, and I often have to go forward three or four degrees and then—finding signals fall off there—I come back and find the station has apparently moved again, and has gone lower down.

"All sorts of remedies have been suggested to me, and, consequently, I have examined every blessed thing upon the set without much result. I can say, however, that the batteries are all right, according to the voltmeter, and there is not a single part upon the set that has not been inspected and scrutinised without revealing any fault at all.

"Moreover, the set has never been roughly handled, and there is no way in which I can account for this sudden falling off and strange behaviour! Except, as I say, by pure cussedness. Can you suggest what is wrong?"

Perhaps you have concentrated too much upon the set itself, and have forgotten that the aerial and earth are also important factors in reception. It certainly appears, from the fact that the tuning alters, that something is wrong with your aerial-earth system.

In view of the fact that hand capacity also is affected, we should imagine that it is a faulty earth connection. If you have not already done so trace the earth circuit out very carefully. Start inside the receiver (bottom of the aerial coil, condenser, etc.), going through the earth terminal (making sure there is no dry joint here), and then along the earth lead.

If there is any doubt about the soundness of this lead, replace it by a new one, and do not stop here but carry your investigations right out to the buried earth. Make sure that the connection to this really is a connection, and not a snare and a delusion. And if necessary use a different earth altogether, until you are absolutely convinced that there is no fault here.

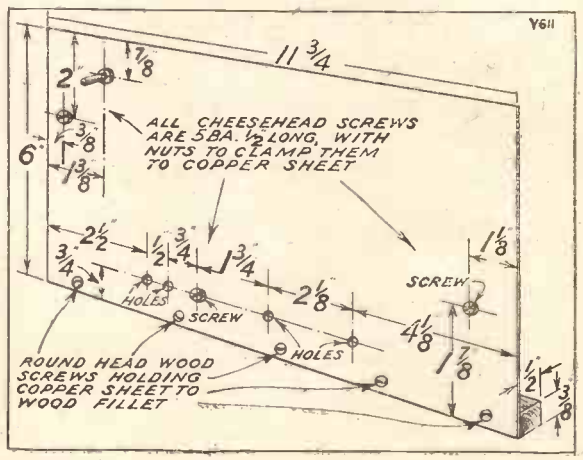
TOO MUCH GRID BIAS.

V. W. (Aldershot).—"Why is it that when I put too much grid bias on the last valve the loud speaker packs up altogether, and I cannot hear anything?"

In order to operate, the loud speaker depends upon the current which is flowing from the filament of the valve to its plate. The effect of a strong negative grid bias on the grid is to reduce this plate current, and if sufficient negative bias is used the attraction which the highly positive plate has for electrons leaving the filament is entirely overcome by the repellent action of the grid. In other words the plate current is completely cut off by too much negative bias on the grid and, consequently, it is impossible for the loud speaker to operate.

SCREEN FOR THE "DERBY" THREE.

R. F. D. (Scarborough).—"What are the exact dimensions of the copper screen for the 'Derby' Three, and where should the holes be drilled?"



All the requisite details are shown upon the accompanying diagram, which, owing to lack of space, had to be held over last week.

STRAIGHTENING A PANEL.

"Toby" (West Kent).—"Several months ago I got all the components together to build a three-valve set, but, owing to one thing and another, I had to put off the construction. All the things for it were put away in a cupboard, but the other day, when I took them out, I found that the panel had become very bent.

"Formerly, it fitted the cabinet nicely, but now it is very warped, and I am wondering if there is any method of straightening it, or shall I have to get a new panel?"

In all probability you will be able to straighten the panel without much difficulty. To do this, it should be heated slowly, and when warmed placed in a flat press and left to cool there.

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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 544.)

A good method of doing this is to have a bath of hot water and to place the panel in this until it is warmed through, when it can be taken out and laid on a flat board. Then another board can be placed on it, and heavy weights laid on this, taking care not to crack the panel.

If it seems to straighten satisfactorily, leave the weights on as long as possible, and when they are removed it will be found that the panel is again O.K. for use.

AN UNSUITABLE VALVE.

F. K. G. (Littlehampton, Sussex)—"The last valve (a power valve) was on its last legs two months ago, but I have been struggling on with it, in spite of noisy reception. To-day, it suddenly went altogether, and my neighbour lent me one of his valves, marked 'R.C.' (he has changed over to 4-volters).

"Although it gave perfect results on his old set, I find it will only give distortion and bad reception on my set, so I have ordered a new power valve. Why is it that the R.C. valve will not work on my set?"

As the initials indicate, the R.C. valve is made for resistance coupling. The conditions under which a resistance-coupling valve has to work are quite different from those under which an output or power valve has to work. The main requirement in a resistance-capacity valve is that it should be extremely responsive to small voltage variations on its grid; in other words, it must have a high magnification factor. Such a valve does not carry very much current, but this is not to be wondered at, because, in order to get a high magnification factor the impedance of the valve is necessarily high, and this means that even with considerable high tension not much current will flow.

The function of a power or output valve is quite different. When the signals are handed to this valve they have been magnified right through the set, and consequently do not require further high magnification.

For the output stage, however, it is essential to use plenty of current, so that a valve with a comparatively low impedance is required in this position. This will have a low amplification factor, and it is because of these fundamental differences in the characteristic of the valve that the R.C. valve will not work properly in the output stage.

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

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

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

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

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

USING A BUZZER OSCILLATOR.

L. C. D. (Macclesfield).—"The outfit consists of a little baseboard with what looks like a buzzer mounted on it, across which is a fixed condenser. There are four terminals, two of which can be shorted across by means of a sort of sliding-contact pin.

"In addition, there is a clip which looks as though it would hold a dry cell, and I was told that with this I could make a buzzer oscillator. Is this all that is necessary, and if so, what are the connections?"

The two terminals, with the shorting strip, can be used as the buzzer key, the strip being in contact with both when the buzzer is in operation, and disconnected when it is out of action.

Connect one of these two contacts to a dry cell. The remaining side of the dry cell goes to one side of the buzzer, and to the by-pass condenser.

The remaining side of the buzzer and the remaining side of the by-pass condenser are then connected together and taken to one of the ordinary terminals. The other ordinary terminal is connected to the remaining side of the key.

If, now, a tuning coil and condenser are then connected across the two ordinary terminals, as soon as the other terminals are shorted across by a shorting bar the buzzer will provide an alternating or pulsating current, which will energise the tuned circuit connected to the two ordinary terminals.

Such a local oscillator can be used as a wave-meter, and will also be found very handy for providing a weak source of high-frequency impulses suitable for testing purposes.

A POTENTIOMETER PROBLEM.

"ECONOMY FIRST" (Keswick).—"As I have a spare potentiometer on hand, I should like to use this for regulating the voltage on the grid of the detector valve. I understand that all that is necessary is to connect the potentiometer across L.T. positive and L.T. negative, and then to connect the end of the grid leak to the slider.

"Does this arrangement use up any L.T. current, and if so, how much? (It is a 400-ohms potentiometer.)"

You omit to mention the voltage of the L.T. accumulator, and this will have an important bearing upon the amount of current which the potentiometer will take. You can, however, easily work out the current consumption for yourself, as it is simply a question of applying Ohms Law.

Ohms Law states that the current flowing will depend upon the voltage of the supply (in your case the voltage of the accumulator) divided by the resistance in ohms; so if you have a 4-volt accumulator you will simply divide this figure by 400 (the resistance of the potentiometer) and the answer will indicate the current taken.

In this instance the answer is 0·01 (this is equivalent to 10 milliamps), but if the battery is a 2-volt one the current will be correspondingly less, while if it is a 6-volt one it will be correspondingly higher. You can easily work out the exact figure by applying Ohms Law.

An important point to remember when connecting a potentiometer in this way is that one lead should be on the *filament* side of the on-off switch.

If this point is not watched it is quite possible that you will connect the potentiometer across the L.T. battery in a position where it will take current *even when the set is not in operation.* This, of course, would mean that more current than was necessary would be withdrawn from the accumulator, so be sure that the wiring is so arranged that when the on-off switch is out the connection to one side of the potentiometer is broken.

L.F. TRANSFORMER.

"Are the L.F. transformers used for radio work of the open-core type, or closed?"

Both open-core and closed-core transformers are used for low-frequency transformers.

VARIABLE CONDENSER CAPACITY.

M. T. C. (Tamworth, Staffs).—"When a variable condenser is sold as having a capacity of ·0005 mfd., does this mean that it is ·0005 when the vanes are all interleaved, i.e. when the condenser is turned as far in as possible? If so, what is its capacity when the vanes are all turned right out, and why is its capacity called "·0005 mfd." when obviously such a condenser has a varying capacity?"

In such a case the "·0005 mfd." refers to the maximum capacity, i.e. to the capacity of the condenser when the vanes are all in. The ideal variable condenser would have no capacity at all when the vanes are all out. But as this is not practicable in commercial types, the manufacturers aim at getting the lowest possible minimum capacity.

To function efficiently for tuning, a variable condenser must have a minimum of not more than one-tenth of its maximum capacity, and some makers get a minimum which is much below this figure. As the aim in all such condensers is to obtain a minimum capacity of zero, the showing on the box of the actual minimum as well as the maximum capacity would, in general, be unnecessarily confusing.

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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 546.)

OVERLOADING THE DETECTOR.

"PURITY" (Monmouth).—"Is it possible to overload the detector valve in the same way that the power valve becomes overloaded—by excessive voltage upon its grid?"

Yes, it is quite possible to overload a detector valve, especially if several stages of high-frequency amplification are used.

THE "ANTIPODES ADAPTOR"—STAR MODEL.

For the benefit of those readers who prefer to wire up from a printed description, and for those who like a list to check up the point-to-point connections, below will be found the "wiring in words" of the "Antipodes Adaptor"—Star Model (the construction of which was fully described in "P.W." No. 312.

Join the grid socket for the cross coil—that nearest the panel—to one side of grid condenser and leak and to fixed vanes of C_1.

Join moving vanes of C_1 to slider of potentiometer and to a flex lead terminating in a clip. (This is the grid coil tapping.)

Join remaining side of grid condenser and leak to grid of valve.

Join one side of potentiometer winding to one filament contact on valve holder, and by a flex lead to one filament pin of valve plug.

Join remaining side of potentiometer winding to remaining filament contact on V_1, and by a flex lead to remaining filament pin on valve plug.

Join fixed vanes of remaining variable condenser to a flex lead terminating in a clip. (This is the reaction-coil tapping).

The moving vanes are connected by the metal screen to the moving vanes of C_1 and to filament, and no extra connection is therefore necessary.

Join anode of V_1 to one side of H.F. choke socket and to remaining cross-coil socket on sub-panel.

Join other side of H.F. choke socket by a flex lead to anode pin of valve plug.

Join screen to earth terminal.

Connect each side of the aerial coupling coil sockets together, taking one set to aerial and one to earth.

WINDING A NON-INDUCTIVE SHUNT COIL.

W. D. F. (Longton, Staffs).—"I am making up a buzzer set, but there is one thing in the instructions that puzzles me and that is the non-inductive shunt. It says, 'The coil for the non-inductive shunt should consist of 50 double turns wound hank fashion on a half-inch circular former.' What does that mean?"

A non-inductive winding is one in which half the wire is wound on in one direction, and the other half in the opposite direction.

For instance, a 50-ft. length of wire can be doubled back upon itself to form a double 25-ft. length. If the centre point is then placed upon a wooden former of the size named, and the double wire is wound for, say, 50 turns round that former, there will be two ends of wire left to finish off, and half the turns will be laid on in one direction, and the other half in the other way.

In other words, the current flowing in at one end of the wire would go round the former in one direction for 50 turns, come to the centre point and then would double back on itself and wind round 50 turns in the opposite direction.

This is a non-inductive winding, and properly connected the whole coil would form a non-inductive shunt. If the size of the wire is not stated we should use quite fine wire, as this is usual in non-inductive shunts for buzzer circuits.

MATERIAL FOR SHIELDING.

C. R. (Dunmow, Essex).—"Can any other metal besides copper and aluminium be used for shielding?"

Yes, brass can be used if desired, but is not quite as efficient theoretically as either copper or aluminium. Many other metals will exercise a shielding effect, including iron and steel, but owing to the introduction of undesirable magnetic effects and other factors, it is best to use either copper, aluminium or brass.

FREQUENCY FIGURES.

"FREQUENCY" (Aldershot).—"What are the highest and the lowest frequencies which correspond with audible sound?"

There is no absolute answer to this question because the personal equation enters into it, and some people are able to hear sounds which to other people are quite inaudible.

For instance, some people cannot hear the cry of a bat, not because it is not loud enough, but because their ears are incapable of responding to the high frequency of the bat's cry. The lower limits of sound frequencies are generally considered to be between 16 and 20, and the highest audible frequencies from 10,000 up to 30,000, or more.

CORRESPONDENCE.

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.

USING BROKEN DRILLS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Here is a little tip for use where very small or broken drills are used. Every amateur knows that when a drill is broken he finds it hard to hold in the chuck.

Obtain a piece of round steel or brass about 1 in. or 1½ in. long (according to size of drill) by ¼ in. diameter. Clamp it in the vice and find the exact centre of one end. This done, mark it with a centre punch.

Now drill a hole the exact size of the drill that is to be inserted. The hole must be drilled square with the drill, which is best done by machine and about ¼ in. to ½ in. deep. (If the hole is not drilled square when put in the chuck, the drill will wobble about.)

This done, insert the broken end of drill in the hole, clamp in the vice, and solder the drill to the steel. When this is done the solder can be filed off smooth, making it a good job. It will be found that a drill can't be lost in this way so easily as before, and it can be held much better in the chuck.

C. G. B.

S.E. 17.

SWINGING-COIL REACTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—On reading through "Letters to the Editor" in recent issues I have been struck by the number of readers who claim to get as good, if not better, results with the old swinging-coil method than can be obtained with capacity reaction.

I have experimented with both types of reaction for some time past, and can get much better results with the swinging-coil type of set over a larger band of wave-lengths than I can get with either the Reinartz or the Hartley system; of course, this is on the broadcast and high-wave bands.

On the short waves I connect a potentiometer in circuit so as to regulate the grid-swing of the detector valve, and can get very smooth control of reaction on the ultra-short waves which are again much easier to work in with this type of circuit than with the Reinartz.

With all these good points I do not see why swinging-coil reaction type of receivers went out of date. For simplicity of construction the swinging-coil type takes premier place; for economy it is a lot cheaper to buy two coils and a coil holder than a high-frequency choke, coil holders, fixed condenser, variable condenser and various other little items which go to make the capacity reaction a success.

Why not give us more swinging-coil reaction type of receivers in your periodical, which would then cater for everybody, and if the question of the smoothness of capacity reaction versus the greater wave-band swinging-coil reaction arises, you could incorporate both in a receiver.

Yours truly,
"ULSTERMAN."

Ulster.

SIMPLE H.T. FUSES.

The Editor, POPULAR WIRELESS.

Dear Sir,—I notice a correspondent in the June 2nd issue takes me to task for mentioning that "flash-lamp bulbs make good fuses" in the course of my article entitled "Simple H.T. Fuses." If my statement had been as quoted he would have been perfectly justified, but if he refers to the article in question he will notice that I mention specifically LOW CONSUMPTION flash-lamp bulbs. By low consumption I was referring to the 60 milliamp bulb which is now on the market. The ordinary type of bulb has undoubtedly failed to prove a reliable fuse on many occasions, but if your correspondent tries the class mentioned he will no doubt become a regular convert to their use.

Yours faithfully,
H. J. BARTON CHAPPLE (H.J.B.C.)
"St. Clair," Goodwyn Avenue,
Mill Hill, London, N.W.7.

APPARATUS TESTED.

(*Continued from page 542.*)

Both are in every sense of the term high-class instruments, and "P W." readers need have no hesitation in purchasing them. It should be remembered that the initial cost of an article of this nature must be balanced up against a number of considerations. Of these, safety and reliability are well up on the list, but almost equally important is the question of current output and freedom from hum, for a paucity of one and an excess of the other can render such an instrument almost useless. Again, there is cost of maintenance. On all these counts the Philips' Units should prove most attractive propositions to the discriminating amateur.

The price of the Unit Type 3002 complete with a Type No. 506 full-wave rectifying valve is £8 10s. 0d. and that of the Unit Type 3003, complete with the two necessary valves, is £10 10s. 0d.

"LEWCOS" ACTIVITIES.

To increase the efficiency of the service to customers, The London Electric Wire Company and Smiths Ltd. are removing their sales, orders, and accounts departments from Playhouse Yard to larger offices at Leyton, on June 16th. From this date all correspondence with these departments should be addressed to them at Church Road, Leyton, London, E.10. The telegraphic address of the new Leyton offices will be "Lewcos Phone London," and the telephone number, "Walthamstow 2531."

A GRID-LEAK BASE.

The Graham Farish Mfg. Co., of Bromley, Kent, have produced a grid-leak base suitable for their own resistances and also suitable for both Dubilier and Ediswan grid leaks. The device consists of a neat, clean brown bakelite moulding reinforced by heavy ribs towards a central screw hole. This design gives great strength where it is most needed, and an attractive appearance. A nickel clip and terminal is fixed at each end. The base retails at 6d. At this price this useful article should meet with a heavy demand. One is always wanting items of this nature in the building of sets, only to find that they are not available and have to be clumsily fashioned by oneself.

THE LATEST CLIX DEVICE.

Another new Clix production is due to Messrs. Lectro Linx Ltd., which still further extends their large and comprehensive range of useful connection devices. It is the Clix accumulator knob, which is available in all the standard threads employed on well-known accumulators. Its chief feature is that it is non-corrosive, and its use eliminates all the trouble usually associated with the corrosion of accumulator contact terminals through the creeping of acid. Further, it is provided with a socket into which can be plugged the Clix Lox adjustable wander plug, and this assures a permanent and acid-proof connection.

OSRAM VALVE BOOKLET.

A booklet has been produced by the G.E.C. people dealing with the correct types of Osram valves for use in various circuits and for different purposes. Copies will be sent to anybody who writes to the Osram Valve Dept., Magnet House, Kingsway, London, W.C.2.

NEWS FROM SAVOY HILL.

(*Continued from page 536.*)

The Listeners' Committee.

The Wireless Organisations Advisory Committee manages to keep together. It has met sixteen times in the past eighteen months, and has done some useful work. But it is likely to be subject to overhaul before long. People are wondering about the status and credentials of the societies supposed to be truly representative of the whole body of listeners. Besides, there is the old suggestion of adding a representative of the Wireless Press still hanging fire. Why?

The Pitman's Derby.

The famous Pitman's Derby, the race for the Northumberland Plate, which is to take place at 3 p.m. at Gosforth Park on Wednesday, June 27th, will be the subject of a running commentary from the Newcastle Station.

The commentator's box is to be installed on the roof of the grand stand, and from here a description of the scenes on the course, in the paddock and betting rings will be given, together with a detailed account of the actual events with, of course, the all-important result which may mean so much to many listeners. The Pitman's Derby is probably the most famous race in the North of England, and while, as always, it will undoubtedly be largely attended, there will be many people to whom the news of its first broadcast will be welcome.

"I Remember."

Recollections of Sir Henry Campbell-Bannerman will form the subject of the next talk in the "I Remember" series which the Right Hon. Arthur Ponsonby, M.P., is giving in the London Studio on Monday evening, June 25th. Mr. Ponsonby, who represents Labour for the Brightside Division of Sheffield, was Under-Secretary of State for Foreign Affairs during Mr. Macdonald's Government, and was principal private secretary to Sir Henry Campbell-Bannerman whilst he was Prime Minister, between 1906 and 1908.

Mr. Ponsonby is no stranger to the microphone, having given a most interesting and authoritative talk on diaries some months ago. By the way, this "I Remember" series has been particularly successful, proving again, were that necessary, that talks of real entertainment value are acceptable.

Newcastle's Birthday.

The forty-sixth anniversary of the day when Newcastle-on-Tyne was created a City by Royal Charter falls on Saturday, June 30th, when, as might be expected, the occasion will be marked by a programme from the local station. It will be introduced by the Lord Mayor, Alderman Stephen Easten, J.P., while short speeches will also be given by Sir Theodore Morison, K.C.S.I., K.C.I.E., Principal of the Armstrong College, and Councillor Arthur W. Lambert, M.C., ex-Lord Mayor. The musical programme will include items by Miss Myra Hess, one of the foremost lady pianists of present times, Norman Allin, the well-known bass singer, and Tommy Handley, about whom nothing need be said.

TECHNICAL NOTES.

(*Continued from page 536.*)

of the loud speaker to that of the last valve of the receiver, then an output transformer is not necessary, although a 1 to 1 ratio transformer may be used if particularly desired.

Matching the Impedance.

On the other hand, if the loud speaker has a lower impedance than that of the valve, a transformer with a high impedance primary and a low impedance secondary may be used. In this case the transformer has a step-down ratio, and the voltage at the secondary is lower than that at the primary terminals.

If the output valve of the receiver is of low impedance, and it is desired to use a high-resistance (impedance) loud speaker, then a step-up transformer should be used having a lower primary than secondary voltage. This produces an increase in the voltage and renders the output suitable for the loud speaker.

Baffles.

Talking about loud speakers, another question which often crops up, since the growing popularity of coil-driven loud speakers, is concerned with the use of the baffle. You know that with a coil-driven loud speaker a comparatively small diaphragm is used, and this is "let into" a large baffle plate.

The baffle plate is necessary because if it were not used, the sound waves produced at the front of the diaphragm, and especially by the part of the diaphragm in the region of the edges, would bend back and interfere with the waves produced by the edge portions of the diaphragm on the reverse side. Or perhaps it would be more correct to put it the other way round, and to say that the waves produced by the back of the diaphragm would interfere with those by the front.

Separating the Waves.

In practice, the baffle often consists of a wooden board, 2 or 3 ft. square, in the centre of which a hole is cut of just the right size to admit the cone of the loud speaker. The edge of the cone diaphragm is then secured to the baffle by means of oiled silk or thin rubber, or some other very light and flexible material. In this way the waves produced by the back surface and front surface of the cone diaphragm are kept separate until they have travelled an appreciable distance from their source.

The baffle is very important in the operation of a coil-driven loud speaker—or, indeed, in any loud speaker with a comparatively small diaphragm vibrating with a large amplitude—and experimenters fitting up a coil-driven loud speaker will find it well worth while to pay particular attention to a properly fitted and efficient baffle. It will often be found that a fairly "dead" material for the baffle plate works well. If ordinary wood be used, this may be still further deadened by coating the surface with sheet cork or felt, or similar material.

(*Continued on next page.*)

TECHNICAL NOTES.

(Continued from previous page.)

Local Interference.

My remarks recently on the subject of local interference, when I quoted one or two letters from readers, have brought me a shoal of further letters describing similar experiences. It would seem from these that local interference from electric railways and flashing electric signs is very widespread, and must cause a great deal of inconvenience and annoyance to wireless listeners.

For example, a reader in Birmingham, who has the misfortune to live near to a petrol station which keeps its petrol-pump signs flashing intermittently, finds that it is practically impossible to receive foreign stations from dusk (when the garage signs commence "operations") until 11.30 or midnight.

"Plonks."

He describes the effect of the intermittent electric signs as setting up a continual series of "plonks," grunts, and scratches in the loud speaker. These, of course, vary in intensity with the degree of reaction which is being employed, and as the set (which is a "Cossor Melody Maker") requires practically no reaction (at Birmingham) for 5 X X and 5 G B, the interference is scarcely noticeable with these stations.

He adds: "My house is wired for electric light, and I probably come on the same electric main as the petrol-pump station; but my set is run from the usual accumulators, and is never connected in any way with the mains."

ANOTHER NEW VALVE

AN interesting new valve is likely to make its appearance upon the market very shortly. This is the Pentone, brought out by the Mullard Radio Valve Co., and designed especially for L.F. circuits. It will appear in two voltages, suitable for 2- or 4-volt accumulators, and will be known as the P.M.22 and P.M.24 respectively.

Five Electrodes.

It is a five-electrode valve designed for use in the last, or output, stage of low-frequency amplifiers, and, as its name suggests, has five electrodes, consisting of the usual filament and plate, and three grids inserted between them.

That grid nearest the filament is the usual control grid; outside this is an auxiliary grid which is connected to a terminal on the side of the valve base, and which under working conditions is provided with a positive bias equal to that applied to the anode of the valve, while the third grid (nearest to the plate is connected internally to one of the filament pins.

In use the valve can be plugged in to any set, its four pins in the base making contact with the usual plate, grid, and two filament sockets of the normal valve holder, while the extra terminal on the base of the valve is connected by a piece of flex to that H.T.+ terminal which supplies the H.T.+ to the anode of the valve.

It is claimed that by this arrangement of the electrodes the extremely high amplification factors of 62 (in the case of the 4-volt valve), and 82 (in the case of the 2-volter), can be obtained with a mutual conductance of 2·3 and 1·3 respectively. The impedances being 28,600 ohms in the case of the 4-volt valve, and 62,500 ohms in the P.M.22. Thus, with a small input, the Pentone should give a considerable output.

Fewer Valves Needed.

It is not suggested that, although the Pentone is a last-stage valve, the present super-power valves should be withdrawn, and it must not be thought that the P.M.22 and P.M.24 are merely *substitutes* for the super-power valves, because the Pentone's magnification powers make it such that whereas it is now general practice to employ an L.F. stage between the detector valve and the output valve (which would be one of the super-power valves referred to), the use of the Pentone in the place of this latter should enable one to dispense with the intermediate L.F. stage.

In other words, it is claimed that, instead of a detector and 2 L.F., a detector and 1 L.F. can be made to give equally good results if this 5-electrode valve is employed in the last stage.

Up to the present we have carried out only a few tests with the Pentone valves, but it is obvious that they *are* capable of providing considerable amplification. Like all steep slope valves, however, they easily overload and so can only be used—as intended—with a small input.

The H.T. consumption works out at from 9 to 12 milliamps or so, and thus it is clear that if a set were to be redesigned to take a detector and a Pentone instead of a detector, 1 L.F. and a super-power valve, a lowering of H.T. current consumption would be effected.

It must be realised, however, that the Pentone really needs an output to transformer in its plate circuit, whatever type of loud speaker is employed with it, owing to its very high impedance, although it will give results when the loud speaker is placed directly in the anode circuit.

Output Filters.

Where choke output filters are used the filter choke should be of high impedance if anything like a reasonable proportion of the amplification factor of the valve is to be obtained.

As we remarked before, we have not thoroughly tested these new valves yet and so cannot give any opinion as to their efficiency or advise our readers as to the best circuits to employ, or the most effective methods to take to get the best out of the Pentone valve.

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. Registered as a newspaper for transmission by Canadian Magazine Post. Subscription Rates: Inland, 17/4 per annum; 8/8 for six months. Abroad, 19/6 per annum; 9/9 for six months. Sole agents for South Africa: Central News Agency, Ltd. Sole Agents in Australia and New Zealand: Messrs. Gordon & Gotch, Ltd.; and for Canada: The Imperial News Co. (Canada), Ltd. Saturday, June 16th, 1928.

POPULAR WIRELESS, June 23rd, 1928. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THE PAPER THAT MADE WIRELESS POPULAR

Popular Wireless

Every Thursday PRICE 3d.

No. 316. Vol. XIII. INCORPORATING "WIRELESS" June 23rd, 1928.

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RADIO NOTES AND NEWS.

Australia's Thrill—The "Southern Cross"—An Arctic Adventure—Listening for the Moki-Moki—Programme Pauses—The Silence of 5SW.—Blind Broadcasting.

Australia's Thrill.

BY flying from San Francisco to Brisbane, a distance of 7,340 miles, in 89½ hours, the "Southern Cross" has scored over the Pacific one of the greatest exploits of the century. Of the crew of four, the credit of actually flying the plane goes to the two Australians, Captain Kingsford-Smith and Mr. Ulm; the other pair, Lieut. Lyons, the navigator, and Mr. Warner, the wireless wizard, are both Americans. And that little quartet constituted the hottest plane-ful of flying genius and grit that ever showed San Francisco the way to advance Australia-wards.

The closing stages of the flight, reported by wireless and broadcast by the Australian stations, were one tremendous thrill!

The "Southern Cross."

TO praise Mr. Warner—the radio man who kept the plane in touch with the continent ahead and the continent astern—would be superfluous. The fact that he was in the "Southern Cross," pulling his weight, places him right away and without dispute in the Hats-off-to class. (As I said before, those four were some plane-ful!)

Some people still wonder if wireless is worth its flying weight—Mr. Warner proved it! Though radio as an aid to aviation gets overlooked sometimes—Mr. Warner, Southern Cross-ing, overlooked nothing.

An Arctic Adventure.

AFTER a long and weary wait the lost airship "Italia" has spoken by radio from Spitzbergen, whither she was driven in her dash for the North Pole.

Surely this was one of the most dramatic of all stories of rescue by radio. Supply ships, relief planes, and dog-teams—all were impotent to help until those brief particulars of position were picked up by the anxious listeners.

Within a few moments of the receipt of that radio, the situation had swiftly changed, and relief was rushing to General Nobile from all the rescuers.

Did You Hear It?

I HEAR that PCJJ made an attempt to call the airship "Italia" on Friday evening, June 8th, between 5 p.m. and 7 p.m. A wave-length of 31 metres was used, and messages were sent every three minutes in French and Italian, but no reply was received.

North Cape, Spitzbergen, reported good reception, and any listeners who may have heard these signals are requested to communicate with Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.

Listening for the Moki-Moki.

SO pleased are New Zealanders who heard the song of the nightingale over thirteen thousand miles of ocean that they are thinking of repaying us for the B.B.C. broadcast by sending out from their stations the song of the New Zealand bell-bird, or "Moki-Moki." The call of this creature is reported to be one of the most beautiful series of sounds ever produced.

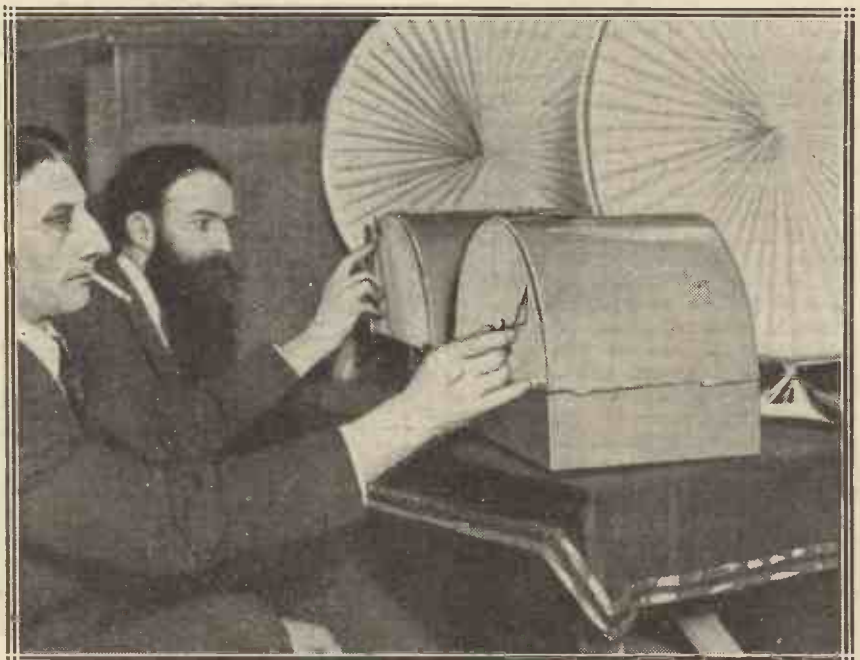
Not having heard this New Zealand wonder I cannot vouch for its warbling abilities, but I am not going to let myself hope for too much from this famous songster. It would be too bad to listen longingly for the Moki-Moki, and then find it was all Hoki-Poki!

A Yorkshire Stew.

WHEN a Yorkshire police inspector recently called upon a man to produce his wireless licence, he was asked why a dog licence need not be obtained until the dog was six months old? The inspector, the story goes, replied that it was "no good until it was that age": and then the erring listener contended that he need not get a licence until his

(*Continued on next page.*)

MORE "MUSIC FROM THE AIR."



Professor Theremin's success in making "Music from the Air" with oscillating valve circuits has brought to light several similar systems. Above is shown Rene Bertrand, a French electrical engineer, with his device, which is claimed to be easy to play, and to possess great possibilities of power and range.

NOTES AND NEWS.

(*Continued from previous page.*)

wireless set was fit to work a loud speaker! At the Bradford Police Court he was fined five pounds and fifteen shillings costs. A sad lesson for those who try to "get 'owt for nowt."

Swinging the Beam.

A GOOD deal of mystery surrounds the latest experiments of Senatore Marconi. It is known that his famous yacht, the "Elettra," and the experimental station at Poldhu, Cornwall, are being employed, and big developments in the system of beam communication are expected. One report says that instead of spreading out to about 45 deg. the angle of the beam is now concentrated down to about 8 deg. or 9 deg., and a system will shortly be introduced whereby the beam can be swung in any direction in which it is required to transmit.

No Radio Pictures Yet.

APROPOS of the Television rumours, an official of the B.B.C. recently declared that it was premature to say that any system of broadcasting pictures had been adopted.

He explained that at least three systems were being investigated, and it was unfair to say that anything definite would be accomplished "in September or October," as had been reported.

Programme Pauses.

THE B.B.C.'s licensed congregation now numbers two and a half million. And I do not suppose there is one amongst all that crowd that tries harder than I do to give the B.B.C. its due, and to appreciate the difficulties of announcers. But I must confess that there are times when they make me positively peevish.

Only a few months ago we listeners felt we had a part in the programmes. But recently the loud speaker has seemed to condescend towards the rest of the room in a way that suggests that the programmes are much too good for us—*much* too good for us!

The Spirit of Service.

WHERE has the old friendly spirit of service gone? Why, at one time if we were kept waiting between items for a few moments, the announcer would be awfully sorry, and apologetically explain that Miss Thingimebob had lost her music, or something of the kind. We had the illusion that we were honoured guests with a polite host who was sorry to inconvenience us. Yet if you listen to 5 G B sometimes, nowadays, you may get the impression that you ought not to be there at all. What has happened to the old friendly footing?

The Silence of 5 S W.

AND whilst I am in a critical mood, what about 5 S W? Is that supposed to be an experimental station or is it not? If it is, why does it not *say* so sometimes during the experiments? What on earth is the good of relaying the London programmes on short waves without saying why you are doing this, and where it's from? Why waste time in turning out a programme without a proper identification mark?

It Pays to Advertise.

ALONE amongst the short-wave experimental stations 5 S W puts a programme on the air, and leaves it at that! If you listen to K D K A, 2 X A F, or any other of these short-wave experimenters, you will find that between items, and every time they get the chance, they tell you what station is relaying. They will tell you where the programme comes from, what the wavelength is, why, and all about it. Also you are cordially invited to write to the Station Director. And the announcer keeps telling you who he is, what a fine "turn" he is relaying, and what they hope to do next. But 5 S W "lays low and ses nuffin."

SHORT WAVES.

STRETCHING IT.

A talk on angling is to be broadcast. Naturally, it will be on a long wave-length. —"Sunday Pictorial."

* * *

Under-water experiments in North Carolina have been abandoned owing to the singing of oysters during certain months.

There must be something in this talk of bivalve sets, after all.

* * *

GRIN AND BEAR IT.

Visitor: Pretty nice, eh, Bill, having a radio to entertain you when you've got a broken leg?"

Patient: "Well, I certainly can't kick." —"Radio News."

* * *

Dry batteries, experts tell us, should always be used lying down. But they run down "notwithstanding."

* * *

The Archdeacon of Bedford is reported to have said that the word "damn" has changed its meaning, and he does not mind saying it himself. That accounts for the large number of letters we've received lately from members of the church who are building radio sets.

* * *

Flapper: "Daddy, I'd like to get a permanent wave."

Daddy: (also a radio broadcaster): "Well, you'll have to take it out in liking; there aren't any left."

* * *

Answer to Correspondent: No, you will not get Ireland on your crystal set, even if you do cover all the connecting wires in green rubber sleeving.

* * *

DISILLUSIONED.

The gramophone enthusiast who went to a big city radio store because they advertised a "Record" sale.

* * *

Bess: "What makes you think Salome was a radio fan?"

Tess: "Why, she must have been. Didn't she ask for John the Baptist's head on a charger?"—"Radio News."

* * *

In the United States last year 12,000 people lost their lives through acts of violence, we read in the "Pictorial Magazine." There is, however, no truth in the rumour that home-made wireless sets were in many cases responsible.

Blind Broadcasts.

SURELY, if 5 S W is putting out a programme from London it need not be anonymous? Why not let the engineer take his listeners into his confidence a little? Why not explain this is 5 S W, the British Broadcasting Corporation's short-wave station at Chelmsford, experimenting on a wave-length of 32 metres, in the hope of reaching right round creation? Why not establish a bond between the lonely listeners of the Empire and the station that is catering for their requirements? The fact of fading on short waves makes frequent announcements absolutely essential to successful identification. Why is 5 S W alone among the experimental stations content to broadcast blindly? Why does not Chelmsford put over the personal appeal, instead of just palavering in public?

The "Handyman" Two.

HAVING got my grumble off my chest, let me like a soldier fall upon a nice long letter from South Africa. This is Balm of Gilead, and of Wellington, S.A. For this South African reader tells me that he built the "Handyman" Two, and caught two regular earfulls!

The short-wave stations shout aloud, and even on the longer waves he has managed to bag Langenberg definitely, and several other German stations who just eluded capture. Both Durban and Jo'burg are nearly a thousand miles away from this listener's aerial, but there are times when they seem so strong that they get in his way when he really wants to reach out! Some set, what!

Radio for Air Force.

HAVE you heard about the rotating radio beacon system, experiments on which have been carried out by the Royal Air Force near Gosport? The system which has recently been tried out at Fort Monckton is one in which all the direction-finding apparatus is at the transmitting station. From this ships or air liners can find their positions with an ordinary wireless receiver and a suitable watch, by means of which bearings can be taken. Some highly favourable reports are obtained, and on account of the simplicity of the apparatus required it seems likely that this rotating beacon system has a fine future before it.

Short Waves in Ireland.

"I HAVE been a regular reader of 'P.W.' for some years, but I have not yet seen any account concerning short-wave reception in Ireland," writes a broth of a bhoy from Cork. He then proceeds to remedy this state of affairs by sending me his own record of reception, using a straight three-valver (det. and 2 L.F.). And what a haul, begorra!

Cork-ing Stations.

AMONGST the stations which have fallen to this Irish three-valver are 2 X A D, 2 X A F, K D K A, W L W (Cincinnati), 2 X A L (New York), and stations as far separated as Bergen, Vienna, 3 L O (Melbourne), Copenhagen, and R F N (Russia). "Easily the best American transmission," he says, "is 2 X A F," and he reserves special mention for 3 L O (Melbourne) and P C J J.

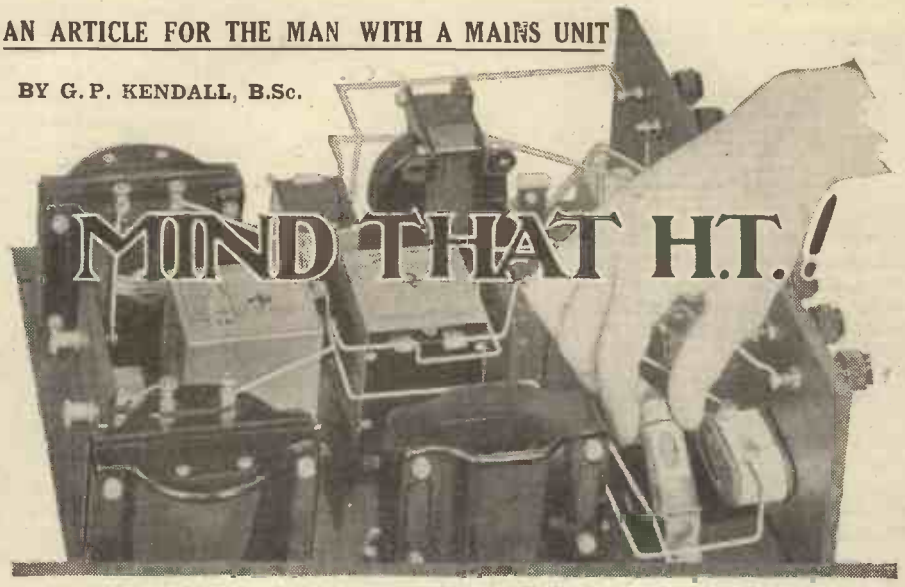
Sure an' I ought to be after tellin' ye that all the above were tuned in *on the loud speaker*. Space does not permit me to mention further details, but I can assure my seventeen-year-old correspondent that he has firmly convinced me of the healthy condition of short-wave reception in County Cork.

ARIEL.

AN ARTICLE FOR THE MAN WITH A MAINS UNIT

BY G. P. KENDALL, B.Sc.

MIND THAT H.T.!



If you're a unit-user, use your unit to the best advantage.

BEFORE you say to yourself, "Oh, another article warning us to turn off the mains before doing anything inside the set!" and turn over the page hurriedly, please read just this first paragraph and see whether there may not be, perhaps, a possibility of something useful in the notes which follow. True, to make them complete, I shall have to include the usual warning about the precautions which should be taken to ensure personal safety, but my real object is to give you some useful hints as to the avoidance of trouble in your set itself as a result of the wrong use of a mains unit.

If you are inclined to doubt whether it is possible to do any harm to any part of your receiving set by the incorrect use of a mains unit, just consider the following facts. In a very large proportion of mains units the method of obtaining a reduced voltage on the various tappings to feed the detector and H.F. valves is by the use of a series resistance.

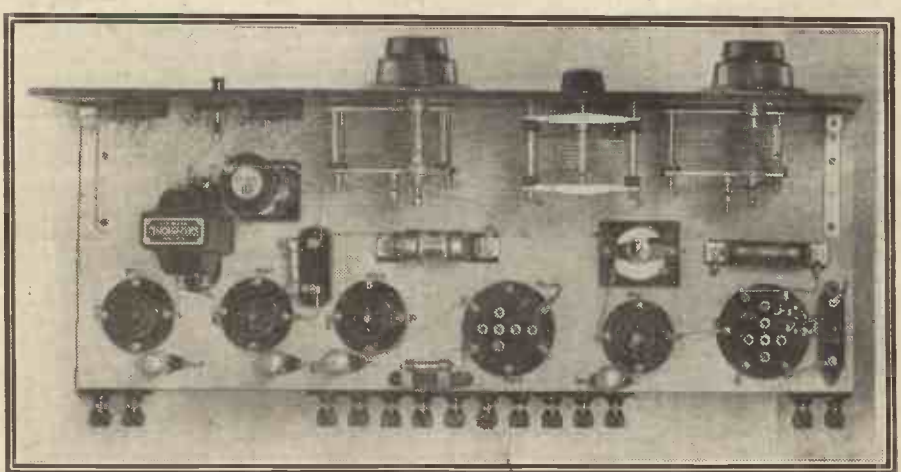
This only produces a reduced voltage when current is actually flowing, and if for any reason no current is being drawn from the eliminator the voltage on each terminal rises to the full maximum available across any part of the internal circuit. This, in the case of a unit for direct-current mains, means the full voltage of the mains, while in the case of an A.C. type it means the full no-load voltage across the rectifier circuit. In this latter case the rise of voltage may be a great deal more than you would expect, for in some badly-designed commercial mains units it may be very nearly twice the normal maximum output voltage.

Why the Panic?

"Well," you may be inclined to ask, "all this may sound very alarming, but what does it really amount to? What does it matter if the open circuit voltage does rise?" Well, this is where the danger arises. Supposing your set and H.T. unit are all connected up and working, and then you switch off the valve filaments in the receiver. This immediately brings about the state of affairs which we have been considering, since the anode current is no longer being drawn from the H.T. supply, and immediately up goes the voltage on all the tappings. In itself, there may be no danger in this, but the point is that in your set you will almost certainly have Mansbridge type condensers across each H.T. positive tapping; or, at any rate, across one or two of them. These, in most makes, are only designed to withstand pressures up to, perhaps, 150 volts, and to apply 200 or 250 to them is liable to cause trouble. A short circuit is pretty sure to take place sooner or later if this kind of thing happens more than once, or for long periods.

A Real Risk.

Again, if you switch off the filaments in this way and allow the reservoir condensers to be charged up to the full open circuit voltage of the H.T. unit—which, as we have seen, may be quite a high pressure—when you switch on again your valves will all be supplied with H.T. at the new high voltage for a certain short period, depending for its length upon the actual current drawn by the valves, capacity of the condensers, and so on. This is probably a minor matter, but it is imaginable that if it were to occur very often valves might be damaged, especially some of the less robust types with coated filaments.



Even when completely wired up this set presents a remarkably simple appearance owing to the fact that the "under baseboard" system of wiring is employed. Provided the constructor knows which wire to take through the baseboard, and which direct, this is an excellent scheme for minimising the risk of accidental shock.

Just how dangerous this rise of voltage may be to your set obviously depends upon the type of H.T. unit employed, and in the case of direct-current mains it is probably not a very grave risk, since in few cases will the new voltage exceed 200-240 volts. With an A.C. mains unit, however, the matter is rather different, especially with those of the larger type giving a high voltage on one of its terminals for use with super-power valves.

For example, one of fairly reputable make which I tested recently was rated to give 180 volts on the highest voltage terminal, and this it would certainly do even when quite a large current was being drawn. When, however, no current was being drawn the voltage rose to a figure in the neighbourhood of 340 volts!

The obvious remedy for this particular kind of trouble is to make it a rule never on any account to switch off the filaments of the valves when the H.T. unit is connected to the mains. On the contrary, always turn off the H.T. before you turn off the filaments, and conversely, when switching on, turn on the filaments first and the mains unit last. You will soon be able to make a habit of this, if you realise that you must see that the H.T. unit is never "on" when the filaments are "off."

'Ware Charged Condensers!

This rule is a very good safety-first one, not merely from the point of view of safeguarding the receiving set, but also the operator, since most of us have already got into the habit of turning off the filaments before we do anything to the set.

Another thing that should not be forgotten concerns the fact that when you switch off a mains unit all the reservoir condensers, both in the unit and in the receiver, are well filled up with high-voltage juice, and they will remain so for some minutes, unless something is done to empty them. It is quite possible to get a really nasty shock in this way, i.e. forgetting that the condensers are full and putting one's fingers across where one shouldn't.

Here, again, the rule which we have arrived at is a complete safeguard, since the easiest way of all of emptying the condensers is simply to turn the H.T. off at the mains and leave the filaments on for a few seconds.

TELEVISION DEVELOPMENTS.

It has been stated that we shall have picture broadcasts this year.

By THE EDITOR.

FURTHER developments in connection with television occupied a prominent position in the Press last week, when it was announced that broadcast pictures are held out as an Autumn prospect.

According to the "Daily Chronicle," by September 1st, Baird Television Sets will probably be available for home use, while in the following month the Fultograph Service may come into operation. Not much has been heard about the latter until recently, but it may be explained that the Fultograph is the invention of Captain O. Fulton, who has been doing a lot of experimental work in connection with wireless photography in Vienna.

Too Eulogistic.

The Fultograph is an invention which enables "still-life" photographs to be transmitted by wireless, and Captain Fulton states that he has perfected a system whereby, at a small cost, an invention for use in connection with one's home wireless receiver may be used for recording still photographs by radio.

The "Daily Herald," in announcing this possible service, was more optimistic. Two inventions, stated that paper, which will revolutionise the whole gamut of broadcasting, are being considered by the B.B.C. These are:

1. Television. A system invented by Captain Baird which would enable the ordinary listener-in to see the chief events of the day as they are occurring.

2. Radio photography. By means of an apparatus invented by Captain Fulton, photographs of the day's events can be viewed by the listener possessing a special apparatus.

It is curious how the newspapers sometimes contradict each other, and how, despite the growth of interest in wireless telegraphy, accuracy is so often missing from so many newspaper reports. For instance, the "Daily Herald" states that television was "invented by Captain Baird."

Mr. Baird will be the first to admit that he did not "invent" television, but has been for some time past experimenting with his system of television, and has also stated that he expects to transmit his first television programme some time in September.

According to him, it will be a programme in which songs will be sung, and the singers will be seen singing. Actors and actresses will be asked to appear, and he hopes to get well-known people to deliver speeches, etc.

Mr. Baird says this is only a start; more ambitious programmes, he hopes, will come later. Plays may be produced. The full significance, says Mr. Baird, of television possibilities has not yet been realised.

Misleading Optimism.

As a matter of fact, that is just what has been realised. The ordinary man-in-the-street is fully aware of the significance of television, but what he is not aware of, and what the newspapers will not realise, are the scientific limitations to known systems of wireless television, and to go on eulogising the possibilities of a service which may *one day* provide a means for showing the world's events by moving pictures before one's fireside by means of a home televisor, is futile, and only misleads the public into expecting something which bona fide scientists have given their considered opinion to be, at the moment, impracticable.

In connection with this recent announcement about the possibilities of a wireless television and photo service in the Autumn, it is interesting to quote from a lecture given by Dr. Herbert E. Ives, the well-known scientist of Yale University. In the course of his lecture, Dr. Ives said: "Where we now pay a nickel to hear a voice, we should have to pay a dollar to see a face, because of the transmission channel."

Dr. Ives does not believe the public will go to the expense of equipping themselves for television in its present state. In his opinion it is very unlikely that television could be made cheap enough for the home. He believes television in the theatre or before gatherings of many people to be more feasible.

"Still" Pictures Practicable.

Probably the most practicable idea in connection with television which has been announced yet is that suggested by Captain Fulton's invention. Although his system can hardly be called wireless television, his idea of reproducing in the home still pictures by wireless is distinctly feasible. It is said that with an ordinary wireless receiving set and the Fultograph, which will cost about £25, listeners will be able to obtain wireless reproductions of photographs taken the same day in various capitals of Europe. This is certainly possible; and the B.B.C. have, we understand, been investigating Captain Fulton's system.

According to an announcement from Savoy Hill, it is a practicable proposition that a system for broadcasting a photographic reproduction of current events may be introduced by the B.B.C., but it is premature to say that any scheme or system has been adopted. "Nothing has yet been decided, for the simple reason that everything is still in a very experimental stage," said a B.B.C. official the other day.

There are in all three systems being developed, and all that the B.B.C. engineers have been asked to do is to give these systems a trial. Nothing more need be said about the possibilities of a television or wireless photograph service until the B.B.C. engineers have made their report.

* * *

There is one thing about the B.B.C.—they are progressing as regards the technical side of broadcasting. We lately had an opportunity of seeing the new studios at Savoy Hill, and we were given information regarding a new kind of studio construction which is to be tried out by the B.B.C.

B.B.C.'s New Studios.

This studio will be a chamber two storeys in height, containing a gallery for the accommodation of the audience when a big orchestral or operatic performance is being given. This particular studio is going to be built for the Manchester Station to begin with, but its plans may be adopted for practical use at Savoy Hill.

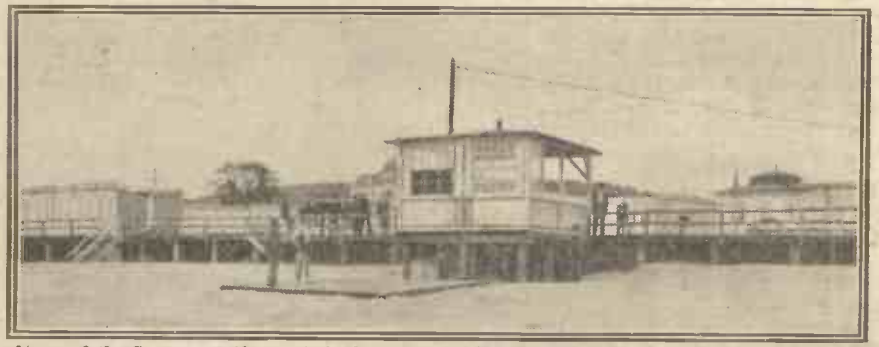
Manchester's new studio will be one of the largest in the country. It will be, roughly, 54 ft. long and 34 ft. wide. London already has this large double-decker studio, but the new Manchester one will be first of its kind among B.B.C. studios by possessing a gallery for the accommodation of listeners.

What is known as a "hall" effect is necessary for the proper and more faithful transmission of orchestral works by broadcasting, and this has been obtained by use of an Echo Room, in which a microphone and loud speaker are installed.

The latest studio at Savoy Hill is also, from the artistic point of view, much more bright and cheerful than the old studios. The latest studio in the basement, for instance, is painted a vivid red and black, and round the walls is a pictorial scene of a cheerful nature. Chinese lanterns give a nicely soothing effect, and it is just the sort of studio in which nervous artistes broadcasting for the first time might feel thoroughly at home. This latest studio in the basement at Savoy Hill brings the number of studios in London up to nine. It is interesting to remember that in the old days its site was that of a Turkish Bath.

There are altogether now three studios below the ground level at Savoy Hill, and the engineers have overcome any underground deadening effect by acoustic boarding and padding.

WHAT ARE THE WILD WAVES SAYING?



At one of the German seaside resorts loud speakers are installed to provide music for the bathers. The speakers are of the moving-coil type fitted into the window frames of a shelter as shown above.

The "P.W." RANGE-STRETCHER

This remarkable little unit is just what you want to convert your set into an "ultra DX" outfit by adding an extra H.F. valve. It is particularly suitable for use with the Cossor "Melody Maker" or with the Mullard "Master Three."

Designed and Described by the "P.W." RESEARCH DEPARTMENT.

HAVE you never wished that you could get those distant stations just a little more loudly and clearly and without squeezing the reaction up to the limit? Surely you must have done so, or you can be no true wireless enthusiast! To most of us, no doubt, the longing comes quite frequently, for there is always the feeling with the smaller and simpler kind of set that there are dozens of interesting stations just out of reach, while with those which *can* be received there is always a suspicion that the quality would be much better and the background quieter if only one could use a little less reaction and have a little genuine H.F. amplification instead.

A Simple Solution.

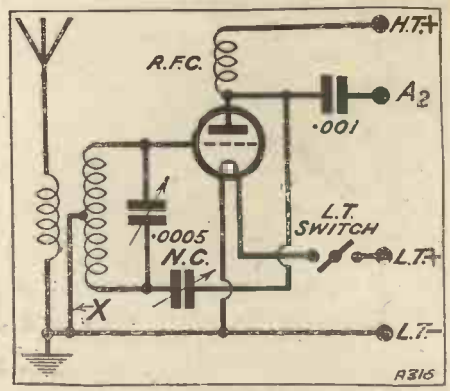
Of course, there is one very simple remedy for this state of affairs: just build a really powerful receiver like the 1928 Solodyne, and then you will no doubt find that all the worth-while stations will come in at full loud-speaker strength, probably with

Simplicity itself! Just a tuning dial and an on-off switch,

no reaction at all, unless your aerial is a very bad one. As a "counsel of perfection" this is all very well, but most of us feel inclined to ask whether there is a way out of the difficulty which is not so expensive and which, perhaps, does not involve taking on such a big piece of constructional work.

As a matter of fact, *there is* a way out which, although it may not be the absolute ideal, yet serves to bring the average man a great deal nearer to his heart's desire. This is simply to add a really good H.F. stage as a separate unit, placed in front of the present set and so amplify all the incoming signals before they actually reach the receiver proper. Thus you will be able to keep your old set without any alteration, and simply build one little extra unit. Moreover, you will be able to keep the existing set as a stand by, cutting out the extra unit when you only desire to receive the local station.

There has been in the past a good deal of prejudice against the addition of extra valves to existing sets, but this was very largely based upon two things. In the first place, the average listener was very keen



to add the extra valve on the existing panel and baseboard, and since these were usually laid out to serve the purposes only of the original circuit, a good deal of objectionable overcrowding almost always resulted, and the product was very rarely an efficient arrangement. The other reason was that in bygone days little was known about real H.F. amplification, methods of stabilising without great loss of efficiency, and so on, the neutrodyne circuit in particular not being available for amateur use. As a result the lay-out and general arrangement of an H.F. stage were matters of vast importance, and it was scarcely safe to advise anyone to build one separately and just place it beside the set in the hope that things would work out well. As a rule they did not!

Real H.F. Amplification.

Nowadays things are rather changed, because we have learned a good deal more about H.F. amplification, particularly in regard to matters pertaining to stability,

(*Continued on next page.*)

LIST OF COMPONENTS.

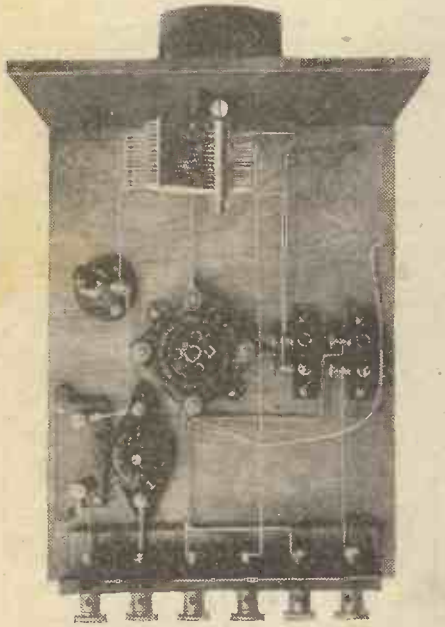
- Ebonite panel, 7 in. × 7 in. × ¼ in. or ⅜ in. (Any good branded material).
- Cabinet, to take above panel and baseboard, 9 in. deep (Artcraft, Cameo, Caxton, Makerimport, Pickett, Raymond, etc.).
- 2 Single baseboard-mounting coil sockets (Lotus, or other standard type).
- 1 Valve socket (Can be sprung or rigid as desired). (Bowyer-Lowe, Burndept, Burne-Jones, B.T.H., Igranic, Lissen, Lotus, Marconiphone, W.B., etc.)
- 1 H.F. choke (Burne-Jones in original. Any good make will suit here).
- 1 Neutralising condenser (Gambrell. Any good make).
- 1 ·0005 mfd. variable condenser with plain or vernier dial (Formo new type in original. Any good make, square law or straight line frequency, etc., as desired).
- 1 ·001 mfd. fixed condenser (Clarke, Dubilier, Igranic, Lissen, Mullard, T.C.C., etc.).
- 1 Terminal strip, 6 in. × 1½ in., with six terminals (Eelex terminals were used on the original with suitable markings. Other indicating types also give a good appearance, such as the Belling-Lee, Igranic, etc.).
- 1 On-and-off switch (Lissen in original). (Any good type giving good, reliable contact, such as Benjamin, Igranic, Lotus, to mention only a few examples.)

THE "P.W." "RANGE-STRETCHER."

(*Continued from previous page.*)

and it is now quite possible to design a simple and straightforward H.F. unit which can be placed in front of practically any set, whether it is of the simple detector and L.F. type such as the Cossor "Melody Maker," the Mullard "Master Three," or even those including already a single stage of H.F. amplification, with a definite guarantee of good results so long as the proper valves and coils are used.

The general effect is to give a very marked improvement in the volume of those stations which you were otherwise only just able to get in, and you will then be able to work a little further off the oscillation point than before, and so get better quality and a quieter background, and without the woolly



The flex lead you see here is normally connected to the centre tap on the secondary coil.

quality associated with the use of too much reaction. Again, you will find that there is, when the unit is properly adjusted, a very helpful improvement in selectivity.

Two Versions.

So useful an accessory is a well-designed modern H.F. unit that it has been decided to prepare designs for two special examples for publication, the first of these appearing in this issue, and the other in a future issue of "Modern Wireless." The one described here is a "standard" version of a fairly simple yet effective type, while the one to appear [illegible] will be a "de Luxe" version, with certain special refinements, such as a simple volume control, and a switching scheme for changing from the long to the short waves and vice versa without the nuisance of coil changing. The simpler version will give just as good results as the more elaborate one, but it lacks the volume control, and you must change coils when you desire to go over to 5 X X. On the other hand, it is decidedly easier to make and is, of course, rather cheaper.

The "P.W." Range-Stretcher is the name of this unit, and the same simple but highly-efficient circuit is used in both cases. It is properly stabilised by one of the well-known methods of neutralisation, and you need have no fear of difficulty with this, since it is very easy to adjust to the correct working condition, and when once this is done it adds very little to the difficulty of operating the complete outfit, merely giving you an extra dial upon which you must tune in.

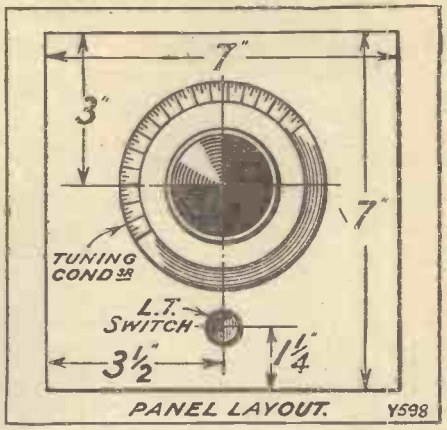
Simple but Efficient.

The general features of the circuit are as follows. The aerial to earth circuit consists of an untuned coil giving the arrangement commonly called an "aperiodic aerial," tightly coupled to a secondary circuit consisting of a standard centre-tapped coil tuned by a ·0005 mfd. variable condenser, which constitutes the grid circuit of the H.F. valve. (The purpose of the centre tap we shall see in a moment.) In the anode circuit of the valve is an H.F. choke, and from the plate end of this choke, that is to say, from the anode of the valve itself, a lead goes off to a ·001 mfd. fixed condenser, whose other side goes to the output terminal of the unit. (It is intended, of course, that a wire shall go off from this terminal to the usual aerial terminal of the existing set, the aerial itself being connected to a new terminal on the unit.) This gives us what is called a parallel feed output arrangement to the detector circuit in the existing set, or to the grid circuit of the first valve, if your set already includes H.F.

Now for the method of neutralising. If you look at the circuit diagram, you will see that one side of the tuned circuit of the H.F. valve is connected to the grid, and the centre tap is connected to the filament. The free side of this tuned circuit is connected to one side of the neutralising condenser, the other side of which is connected to the anode of the valve, this giving us what is called split-secondary neutralisation.

The construction of this little unit is a very simple matter, and you will probably find that you can complete the whole job in one evening without the slightest difficulty. There are only two holes to drill on the panel, one for the one-hole fixing variable condenser (assuming that you use one of that kind) and one for the on-and-off switch.

On the baseboard you will require to mount the two single-coil sockets, valve holder, neutralising condenser, H.F. choke, fixed condenser and terminal strip, as illustrated in the wiring diagram. There is



nothing difficult about the wiring up, either, and you can use either bare wire, one of the specially prepared, easy-soldering materials like Junit, bare wire and Systoflex or Glazite, as you wish, and just a little pains taken in seeing that the wires run straight and are nicely spaced from one

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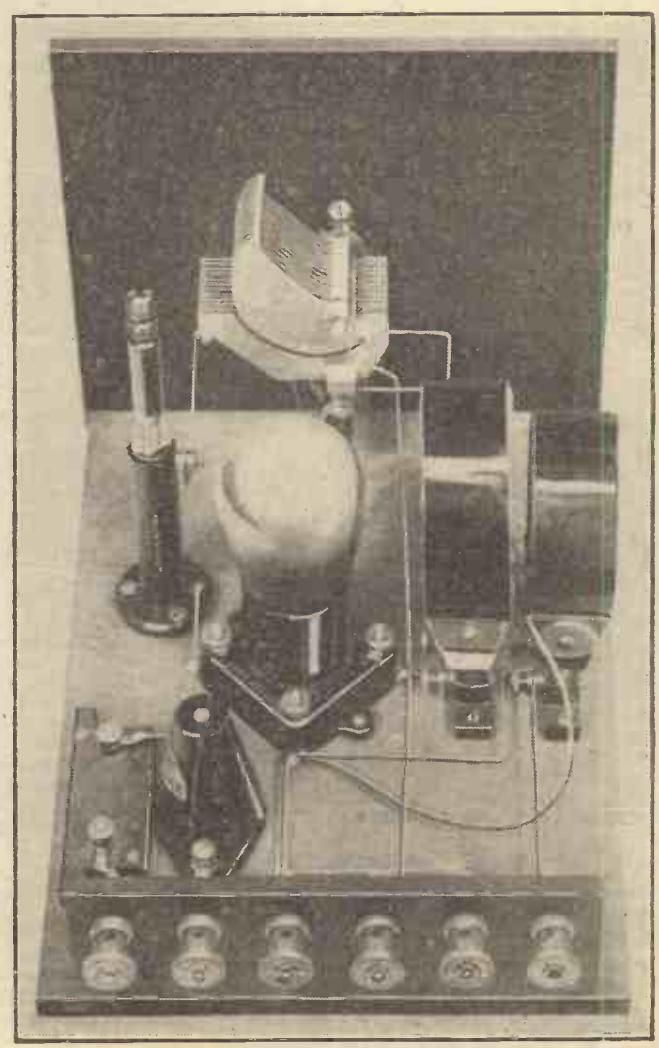
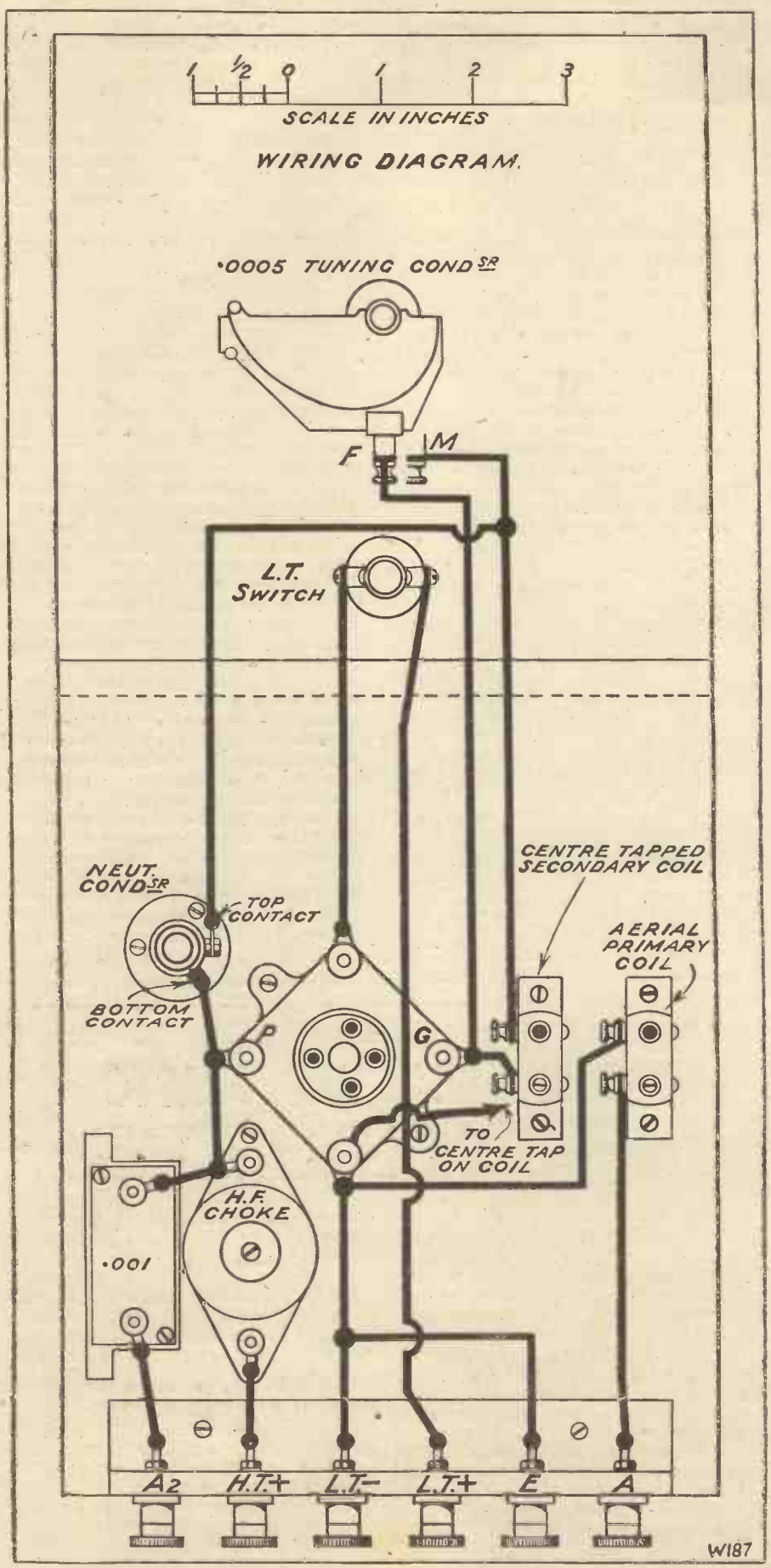


A very neat lay-out and simple wiring are special features of this efficient little unit.



THE "P.W." "RANGE-STRETCHER."

(Continued from previous page.)

another will result in a similar workmanlike appearance to that which you see in the photographs.

Valves and Voltages.

Assuming that we have now completed our unit, we can start on operating matters, and the first thing to claim our attention is obviously that of the type of valve to be used. What you require is a valve of the special H.F. type now available in every well-known make. Here are a few examples: P.M.5X, S.S.6075 H.F., D.E.L.610, S.P. 55G, 610 H.F., etc. These are all 6-volt valves and, of course, if you want the very finest of results you will choose those of this rating. If, on the other hand, you desire to get the greatest economy no doubt you will choose a 2-volter, equivalents again being available in every one of the better-known makes.

POINT-TO-POINT CONNECTIONS.

Aerial terminal to one side of aerial coil socket (it does not matter which) Other side of aerial coil socket to one filament connection on valve socket, to L.T. — terminal to centre tap on coil and to earth terminal. One side of secondary coil holder to grid connection on valve socket, and to fixed vanes of tuning condenser. Other side of secondary coil socket to moving vanes of tuning condenser and to one side of neutralising condenser.

Other side of neutralising condenser to plate connection on valve socket, to one side of H.F. choke, to one side of ·001 mfd. fixed condenser. Other side of ·001 mfd. fixed condenser to output terminal. The remaining side of H.T. choke to H.T. + terminal. The remaining filament connection on valve socket to one side of on-and-off switch. Other side of switch to L.T. positive terminal. Flex lead from filament negative to centre tap on coil.

A fairly high value of H.T. voltage is desirable for any neutralised H.F. valve, and this unit is no exception; 60 volts should be regarded really as a minimum, and 72 or 80 volts is better still. If you have it available, by all means use 100 volts, and so be sure that the valve is giving the best of which it is capable.

Filament Control.

You will notice, by the way, that there is no filament rheostat provided upon this unit, and it should perhaps be explained that this is because practically every one of the modern types of 2- and 6-volt valves work perfectly well direct from a 2- or 6-volt accumulator without any adjusting rheostat whatever. If you anticipate using some other type of valve requiring an intermediate voltage, you could, of course, make provision by inserting a rheostat in the lead between one of the filament terminals of the valve socket and the on-and-off switch. You will find there is ample room for one of these on the baseboard between the neutralising condenser and the panel.

(See "Radiotorial" for further details.)

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

LOW-TENSION ELIMINATORS

COMMERCIAL FORMS—SET FOR CONSTRUCTORS—WOODEN HORNS—RESISTANCE CAPACITY, ETC., ETC.

Low-Tension Eliminators.

THE subject of high-capacity electrolytic condensers, which I mentioned some few weeks back, and again last week, is evidently one of very considerable interest, judging by the letters which I continue to receive from readers of these Notes.

Many readers have asked me questions as to the method of using these high-capacity condensers as smoothers in "low-tension eliminator" circuits, otherwise called "low-tension mains-supply units." As I have no diagrams to illustrate "Technical Notes," I shall be obliged to do the best I can without.

First of all, you will understand that, broadly speaking, the electrolytic condenser acts precisely as any other condenser as regards its smoothing properties when used in conjunction with a step-down transformer and rectifier. These condensers are designed for 2-, 4- or 6-volt outputs and, as I say, may be regarded for the moment as simply high-capacity ordinary condensers.

As a matter of fact, they have the rather peculiar quality, not possessed by the ordinary type of laminated condenser, that they require a small polarising current. This amounts in practice to a slight leakage current, but the leakage will usually be extremely small, of the order of a milliampere or even a fraction of a milliampere, and therefore is entirely negligible. Another curious property of the electrolytic condenser—which is, in fact, related to the property just mentioned—is that if it is designed for the smoothing of D.C. output it is not suitable for straight A.C.

Peculiar Properties.

In the case of a direct-current smoothing electrolytic condenser the capacity of the condenser depends to some extent upon the internal polarisation, and this polarisation is maintained by the D.C. voltage applied, a consequence of which is the slight leakage current or polarising current which I mentioned a moment ago.

If condensers of this kind are used at voltages much above the rated value the capacity is apt to decrease and the same remark applies if very high frequencies are used. Nevertheless they can be employed for very high audio frequencies and even for the lower radio frequencies, although, as a matter of fact, this latter point is not of much importance, since the condensers are primarily designed for smoothing out low-frequency A.C. hum.

Owing to their extremely high capacity they are specially efficient for the smoothing purpose just mentioned, and they are actually in use in commercial low-tension eliminators upon the market in the United States and other parts of the world.

Commercial Forms.

In a recent issue of the well-known American journal "Radio News" is a full account, with illlustrations, of the construction of a commercial low-tension eliminator using a special form of rectifier and the electrolytic condensers which I mentioned last week. These electrolytic condensers are in sealed metal containers or cans and, in addition to being very compact and of enormous electrostatic capacity, they seem from all accounts to be a thoroughly proved and practical proposition.

With a comparatively new product one always has a tendency to reserve judgment, and it is therefore very interesting and important to note that they are not only in commercial production and use, but also have been sold, as I said before, quite largely in various parts of the world.

APPEAL ADVISERS.

To deal with radio charity appeals an Advisory Committee investigates all the applications at Savoy Hill. The two members of this body shown above are (left) Mr. A. H. Norris, and (right) Dr. F. N. Kay Menzies.

Set for Constructors.

One of the companies manufacturing the low-tension eliminator, or mains-supply unit, incorporating the rectifier and these condensers, also supplies what they call in the States a "knock-down kit" or, as we should say, a "set of parts" for the constructor to make up his own low-tension supply unit, and it is a very simple matter to assemble an L.T. eliminator from these parts. The whole outfit is so simplified that, according to the suppliers, it should be easily assembled in 15 to 30 minutes by the average experimenter.

The method of using the condensers in a low-tension eliminator is perfectly simple. A.C. current from the low-tension output side of the step-down transformer is passed through the rectifier in the usual way and thereafter, of course, gives us our positive and negative leads. Two chokes (in series) are connected to the positive lead and thence to a terminal which becomes the positive output terminal of the eliminator.

The negative lead from the rectifier goes straight to the terminal which becomes the negative output terminal of the eliminator. A condenser is connected straight across the two leads *before* the *first* choke, another condenser is connected after the first choke (that is, at the point between the first and second chokes), and the third condenser is bridged across the leads *after* the *second* choke, or, if you like, across the output terminals.

Compact and Low Cost.

Although a capacity of 1,000 to 2,000 mfd. is enormously greater than the smoothing capacities ordinarily used in low-tension eliminators, it is interesting to note that there is no difficulty in providing quite a comparatively small electrolytic condenser of this type to give a capacity of several thousand mfd. Not only is the question of space important, but the question of cost is perhaps more important, and it is a matter of simple arithmetic (which I leave you to work out) to show that the cost of an

(*Continued on page* 584.)

NEWS FROM SAVOY HILL. FROM OUR OWN CORRESPONDENTS.

"SURPRISE" BROADCASTS

INTERESTING TRAVEL TALKS—A LOG CABIN PROGRAMME FOR CARDIFF—AIR DISPLAY BY RADIO—SPORTS TALKS, ETC., ETC.

"Surprise" Broadcasts.

EVERY Friday evening, beginning from the second week in July, the period between 10.45 and 11 p.m. in the broadcast programmes from London will be described by the bald announcement of "Surprise Item." Not even the programme builders know what it will consist of, because this will not be settled until the same evening and no notification of the form it is to take will be given until the announcer begins speaking.

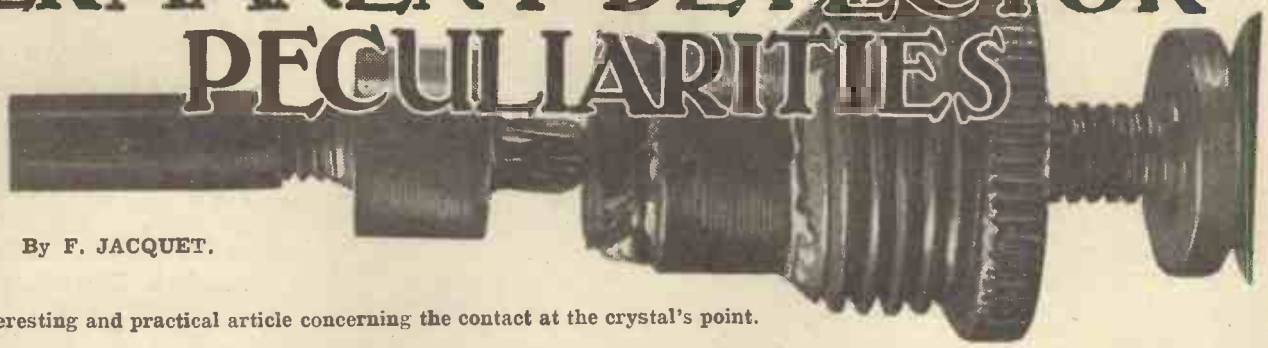
It often happens that some topical talk becomes available long after the programmes have been made up, or that a prominent theatrical or vaudeville "star" is able to accept a one night engagement at short notice. Such items have always been difficult to fit into the programmes, but with a definite time allocated each week, they can easily become one of the most looked-for parts of the programmes, particularly when the exact details and character are not revealed until the last moment. A "stunt" of this kind is long overdue. Not since Donald Calthrop left Savoy Hill two years ago has anything of the kind been attempted.

Interesting Travel Talks.

Mr. Douglas Lockhart, who lived in Hungary during the stirring events of 1920 and 1921, is giving a talk on that much discussed country for London and Daventry listeners on Tuesday, June 26th. The talk is in the series on "Holidays Abroad" so that Mr. Lockhart's remarks will deal with

(*Continued on page* 582.)

PERMANENT-DETECTOR PECULIARITIES



By F. JACQUET.

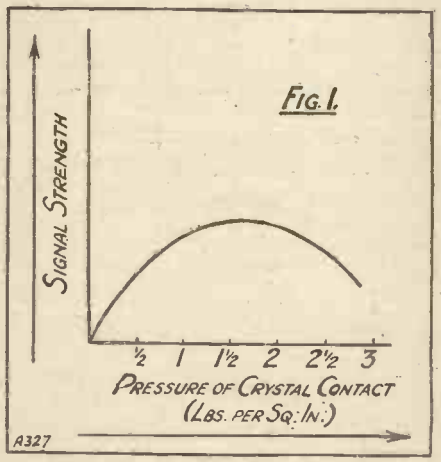
An interesting and practical article concerning the contact at the crystal's point.

THE early days of broadcasting gave to the "cat's-whisker" type of detector an extremely high popularity, and it was considered that the "Perikon," or two-crystal detector, was quickly to become a thing of the past. People thought that the perikon detector was, comparatively speaking, an insensitive device, and so crystal-set owners for the most part pinned their faith to the use of the rectifying crystal of galena used in conjunction with the little wire spiral which has so curiously been designated a "cat's-whisker."

Where the Cat's-whisker Scores.

The fact that now the cat's-whisker form of detector is rather waning in popularity among crystal users, and that the two-crystal combination, or perikon type of detector is still being used in one form or another is certainly indicative of the superiority of the perikon over the cat's-whisker detector.

If we grant at the outset that the cat's-whisker-galena detector has the greater distance-sensitivity and that it is the most efficient crystal-rectifying device for working on comparatively weak signals, we



As the pressure is increased so the strength increases—up to a point. This figure shows that an increase of pressure beyond 1½ lbs. results in a falling-off of strength.

have enumerated practically all the virtues possessed by this form of detector. The perikon or two-crystal detector, although it is not very effective for working on weak signals, is a much more stable affair than the cat's-whisker detector. It can be adjusted at the beginning of a broadcast programme, and not only will it retain its setting throughout that programme, but its adjustment will be maintained for days, weeks, and sometimes even months afterwards.

After all, few people nowadays take much interest in experimenting with the possibilities of obtaining distant reception on the crystal. The crystal set, at the present time, is mainly a convenient and efficient little instrument to have by one as a standby in times of emergency, and for the use of people whose interest in wireless is not technical enough for them to make a study of the more practicable form of valve reception. Hence it is that the present "ever-ready" form of crystal set generally incorporates a fixed or semi-permanent detector of the perikon type.

Fig. 2. The upper crystal is the tellurium, and in this instance it is too pointed for maximum results.

Nowadays, the name "perikon" is applied to any form of two-crystal detector. Quite a large number of crystal pairs will rectify high-frequency impulses of current, but, for all practical purposes, the only types of perikon detectors in use nowadays are those comprising a contact between zincite and bornite, or between zincite and tellurium, the latter contact being the more popular.

Perikon Peculiarities.

Perikon detectors possess several peculiarities connected with their effective working, and a true appreciation of these will do much in enabling the amateur to obtain the utmost degree of efficiency from his crystal set. For instance, there is still a considerable number of crystal-set users inclined to think that the lighter the contact between the crystal in their semi-permanent detectors the better the reception will be. Such an idea is a fallacy,

In fact, one may sketch out a rough chart, similar to the one depicted at Fig. 1, showing the increase in sensitivity of the perikon type of detector up to a certain maximum with increase in contact pressure, and, after that maximum has been attained, the decrease in rectifying efficiency with further increase in contact pressure—other factors being maintained constant.

Roughly speaking, the degree of contact pressure which gives the best results with perikon detectors is about that obtained when the hand and arm is allowed to rest on the elements of an experimental two-crystal detector, holding them in contact by those means.

The contact area of a perikon detector governs the efficiency of the reception to quite an appreciable extent.

The trio of "close-up" photographs of a perikon contact will make my meaning clearer. At Fig. 2 we have a contact between a crystal of zincite and a fragment of tellurium in which the tellurium element is too pointed. In Fig. 3, the tellurium element of the detector is too flat at the end, whilst in Fig. 4 a happy medium has been obtained, the tellurium fragment being broadly pointed at the end. This latter provides the most effective reception, and amateurs who have experienced any trouble with their two-crystal detectors will often find that a little judicious re-shaping of the end of the tellurium element will put matters right at once.

Contact Efficiency.

The same remarks as the above apply also to perikon detectors comprising a contact between zincite and bornite crystals.

When adjusting or re-adjusting a perikon detector, do not *grind* the crystals together. Tellurium is a very soft material, and the grinding of it against the harder crystal of zincite will result in the surface of the latter crystal being blackened by a deposit of the tellurium. The presence of this deposit tends to lower the resistance between the two crystals, and thus to decrease the rectifying efficiency.

Like every other form of crystal rectifying device, a perikon detector which is not completely cased-in should be kept free from dust.

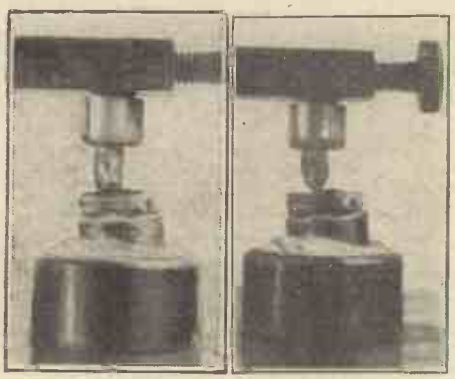


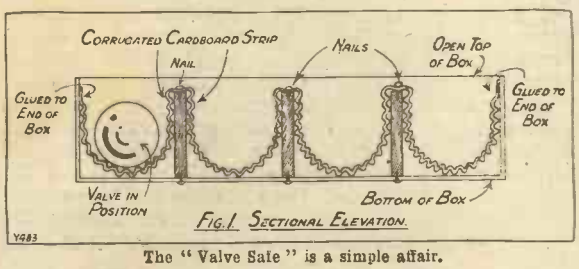
Fig. 3 (to the left) shows the other extreme, and in this case the tellurium is too flat. In Fig. 4 (right) a mean has been obtained, and the crystal is neither too pointed nor too flat, in which condition its rectifying action will be at a maximum

There are no more important, and at the same time vulnerable, parts of a receiver than the valves; yet they are often treated carelessly and the majority meet violent deaths.

By A CORRESPONDENT.

FEW radio valves die the natural death of old age, after having given their owners some thousand hours of interesting entertainment. Some are dropped or otherwise broken, not a few of them are electrocuted by letting the high voltage of the H.T. battery find its way to the delicate filaments.

The experimenter rarely can take sufficient care of his valves; with every slight change in set and circuit the valves have to be withdrawn and reinserted. In the heat of battle pliers and screwdrivers will drop on them, or else a careless move may make them roll off the table.



The "Valve Safe" is a simple affair.

With a simple "safe" it is quite a simple matter to make your valves last a very long time, particularly if you are experimentally inclined.

The safe is merely a cardboard or light wooden box, slightly wider than the length of the largest valve used, and of convenient length.

Quite Small.

The depth need not be great, 2½ in. to 3 in. is ample. Some thin wood strips are spaced along the narrow side of the container; thin nails will hold them in position.

The compartments formed in this manner should be lined with cotton wool, or a strip of corrugated cardboard may be used as padding.

A "safe" for four valves, showing how they are protected by the corrugated cardboard.

FOR YOUR NOTEBOOK.

A good earth is just as important as a good aerial, especially if you are using a crystal set.

* * *

The Watch Committee of the City of York recently recommended that the council should enforce a by-law prohibiting loud speakers from causing annoyance or disturbance, the suggested penalty for non-observance being five pounds.

When wiring up a set contained in a screening box it is unwise to rely upon the insulation of covered wire being sufficient to prevent shorts (when H.T. positive leads are led through holes in the box). Extra covering in the form of Systoflex or insulating tape should be wrapped round the H.T.+ wires.

* * *

The incorrect adjustment of grid bias not only causes distortion but is liable to lead to an unnecessarily heavy drain upon the H.T. battery.

* * *

Grid-bias batteries are often damaged by carelessly allowing the wander plugs simultaneously to touch the positive and the 1½ volts negative tappings. This should be avoided, as it means shorting part of the battery.

* * *

How loose aerial coupling can be made is shown by the fact that very often it pays to disconnect the aerial altogether and leave it dangling a foot or so away from the set.

* * *

A discoloured ebonite panel can often be made to look like new by the application of a little lubricating oil rubbed in with the fingertips and polished with a soft duster.

* * *

It is rumoured that as soon as the B.B.C. has finished constructing the new twin-wave station near Potters Bar it will proceed with the work of erecting the Pennine regional station, which will serve the Manchester district.

* * *

Chicago has the reputation of being the centre of the world's most congested radio district, there being nearly 220 active broadcasting stations in the vicinity.

* * *

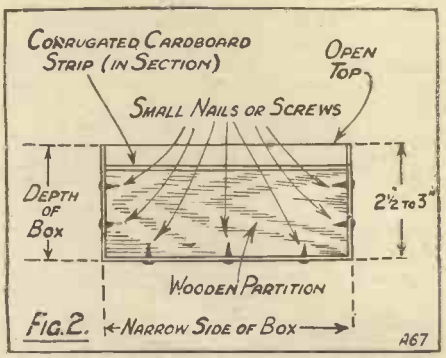
The practice of using wireless masts as aerial beacons for aviators is increasing, and many of the new stations now being erected are marked in some conspicuous way, or have lights at the head of the mast.

* * *

When a counterpoise aerial is used it should be fitted with an earthing switch in the same way as an ordinary aerial.

MAKING RESISTANCES.

EXPERIMENTAL anode resistances or grid leaks are quite easy to make, and at times when a manufactured one is not handy, it is convenient to be able to construct one. The diagram shows how this may be done at very little expense or trouble.



The construction of the valve box will only take a few minutes but may save pounds.

Carbon Rods.

The material necessary comprises some ebonite tube, two 4 B.A. nuts, two round-head 4 B.A. screws, three disc washers, one spring washer, and some sticks of carbon as used for small arc lamps.

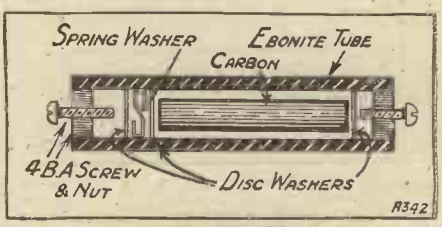
The assembly may be followed from the drawing. The nuts at each end are forced in by first warming the ebonite tube slightly and tapping the nut in.

First secure one end complete with screw, then drop in one disc washer and a length of carbon. After this, drop in a further disc washer, a spring washer, and lastly, a disc washer.

Seal the remaining end by forcing in the other nut, and adjust contact with the screw at this end, the spring washer thus allowing sufficient tension for good contact without breaking the carbon.

Size Governs Resistance.

The point to observe in constructing these gadgets, in all cases, is that the length and diameter of carbon rod thus used in each case governs the ohmic resistance factor.



A home-made grid leak.

A number might, therefore, easily be made of varying degrees in length, keeping the diameter a standard factor for all high resistances of the order of 100,000 ohms, and a smaller diameter for those of the lower grades, such as grid leaks.

The round head screws at each end lend themselves for spring contact between clips in the usual manner.

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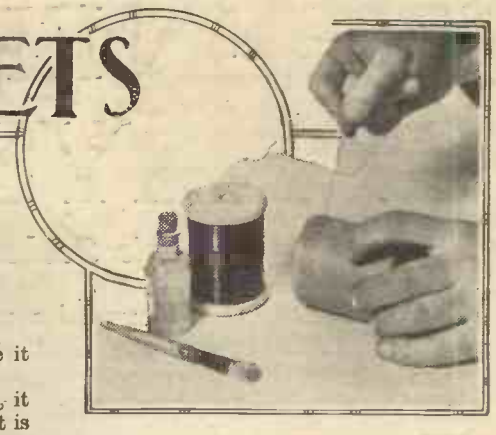
WORKSHOP GADGETS



A description of some ingenious and easily-made devices which will help you in the construction of radio receivers.

By H. J. BARTON-CHAPPLE, Wh. Sch., B.Sc. (Hons.)

WHEN constructing one's own wireless receiver there are several handy little tools which can be pressed into service to render the task less difficult and ensure a more accurate execution of the designer's instructions which are being followed. The following article shows how one or two of these can be made up by the handy man, my own experience in these matters having proved their utility on divers occasions.

When marking out the receiver panel, we require a 12-in. steel rule, a scriber and a centre punch, and as far as the last two are concerned it is very easy to make one tool serve the dual purpose. Obtain a small screwdriver of the jeweller's pattern, that illustrated being one purchased at Woolworth's complete with three driver blades of different sizes.

A Useful Combination.

It consists essentially of a cylindrical body with a loose head, so that by placing the first finger on the head the driver may be rotated with the thumb and second finger moving over the milled shank. The blades fit into a jaw kept closed by a knurled nut.

On the left is shown the small screwdriver adapted as a scriber and centre punch. In the centre is a centre punch made from a small round file and on the right is the other form of scriber dealt with in this article.

To adapt this as a scriber and centre punch, take the largest blade and grind the end so that it has a long, pyramid point.

Since the blade is tempered and hardened it cannot be filed unless it is softened, so if there is no means available for carrying out the grinding, the blade end should be heated and then allowed to cool slowly. This will soften it and the end may then be filed to the correct shape, while to reharden the point, carefully heat the blade to a cherry red and quickly dip the point only into water, and if the metal surface is clean several colours will appear on the blade.

As soon as the straw colour reaches the point end of the blade (the colours actually travelling down the blade as the result of the sudden cooling of one part), plunge it wholly into the water.

On replacing the blade into its holder, it forms an excellent scriber, while, when it is desired to centre punch line intersections for drilling purposes, just insert the point at the required place on the ebonite panel and twist the driver handle a few times. This

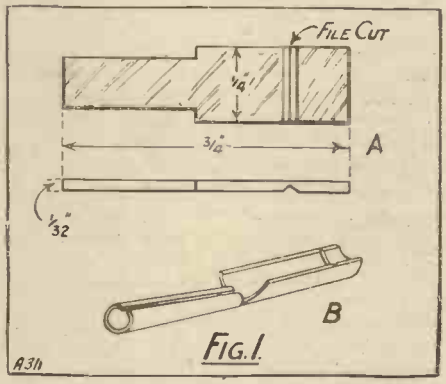


FIG. 1.

will give a nice "pop" mark, accurately positioned. If the hole to be drilled is a large one, then this "centre punch" mark can be enlarged with the aid of a hammer and centre punch of bigger dimensions, but the small pop mark acts as a guide and ensures greater accuracy.

An Easily-Made Scriber.

For those who prefer a small centre punch in addition, one can be made up very readily from the broken end of a small round file. It should be ground to the shape shown in the illustration, or, if this is inconvenient, the double process of softening, filing to shape and tempering, undertaken as in the case of the driver blade just described. The file teeth provide a good grip for the centre punch, while the steel used in manufacturing the file is specially suited to the work for which it has now been adapted.

The handy man often likes to carry one or two tools about in his pocket and quite a useful scriber, which incidentally can be put to other uses, may be made from a propelling pencil as shown. Break off the end of a thick darning needle, or use the end of an existing scriber, and replace the pencil lead with this scriber point. If the propelling pencil case is one in which the point can be withdrawn inside the case when not in use, complete protection is provided when carrying this little tool in the pocket.

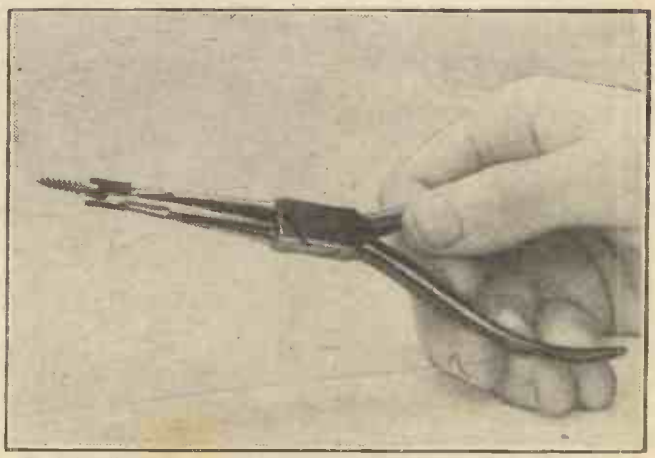
When screwing receiver components on to the wooden baseboard, it happens frequently that if is rather awkward to get the screws slipped into the screw holes. When the lay-out is such that the components are cramped, it is impossible to hold the screw between the fingers and insert it into place, while round or flat-nosed pliers as a rule do not given a firm enough grip to the screw head to enable it to be held and guided into position. To meet such cases a pair of round-nosed pliers can be adapted.

Screw-head "Jaws."

Procure two small pieces of sheet brass $\frac{3}{4}$ in. long, $\frac{1}{4}$ in. wide and $\frac{1}{32}$-in. thick. Cut these to the shape shown in Fig. 1A, making a file cut where indicated to act as a channel across the brass face. Now bend each piece of brass to the shape illustrated in Fig. 1B so that they slip over the plier ends and are held in place when pushed down hard.

These shaped "jaws" will now permit a screw head to be gripped quite rigidly, the edge of the head fitting into the file cut and, as can be seen from the accompanying photograph, a firm grip is retained on the screw enabling it to be manipulated into the required hole and given a twist to make it grip into the wood.

This done, the hold on the screw may be released and the screwdriver called into play to complete the job.



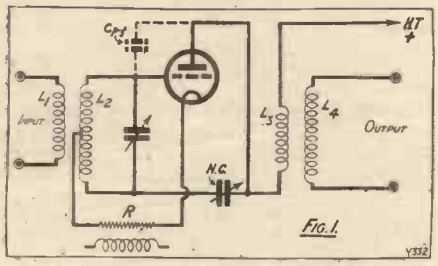
By fitting these simple and easily-made "jaws" to an ordinary pair of round-nosed pliers otherwise awkwardly placed screws can be tackled without trouble.

The question of efficient and convenient neutralisation is not an easy one to answer. A valuable article.

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

BEFORE neutralised circuits became popular we used to employ circuits by various means, all of which involved the introduction of losses or damping in some form or another in the H.F. circuits, so as to make them stable. One method was to employ a potentiometer, another to mount a coil close to the metal end-plate of a condenser, so as to induce eddy current losses; other methods consisted in placing high resistances in leads where they would assist to reduce any tendency towards oscillations being generated. I will put a question which I think is appropriate to the subject at this point. How many of us work with our circuits completely neutralised? The answer, I think, to this is about 1 per cent. This is not done unconsciously, and I do not mean by this that we are not able to neutralise our H.F. sets correctly. What I do mean is that we purposely under or over-neutralise in order to introduce a certain amount of reaction into the associated circuits.

I do this myself, although I would point out that it has to be done carefully, since



if it is carried to excess a natural loss in H.F. amplification is obtained in the H.F. stages. This is probably due to the fact that the optimum values of reaction cannot then be used with the detector valve, since the H.F. valve would otherwise go into oscillation.

A Serious Drawback.

The result is that the damping in the detector circuit, where it is heaviest, cannot be removed to the full extent by the use of reaction, as it can be with the H.F. valve fully neutralised, and this results in a slight loss in signal strength.

Now, admitting that we wish to use a neutralised circuit in order to obtain stability, it occurred to me that what we wanted was not a circuit which was completely neutralised at all frequencies, but rather one which was completely neutralised at such frequencies where the set was most regenerative and would be slightly under-neutralised at frequencies where the set was naturally most stable.

What Is Required.

I have found the same as you have, too, no doubt, that the set is most lively down somewhere in the region of 250 metres, and in some cases even lower, and a set that is neutralised, we will say, correctly at 2 L O's wave-length may tend to go into oscillation as soon as we get down to the bottom of the condensers, whilst at the top end a considerable amount of reaction can be applied.

I therefore thought if I could devise a means by which the receiver could be adjusted so as to be perfectly stable at the bottom reading of the condenser, but would allow a certain amount of regeneration to take place at the higher readings, then an improvement in the over-all efficiency of the receiver should result.

By using a circuit of this description we could neutralise the receiver completely at, say, 200 metres, and we should then find that as the wave-length of the various circuits was increased to the top end of the condenser, a test would show that the set, instead of being completely neutralised, was actually under-neutralised.

The Split-Secondary Circuit.

The first type of neutralised circuit with which I experimented in this direction was the split-secondary circuit, with which I have done so much experimental work in the past. A theoretical skeleton of this circuit is shown in Fig. 1. It is a variation from the straightforward Rice neutralising circuit in that I connect either a high resistance or an H.F. choke in the L.T. negative return, which is joined to the centre tap on the coil L_2.

At first sight it would appear that the neutralising circuit is a bridge circuit, and it can be re-drawn as shown in Fig. 2. The two inductances marked A and B are the two halves of the grid coil L_2, while Cp–g is the plate to grid capacity, and N.C. the neutralising condenser.

Now, this diagram would be quite correct providing that there were no coupling between the two coils A and B. In practice, however, these two inductances, since they are wound side by side, are quite tightly coupled, and they therefore possess mutual inductance, which can be shown as a fictitious inductance placed in series with one of them.

Re-drawing the Fig. 2 circuit correctly, therefore, so as to include this mutual inductance, we get the diagram shown in Fig. 3. I have shown the mutual inductance as a small inductance, L_3, connected in series with the arm A of the grid coil, though as from theoretical considerations it may be placed in series with either of these, it is generally found in practice that it must be assumed to be placed in one arm only.

Now the value of this inductance L_3, which represents the mutual inductance between the two coils, is a variable factor, since the mutual inductance of two coils is a function of their inductance and the wave-length to which they are tuned.

This means that, although we can obtain a true balance at any one given frequency, as soon as the frequency to which the circuits are tuned is altered, the value of the mutual inductance L_3 will alter and the value of the neutralising condenser required to give a true balance will also have to be varied.

First Experiments.

It can be shown theoretically that the value of the inductance L_3 will only vary between certain limits, so that by suitably shifting the tap on the input coil, so as to allow of a mean value for this inductance, we could find a position which would give greater over-all stability, that is a less departure from the true neutralising positions at the top and bottom of the scale, than the more usual centre tap.

We further have the grid-filament capacity in parallel with the one half of the inductance and this is shown at Cg in Fig. 3. This, therefore, introduces an element which upsets the bridge arrangement causing it to be non-symmetrical though its effect is not serious, while we also have the grid-filament impedance across this coil.

This, however, can be regarded as being negligible, since in modern H.F. circuits the grid is worked with a zero or slightly negative bias. It is not the practice nowadays to use a positive bias on the grid of the valve in order to promote stability so that we need not worry about the question of grid-filament impedance in this case.

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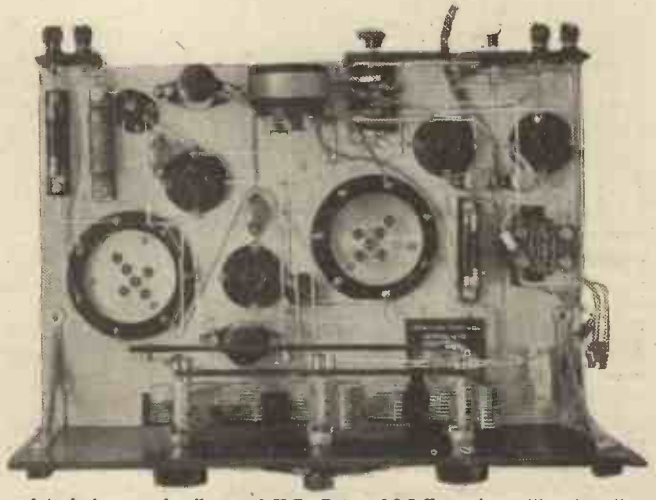


A typical screened-coil ganged H.F., Det. and 2 L.F. receiver with automatic reaction control.

THE "NEUT" NUISANCE.

(Continued from previous page.)

This, however, was not my object, for what I wanted to find was a circuit which would be fully neutralised at the higher frequencies and under-neutralised at the lower frequencies where the set was more naturally stable.

A consideration of the circuit under the principles evolved led me to try the effect, first of all, of reducing the size of the winding B, that is, shifting the tap down the coil L_2 in Fig. 1. At the same time, I experimented with different values of resistance for the resistance R connected in the L.T. return with a view to determining its effect on the neutralisation of the circuit.

These experiments were tried out with coils which could be screened if desired by the usual screening bases, and the results of the experiments carried out are roughly in order as follows:

Moving the Tap.

With the L.T. tap moved from the centre position nearer to the grid end of the winding it was found that when the set was neutralised at a low wave-length it was over neutralised at the high wave-lengths. With the tap shifted down the coil, however, when correctly neutralised at a low wave-length, it was found to be under-neutralised at a high wave-length. This, therefore, was one point which I required in the circuit I was looking for.

The next point which was noted was, that when the tap was shifted down the coil greater amplification was obtained from the H.F. stage by cutting out the resistance in the L.T. return. It was found, however, at the lower readings of the tuning condenser, that parasitic oscillations developed and a variable resistance was, therefore, placed in the L.T. lead with a view to determining what was the minimum value

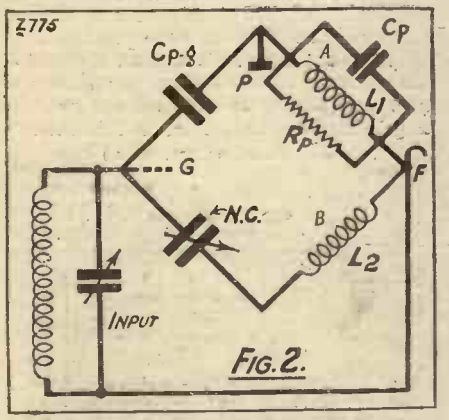


FIG. 2.

which could be used without trouble from parasitic oscillations being experienced.

In a 2-stage H.F. amplifier, I found that this could be cut down to a value in the neighbourhood of 200 ohms without any trouble being experienced from parasitic oscillations.

The effect of reducing the value of this resistance was very marked on the neutralising condenser. When the resistance R was in the neighbourhood of 50,000 to 100,000 ohms, the capacity required to neutralise the circuit was far less than when a low value of resistance or no resistance at all was used.

This, of course, is a decided advantage, since it makes it much easier to neutralise valves having very low self capacities than when the high resistance is included.

Screening an Advantage.

Indeed, it was found that with 6-volt valves the full value of the neutralising condenser was required to give a true neutralising point when the tap was shifted three-quarters of the way down the coil instead of halfway, as previously done.

Other points which were found to affect the neutralising setting on the balancing capacity were the presence or absence of the shield over the coil, and the use of reaction in the detector-valve circuit. One of

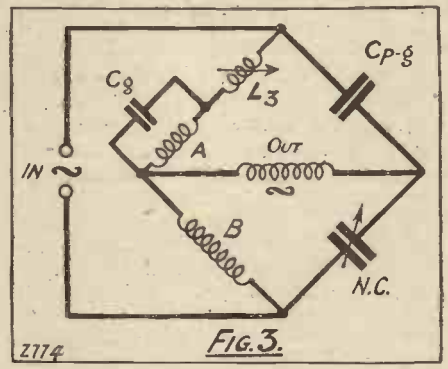


FIG. 3.

the most important effects, however, obtained by the use of a screened coil was that a drop in amplification in the H.F. stages resulted when a closely-fitting screen was used.

By the use of the new screening boxes, which have been developed by Mr. G. P. Kendall, I found that an increase in amplification was obtainable.

This, of course, is owing to the elimination of various undesirable and unwanted capacity couplings which existed in the circuit otherwise, thus reducing their efficiency as a whole.

Amplification Figures.

When removing the ordinary coil screen, it was found that a far greater value of capacity had to be used for neutralisation, which was no doubt due to the increased capacity coupling which resulted from removal of the screen and also from a possible variation in the mutual inductance between the two halves of the coil.

The removal of the screen had no effect, however, on the generation of parasitics when the tap was shifted down the coil, while with the receiver tuned to a fairly long wave-length, so that it was naturally stable, the effect of placing the neutralising condenser at its minimum position did not have a very marked effect on the amplification.

The figures give a rough guide as to the amplification obtainable by an H.F. stage under various conditions.

It will be seen that little difference is to be observed between this and the previous reading. This is no doubt owing to losses caused by unwanted coupling effects between the two coils.

These tests were carried out with 100 volts high tension applied to the H.F. valves, since I consider that this value must be used at least if the maximum efficiency is to be obtained from an H.F. amplifier.

Position of Tap.	Signal Strength.	Remarks.
(1) 15 turns from bottom of coil ..	53	Set correctly neutralised.
(2) Centre of coil. ..	44	Set correctly neutralised.
(3) 15 turns from grid	40	Minimum value of neutralising condenser too great to give zero signal point.
Tap in position 1 ..	53	No resistance in L.T. return.
Position 1	44	50,000 ohm resistance in L.T. return.
Position 1	54	No resistance in L.T. return and neutralising condenser set at zero.
Position 1.	52	200 ohms resistance in L.T. return. This valve was sufficient to stop parasitics.
Position 1	57–58	One coil screen removed set, correctly neutralised.
Position 1	57–58	Both coils unscreened.

A SUBSTITUTE FOR EBONITE.

PERHAPS the one factor which prevents so many amateurs from carrying out experiments with circuit "hook-ups" is the fact that high-grade ebonite is a costly material, and that in order to carry out experiments with various types of radio circuits a panel of some description is needed.

For purely experimental work, however, ebonite or even bakelite panels can be dispensed with very easily.

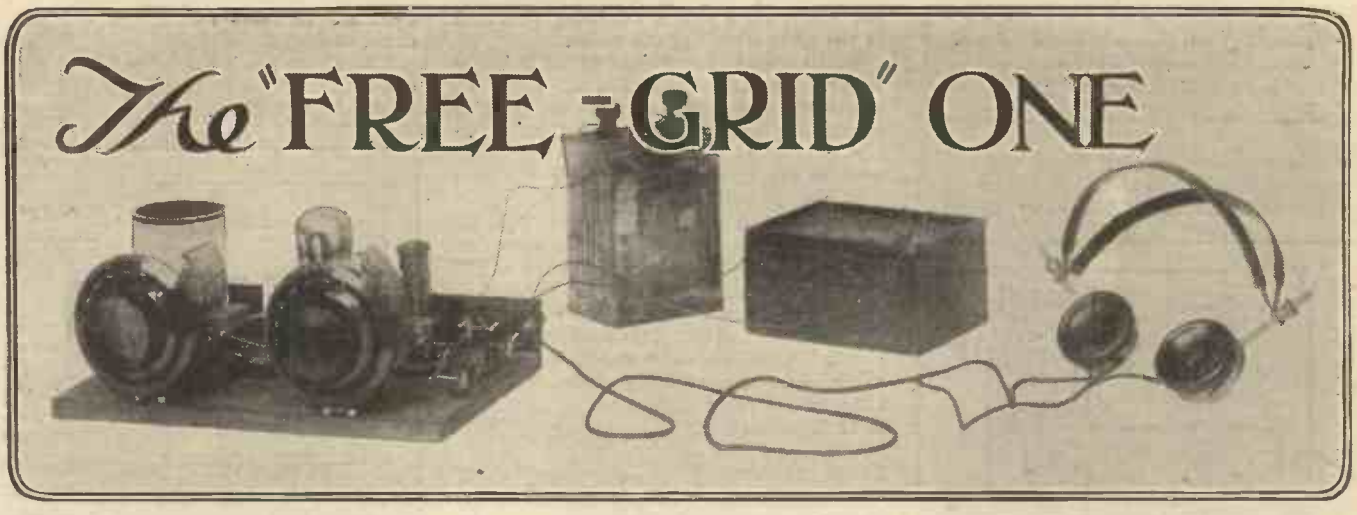
Wood Panels.

First of all, procure a supply of 3-ply wood. This material is not expensive, and when any prolonged amount of experimental work is carried out, it is a good thing to have a stock of this wood handy. Make the necessary panel for the experimental set or apparatus out of this wood. Whilst doing so, procure also one or two old gramophone records and half a pint of naphtha or methylated spirits.

Break the records up into very small pieces, and allow them to soak for several hours in the naphtha or spirit, stirring them frequently. The records will almost completely dissolve in the liquid, which should then be poured off into a bottle.

Before assembling terminals or components on the plywood panel, give the latter three good coats of the above mixture. The panel will then be found to provide a perfect degree of insulation, and its total cost will work out as the merest fraction of that of an ebonite panel of the same dimensions.

The "FREE-GRID" ONE



Here is an easily-made, but highly-efficient, one-valver with a novel circuit, and capable of giving extra-ordinarily good results.

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

WE all know there are many single-valve circuits of undoubted merit, all of them having some special point of interest peculiar to themselves.

Many of us, however, who would like to try them out don't feel like going to the trouble of making a set up specially for the purpose. This is a great pity, however, since many an interesting hour can be spent with these simple circuits.

COMPONENTS REQUIRED.

- 1 ·0005 log. condenser (Formo).
- 1 ·0003 log. condenser (Formo).
- 1 Sprung valve holder. Standard make will do, e.g. Bowyer-Lowe, Lotus, Igranic, B.T.H., Burne-Jones, W.B., etc., etc.
- 1 H.F. choke (Igranic, Lissen, R.I. & Varley, Climax, etc.).
- 1 ·001 fixed condenser (Clarke, Dubilier, Igranic, Lissen, Mullard, T.C.C., etc.).
- 1 6-pin base and 1 6-pin feather-weight coil former (Collinson).
- A number of terminals, and three strips of ebonite for terminal strips.
- 1 Wooden baseboard, 12 in. × 8 in. Raymond, Peto-Scott.

I am going to show you how easy it is to make a single-valve set which can be the basis of numerous experiments, and, as a result of recent experimental work, I have picked out four or five circuits which you should certainly try out, if you have not previously done any work with them.

The constructional work involved need not take more than half an hour, while an examination of your junk box will, no doubt, show that you have most, if not all, the necessary components by you.

The circuit I am choosing as the first of this series is the "Free-Grid" Detector.

Very Sensitive.

It's rather queer the things a valve with a free grid will do. By leaving the grid free, I mean that no conductive path back to L.T. is provided, though there may be a by-pass condenser which will present a free passage to H.F. currents.

A valve with the grid left free, however, will either amplify or rectify, depending apparently on what you want it to do.

As regards amplifying, you will probably have noticed very often that the removal of a wander plug from the grid-bias battery while making adjustments on the low-frequency side has no apparent effect on signal strength; if anything, a slight increase may result. This is especially the case when resistance-capacity coupling is being used. I have also found the same, however, to apply on the high-frequency side, excellent amplification being given with the tuned circuit connected to the grid only.

It has also been known for some time that a valve with a free grid will rectify, but only provided that a fixed condenser is inserted between the bottom end of the tuned circuit and L.T.

The exact mechanism of rectification by this method need not be gone into here, but it is generally accepted that it is equivalent to anode-bend rectification. It has usually been said, however, that this form of rectification is only suitable for use when followed by resistance-capacity coupling, using a high mu valve for detector with a high value of coupling resistance in the neighbourhood of 2 megohms or so.

Efficient on All Waves.

I have recently, however, been carrying out some experiments with this circuit, using both transformer coupling and resistance coupling; also trying out different valves for the detector. I have found that this form of rectification is extra-ordinarily efficient under all circumstances, and apparently gives all the benefits of anode-bend, together with the sensitivity of leaky grid condenser rectification.

A most interesting point is the extra-ordinary adaptability of this circuit, and I

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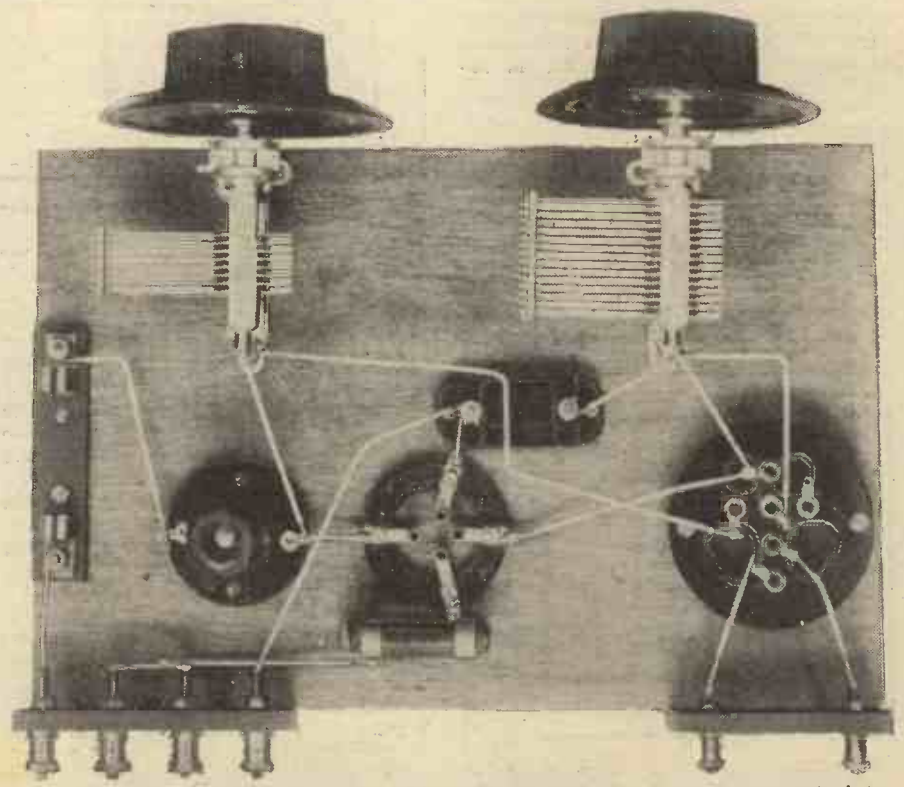


Only fourteen pieces of wire are needed for wiring up this set. Could you have anything more simple to build? And yet it is capable of giving surprisingly good results.

THE "FREE-GRID" ONE.

(Continued from previous page.)

would say, for the benefit of those who may wish to add an amplifier on to this single-valve receiver, that any form of

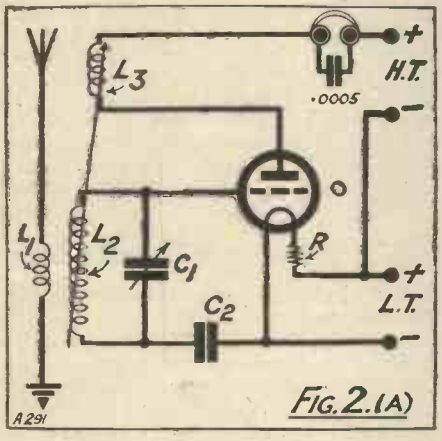


FIG. 2. (A)

coupling may be used. At the same time, this receiver will be found to function perfectly on the short as well as on the broadcast and long waves, and although the use of a ·0005 tuning condenser without a reduction dial makes tuning a little critical on the short wave, I have, nevertheless, been down to 30 metres with this set, and found it to give excellent signal strength.

The actual circuit used is shown in the theoretical diagram of Fig. 1. The aerial is coupled to the tuned circuit of the detector valve by means of a coil, L_1, which, in the receiver I have built, has been made interchangeable, thus allowing of selectivity being controlled to a certain extent, and also the maximum efficiency being obtained on the various wave-bands in cases where selectivity is not an important point.

Reinartz Reaction.

The coil to which it is coupled, L_2, is tuned by the usual variable condenser, C_1, having a capacity of ·0005.

One end of this circuit is connected direct to the grid of the detector valve, the other being connected to L.T. negative through a fixed condenser, C_2, which has a capacity of ·001. Reaction is obtained by means of an extra winding, L_3, and a

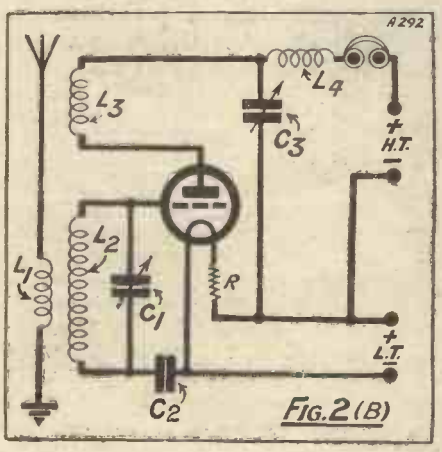


FIG. 2 (B)

condenser, C_3, a choke, L_4, being provided in the plate circuit of the valve.

This method of applying reaction is the well-known Reinartz scheme, and the receiver I am going to describe is built exactly according to this circuit. For the benefit of those, however, who may wish to try different methods of applying reaction, I show the circuit in Fig. 2a with magnetic reaction, and in Fig. 2b with throttle control, which gives the same effect as magnetic reaction with the added ease of control given by a condenser. There are many experimenters who are of the opinion that magnetic reaction is more efficient than capacity reaction, and by using either of the circuits shown in Fig. 2 they can modify the receiver according to their inclination.

Simple and Cheap.

With regard to Fig. 2a, the use of the swinging reaction coil is attended by certain disadvantages, such as mechanical backlash and the large inter-action between reaction and tuning. At the same time, it certainly cuts down the components used to a minimum, and thus considerably reduces the cost of building the set.

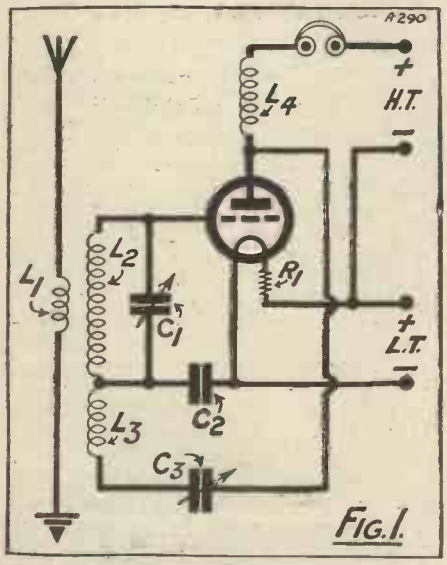


FIG. 1.

If you look at the photographs of the finished receiver, you will see that I have constructed it on baseboard lines, the variable condensers I have used lending themselves particularly to this form of construction.

By this means the ebonite panel has been done away with, resulting in a considerable saving in the first outlay. Most of the components required you will probably find lying about in your workshop, while the actual constructional work involved will not take you more than half an hour.

You can thus try out, with the minimum of outlay in time and labour, a circuit which has many interesting features apart from its novelty.

No Panel to Drill.

In doing the constructional work I must say it was rather a relief not to have an ebonite panel which had carefully to be marked out and drilled and fixed to the baseboard, even though only a one-valve set was being made.

Here, all that has to be done is to fix six components to a wooden baseboard, attach 3 terminal strips, and the job is done.

The wiring too is carried out in a matter of a few moments, there being only 14 leads to put into position.

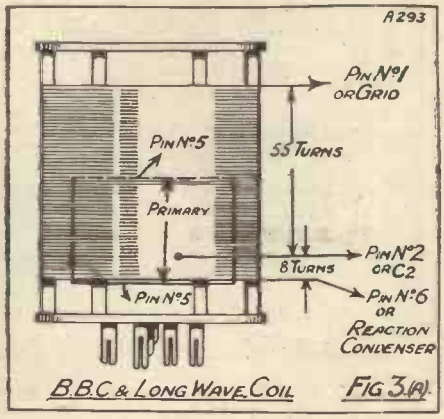


FIG. 3. (A)

This is so simple that you can't go wrong. Just look at the wiring diagram, which, incidentally, will show you just where to place the various components, put the leads in in any order which you fancy, and the job is done.

If you are soldering the connections make sure you get the iron really hot, for even in a simple single valver, such as this receiver, a single dry joint may introduce quite a lot of trouble.

Having wired up the set, just run over the connections to make sure they are O.K., because high tension is not particularly good for a valve filament should it happen to get on to it.

All you have to do now is to make the coil, just a matter of another five minutes before you commence to test the set out.

The Three Coils.

If you want the coils to be interchangeable, then you can use 6-pin formers, which I have suggested. The make I have myself employed is a Collinson feather-weight former which is provided with an interchangeable primary winding. I suggest that you wind up two primaries, one for use on the broadcast wave-band between 200 and 360 metres and one for use on the wave-band above 360 metres. For the first range I would suggest 15 turns, for the second range 25 turns. For greater selectivity 10 turns may be used, but this will be accompanied by a drop in signal strength.

For the tuned circuit, that is the coil L_2, you will require 55 turns of 22 D.S.C. wound, side by side, or if you have the

(Continued on next page.)

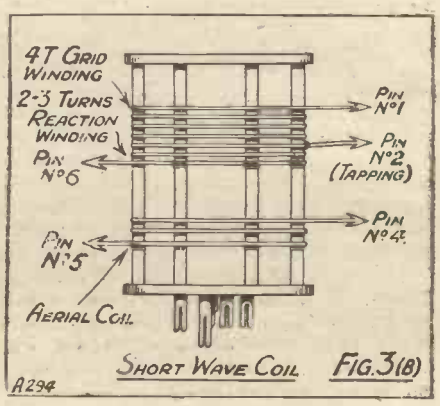


FIG. 3 (B)

THE "FREE-GRID" ONE.

(Continued from previous page.)

means for putting the winding on correctly spaced, the wire to use will be 26 or 28 D.S.C. spaced one diameter. This winding is connected between pins Nos. 1 and 2, and a further 10 turns is put on, carrying on from pin No. 2 to pin No. 6. This is the reaction winding L_3, and although the number of turns may seem somewhat small, the method of rectification used imposes so little damping on the tuned circuit that only a very small number of turns for the reaction winding is required.

If, however, you feel doubtful about it, and think you would like to put a couple of extra turns on, do so by all means. If it is too much, you can always take some off again later on.

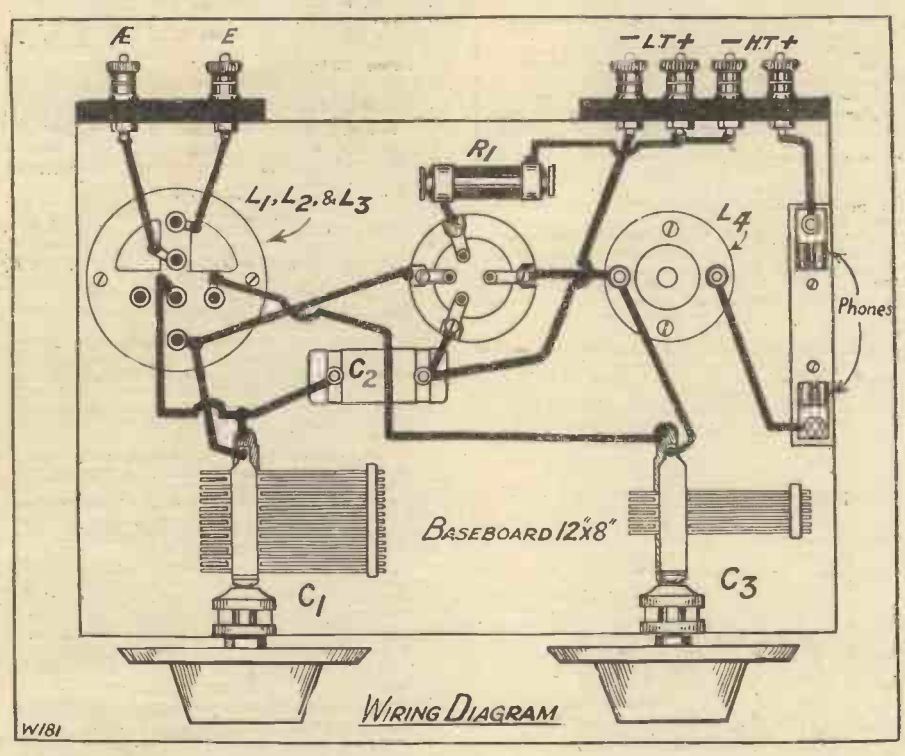
Sketches giving details of the coil are given in Fig. 3, and if you don't want to have the coil interchangeable, you can carry out the winding on an ebonite tube or former, 3 in. in diameter, using the same number of turns. The primary will be wound on a slightly smaller tube, which will just slip inside the one carrying the windings L_2 and L_3; while the circuit connections, as well as the pin connections for the windings, are indicated.

The 5 X X Band.

If you wish to obtain the very utmost efficiency from this set off the B.B.C. waves, you will find that an advantage is to be obtained by winding your grid coil with Litz wire. Particular care must be taken in connecting all the strands together at each end to get the greatest advantage from the use of it, and if wound with Litz it will be found that a smaller reaction winding will be required, on account of the increased efficiency of this inductance.

For the long waves you will need either a slotted former, or will have to put the winding on in layers, since the aerial coil will require 100 turns, the grid coil 250 to 300 turns and the reaction coil about 75 turns. If, however, you have not facilities for winding a special coil of this description, the connections which I have used in the receiver allow you to employ a standard split-primary H.F. transformer which will function quite satisfactorily in the receiver.

I must sound a note of warning here: Do not attempt to use a split-primary H.F. transformer on the B.B.C. waves. The reaction winding is much too big for use with this circuit, and the set will oscillate uncontrollably.



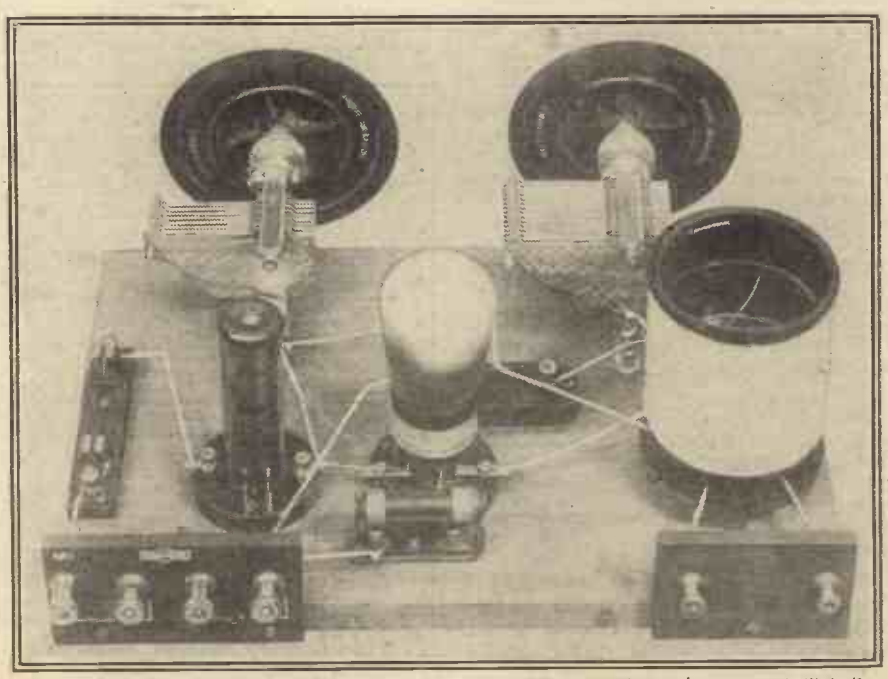
Short-Wave Coils.

If you want to carry out short-wave reception, the coil should be wound as shown in Fig. 3B. For the 25- to 50-metre band the turn numbers will be: Aerial coil 1, reaction coil 2 to 3, grid coil 4. It may be necessary to try out different numbers of turns for the reaction winding since this will depend to a certain extent on the damping of your aerial and earth system. It is also advisable that these windings be put on with fairly heavy gauge wire, say 18 D.S.C., and be spaced out about 1 diameter. It may also be necessary to leave at least ¼ in. between the aerial winding and the other winding, so as to reduce the coupling, which otherwise, if too tight, would result in dead spots being found. For the 30- to 100-metre band, the following turn numbers are indicated; aerial coil 3 turns, reaction coil 5 to 7 turns, grid coil 8 turns.

The remarkable versatility of this receiver can be judged from this article, and further circuits and variations in design will be given in the near future.

The set will work with any valve, but for the best results I recommend the use of the medium-impedance valve.

In order to obtain the maximum efficiency, as high a value of high tension as available should be used. This can be done with this receiver on account of the extraordinarily smooth reaction control which is given, and you need not fear that the use of something like 100 or 120 volts high tension will result in backlash. In any case the value of high tension is not critical while the H.T. current consumption is considerably lower than that resulting when leaky-grid condenser rectification is used with a positively biased grid.



The completed set, showing the valve and the six-pin coil in position. The receiver can be built in the space of half an hour or so.

CORRESPONDENCE.

SHIELDING THE GRID LEAK!

A SHORT-WAVE COIL— THE ROW ABOUT 5 G B.

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.

SHIELDING THE GRID LEAK!

The Editor, POPULAR WIRELESS.

Dear Sir,—I have read POPULAR WIRELESS from No. 1, but, so far as my memory serves, do not recollect ever having read of a *shielded grid leak*. I know that this component, especially if of the wrong value, can cause a lot of trouble in a set, so that an account of a recent experience of mine may prove of value to others.

My receiver is a "straight" three-valver (0-v-2), built by myself of good components from a "P.W." blue print. It makes use of magnetic reaction, with a two-way coil holder. Old fashioned, you will say, but I find I get more punch in my signals using this method than by the Reinartz, much as I like this latter for its smoothness. A certain amount of smoothness is obtained by the older method by using as small a coil as possible that will bring about reaction. To continue, the coil holder I use is well known and very efficient and takes up little panel space, since it allows the reaction coil to fall back from the panel. Behind the coil holder, and in a straight line with it at the rear of the baseboard, is a small strip of ebonite containing two aerial and one earth terminals. Between these and the coil holder are two small fixed condensers screwed to the baseboard, one for use in the aerial lead and the other the usual grid condenser and leak. The lead from this to the detector valve is about ¾ in., and the other lead to the aerial grid coil wiring about the same, so that both leads are short. I mention these details so that readers may form a mental picture of the trouble I met with, and how I overcame it. I never had any trouble in receiving the local station, but when I attempted to tune in more distant stations I was, oftener than not, troubled with hand-capacity effects, particularly with the knob controlling the reaction coil. Even with my hand three or four inches away from it, the set would shriek in wild protestation. Curiously enough, this did not happen always.

The other night when trying to tune in Dublin (2 R N) I was very much troubled with a shrill whistle, which, for some reason was particularly obnoxious on this occasion. Determined to get at the cause of the trouble (for I was about fed-up), I placed a copper shield between the coil holder and the panel, and earthed it—the shield, of course, not the panel! The only effect of this was to cut down volume by about 50 per cent. I expect that the shield, being so close to the aerial grid coil, absorbed its magnetic flux and carried it to earth useless. The idea then occurred to me to try what shielding the grid leak would do, probably because I had noticed that on one or two occasions when I had changed the leak for an experiment, this component whistled when I touched it. I therefore cut a strip of copper sheet of sufficient width and length to form a small bridge over the grid condenser and leak, keeping it free of all wires. To this little copper bridge I soldered a short length of flex, then, fixing a spade tag at the other end, I screwed this under the earth terminal. I had switched off the set, leaving all controls just as they were, so that I knew if my little gadget did not work I would hear that dreadful whistle again. Imagine my delight and relief then, when I switched on again the trouble had vanished entirely. I was a bit nonplussed at first to find that 2 R N did not come in on the condenser dial where I expected it. However, a brief search found it about five degrees lower down the scale. And this seems to be the only difference that shielding the grid leak has made, i.e. distant stations are a few degrees lower down than formerly.

One other remarkable and satisfactory result of shielding the grid I must put on record. I have read so many letters from readers of "P.W." asking for remedies for low-frequency howling that it occurs to me that it does not always arise from the causes mentioned, i.e. loud speaker too near the receiver, setting up valve oscillation; badly arranged transformers; dud cells in H.T. battery, etc., but to grid leak vagaries. Here is the reason for my opinion. Owing to mechanical wear in my loud-speaker base, I replaced it with a new one. This was quite O.K. on the local station on either two or three valves, but the first time I tuned in 5 X X and switched on the third valve it began to howl dismally and drowned the music. I naturally thought it was low-frequency trouble developing. But here is the mystery. I had temporarily removed the shield from off the grid leak, but as soon as I replaced it *the howl ceased!* I later found that this howl occurred on *all distant stations* with the third valve in circuit, although quite all right on the local. Perhaps the experts can explain the mystery, I cannot. What does seem clear, however, is that shielding the grid leak may cure the obscure causes of L.F. howling and whistling in sets. And I should be interested to hear other readers' experiments in this direction, especially as I can hardly believe that my own experience is unique in these respects. Certainly my own receiver is much quieter since I shielded the grid leak.

Yours truly,
A. J. W.

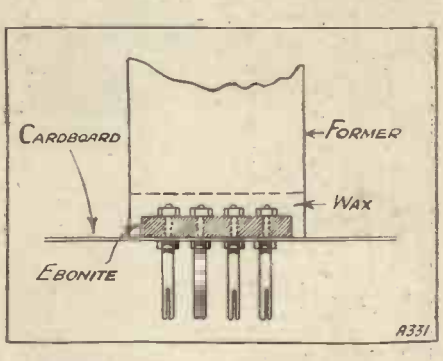
Manchester.

A SHORT-WAVE COIL.

The Editor, POPULAR WIRELESS.

Dear Sir,—I read with great interest, in "P.W." recently, A. D. M. W.'s remarks re the "Mullard Master Three" on short waves. Will it interest A. D. M. W. to know that the "Master Three" is an excellent short-waver, without the aid of an adaptor?

On a home-made 6-pin coil I can receive W G Y (2 X A F) almost every night (audible on the loud speaker). I have also received 3 L O (Melbourne, Australia) on 'phones. P C J J and 7 R L (Copenhagen) come in almost as loud as the local station (London). If it would not take up too much space I would like to add a suitable way to make a 6-pin coil former.



Components required will be: 3-in. length of ribbed former, 3 in. dia., 6 valve legs, a piece of ebonite 2½ in. × 1½ in., 18 enamelled wire (for aerial and secondary), 28 D.C.C. for reaction, and the pitch (or wax) from a few flash-lamp batteries. Drill the ebonite to take the 6 pins to fit the coil-holder, then trim off, so that it wedges inside the ribbed former. Screw a piece of cardboard (with the aid of the legs) flat down on the ebonite, so that the former and ebonite are flush with each other (as diagram enclosed).

Next, take a thick board, and drill 6 holes, so that the legs will slip in. Knock 6 large nails inside the former, along side of ebonite, so that one comes at every leg. Melt the wax and pour in until it just covers the nuts.

When cold, the nails can be withdrawn and the whole former gently eased from the board. The legs can be unscrewed (the nuts being held in place by the wax), and the cardboard peeled off.

The wire can then be threaded through holes in the former, down inside, and through the nail holes to their respective legs. The number of turns required for W G Y., P C J J, and 7 R L will be: 3 aerial, spaced ⅛ in. apart, 5 secondary, ⅛ in. apart, and 7 reaction, wound close, the aerial being at the bottom and reaction at top. Hoping A. D. M. W. will try this, and wishing "P.W." every success.

Yours faithfully,
A. P. S.

Luton, Beds.

THE ROW ABOUT 5 G B.

The Editor, POPULAR WIRELESS.

Dear Sir,—The article in a recent issue of "POPULAR WIRELESS" on the above subject tempts me to write you.

In "P.W." of February 4th and 11th, you described the "Q. & A. Three," and from the particulars given I constructed this set. Its behaviour left nothing at all to be desired, both in reception and reproduction, except the reception of 5 G B. I am nine miles north of 2 Z Y, and 5 G B could only be obtained at a mere whisper. I kept trying various combinations of coils, but with no different result, until a few days ago. Removing the primary coil from the holder, I connected the aerial direct to the secondary coil (to the end opposite the one connected to earth, of course), and now 5 G B is received at very good and satisfactory loud-speaker strength. With this method, of course, selectivity is at a discount, but 5 G B is received loud enough to cover up the background of the Manchester Station, and this latter can only be heard weakly whilst 5 G B is silent. The coils in use are 75 secondary and 100 reaction.

It may be that other of your readers have met with the same difficulty with 5 G B in this set or others using a similar method of aerial coupling, and these remarks may be helpful.

I do not, of course, know why it is far better in this manner for receiving 5 G B, but the result is there, so I am not concerned with the reason.

Yours faithfully,
WM. YATES.

Bury, Lancs.

SWINGING-COIL REACTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—Regarding J. B.'s inability to get reaction below 30 metres with swinging-coil reaction, he will find it advantageous to connect the by-pass condenser, which usually shunts the primary of the L.F. transformers, to earth, as the H.T. battery, especially the dry type, has a considerable internal resistance.

Yours faithfully,
R. S.

Hull, East Yorks.

FOUR USEFUL HINTS

When spade terminals are used at the end of flex leads a neat and efficient way to connect up is to bend the tags of the spade terminal over the covering of the flex wire and then solder the strands of this latter to the flat of the spade terminal.

* * *

In marking out a large panel, a pair of dividers will be found more convenient than the usual pencil and rule.

* * *

One advantage of the flash-lamp when used as a fuse in the H.T. negative lead is that if too much voltage is applied to the valve the glow of the lamp will indicate this, even if the current passing is not sufficient to blow the fuse.

* * *

Once a wet H.T. battery has started to "creep" it will continue to do so unless it is taken to pieces, thoroughly washed and dried and then put into condition again like a new battery.

—AND FOUR MORE.

A thin layer of oil not only assists against evaporation but also tends to prevent creeping of the acid, provided this latter has not been spilt when filling accumulator cells.

* * *

A good instrument for filling "wet" cells without splashing is the small glass nasal douche, which can be obtained from any chemist's for a few pence, and which enables the flow of acid to be regulated exactly by a finger pressing upon the aperture.

* * *

The total capacity of any number of condensers in series is always less than that of the smallest capacity.

* * *

The most satisfactory method of volume control is to use a high resistance potentiometer instead of a grid leak, the grid connection being made to the slider of the potentiometer.

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

QUESTIONS AND ANSWERS.

"THE 'P.W.' 'RANGE-STRETCHER.'"

"H.F. UNIT" (Buckhurst Hill, Essex).—"Where can I get details of a good H.F Unit, to increase the range of a Det. and L.F. set?

"As I am not at all clear about the connections to the set, etc., please give details of a unit which is not difficult to build nor to get going when made up."

You will find just the unit for your purpose described in this issue of "P.W.," under the title of "The 'P.W.' 'Range-Stretcher.'"

The following details should enable you to connect up and get the unit going well without any difficulties due to previous inexperience.

Connecting up the unit to the set and battery is done as follows: Aerial and earth are connected to the appropriate terminals on the unit, and no longer to the receiving set proper. Two wires from the low-tension battery which supplies the set are taken off to the appropriate terminals on the terminal strip of the unit.

Take a lead from the H.T. positive terminal on the unit to say 80 volts on the H.T. battery, or to 100 volts if the battery is of so high a rating. Now take a wire from the output terminal of the unit to the old aerial terminal on the receiving set, and the job is done, and you are ready to proceed with the next operation, which is that of neutralising.

To neutralise the H.F. stage you should proceed as follows: Insert a No. 25 or No. 35 coil in the aerial socket (these are the usual sizes, a No. 40 also being useful for stations working on waves between 400 and 550 metres) and a No. 60 centre-tapped coil in the secondary circuit, taking the flexible lead from the filament circuit to the centre tap. Set the neutralising condenser to its minimum value, and the tuning condenser to a point near the middle of its scale.

Now turn to the receiving set and set the reaction control at minimum. Then manipulate the tuning coils on the receiving set and note whether at any adjustment the complete outfit bursts into oscillation.

If it does so, increase slightly the value of the neutrodyne condenser until oscillation ceases at every point. If no oscillation takes place anywhere simply proceed to the next step.

Next, tune in the local station fully and then extinguish the filament of the valve in the unit by disconnecting one of the wires to the accumulator.

You will probably find that you can still hear the local station fairly strongly by retuning a little, and you should then proceed to increase the capacity of the neutrodyne condenser very carefully and slowly, at the same time retuning a little to make sure that you are keeping hold of the local station.

You will presently find that the signals are growing weaker, and as you proceed to increase the capacity of the neutralising condenser they are rapidly diminished, until a point is found at which they almost, or even completely, vanish, and beyond which further increase of neutralising capacity causes them to be heard once more.

(*Continued on next page.*)

AN INTERESTING VALVE—AN OLDHAM H.T. UNIT—AN "R.C. THREESOME" INNOVATION — THE PHILIPS' L.F. TRANSFORMER.

* *

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

AN INTERESTING VALVE.

AMATEUR transmitters will be interested to learn that the Marconi D.E.T.1 S.W. valve is now available for amateur use at the price of £7 5s. 0d. This valve is a 40-watt double-ended transmitter suitable for wave-lengths down to 10 metres. It was originally developed in connection with the Beam system. Its characteristics are: Fil. volts, 6; fil. current, 2·0 amperes; amplification factor, 8·5; impedance, 5,000 ohms.

AN OLDHAM H.T. UNIT.

The larger types of modern receivers, those employing super-power valves and, in some cases, super-power valves paralleled, demand very high orders of H.T. currents. Failing mains units, one has to resort to a very large wet H.T. battery or to an accumulator for this sort of outfit, and in the particular circumstances mentioned, the accumulator is frequently only the really practical alternative. There is, therefore, in these modern conditions, a decided space for the new Oldham Super-Capacity 10-volt H.T. Unit.

This 10-volt unit consists of five 2-volt accumulator cells built together. The capacity of each cell is five and a half ampere hours and a 10-volt unit retails for 8s., including two wander plugs and a short lead. Carrying crates are available at very reasonable figures. The principle of supplying the battery in 10-volt units like an expanding bookcase will be welcomed by the radio amateur. Not only can he make up a battery of practically exactly the voltage he requires, but when, after several years of use, it becomes necessary seriously to review the battery's condition he is able to replace it in sections. Also, and this is a very important point, it enables him to rearrange the battery so that the consumption of individual sections is, over periods, made more or less uniform. Similarly it is not a difficult matter to connect up the blocks themselves in parallel in order to facilitate charging.

Provision is made for wander-plug connections on each cell. As with all other Oldham batteries, the cells are well designed and robustly constructed, and should give long and useful service.

AN "R.C. THREESOME" INNOVATION.

Many readers will no doubt learn with interest that it has now been made possible to add a stage of efficient H.F. amplification to the improved Ediswan "R.C. Threesome." The extension necessitates six

(*Continued on page* 580.)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

When you have found the adjustment which causes the signals to become inaudible or to be as weak as possible, you can leave the neutrodyne condenser set to this value permanently and proceed to operate the unit by turning on its filament once more. You will then find that by manipulating the tuning dial, and using a moderate amount of reaction on the receiver, you will be able to bring in the distant stations in a way which will surprise you.

WHAT IS A TICKLER?

H. M. C. (Herne Bay, Kent).—"My elder brother in Canada recently sent me the particulars of a one-tube set which gave him phenomenally good results when he was in Winnipeg. He wants me to try it out with English components and under English conditions, and tell him the sort of luck I get with it. But there is one thing I do not understand. In the diagram one of the coils is marked 'tickler coil 25 turns.' What is a 'tickler coil'?

In both the United States of America and in Canada the name tickler is often used to denote the reaction coil. It has no special features but is an ordinary coil used for regeneration, just the same as our own "reaction" coil.

THE "SUMMER" ONE.

G. R. R. (Cheltenham, Glos.)—"I was rather disappointed not to find a list of the point-to-point connections of the 'Summer' One. I like the look of the set immensely, but not being at all skilled in the use of diagrams I should like to have a list to go by, as I don't want to burn out a filament.

"Another thing I would like to ask is in reference to the long-wave coil for this set, to cover the 5 X X Daventry band of wave-lengths.

"How many turns should this have, what gauge wire should be used for it, and what sort of former?"

Unfortunately the list of point-to-point connections was crowded out of the original article, but it is given here.

Earth terminal to L.T. — via a flexible lead, to the earth-plate lugs on the two variable condensers, to the moving vanes of the tuning condenser, to the "E" socket for the tuning coil, to one side of the L.T. on-off switch, and to the H.T.— plug via a flexible lead.

Other side of the L.T. on-off switch to one filament socket of the valve holder.

Remaining filament socket of valve holder to the "free" end of grid leak (clip), and to L.T. + via a flexible lead.

Other grid-leak clip, which is screwed under one terminal of the ·0003 fixed grid condenser, to the grid of the valve holder.

Remaining terminal on the ·0003 grid condenser to the fixed vanes of the tuning condenser and to a tapping clip via a flexible lead.

Plate of valve holder to one tag of the ·001 fixed condenser and to one side of the H.F. choke. Other side of choke to the "'phones" terminal.

"Phones +" terminal to the H.T. + plug via a flexible lead.

Remaining side of the ·001 fixed condenser to the fixed vanes of the reaction condenser.

Moving vanes of same condenser to the "reaction" socket for the tuning coil.

Aerial terminal to a tapping clip via a flexible lead.

This completes the wiring.

Regarding the long-wave coil for Daventry 5 X X, Hilversum, Zeesen, etc., this is wound on a former similar to the one employed for the short-wave coil.

The method of winding is really the same in both cases, except that for the long-wave coil there is only one tap required upon the tuning winding. This tap should be taken in the usual way, at the 80th turn.

The long-wave tuning coil is wound with No. 34 gauge enamelled wire. The number of turns for the tuning section is 200.

For the reaction winding the number of turns is only 80, and in this instance double-silk-covered wire (D.S.C.) is employed.

The wire for reaction is slightly smaller than the wire for tuning, and instead of using No. 34 gauge, as for the 200-turn coil, the reaction winding should consist of 80 turns of No. 36 gauge D.S.C. wire.

INDUCTIVELY-COUPLED AERIALS.

"BILLY" (Atherstone, Warwickshire).—"Reading a description the other day of a kind of interference from which I have been suffering for some time, I came across a statement that very often a cure in such cases is to employ inductive aerial coupling.

"What is meant by inductive aerial coupling?"

Inductive aerial coupling refers to a certain method of connecting the aerial to the receiver.

As you know, the selective action of any set, whether valve or crystal, depends to a very great extent upon the tuning. In order that the electro-magnetic impulses should operate the receiver, they are collected by an aerial which is attached to a tuned circuit.

There are several methods of connecting the aerial to the tuned circuit, one method being to attach it directly to that end of the coil which is not earthed. This is called direct coupling.

Capacity coupling also may be employed, and in this case a condenser is used. Inductive coupling, the form to which you are referring, is carried out by means of an additional coil.

This coil is placed in close proximity to the first or the main tuning coil, and it is generally of comparatively few turns—say only half or a quarter of the number of turns of the main coil.

One end of it, like one end of the main coil, is earthed. The other end is attached to the aerial terminal, and by this means the aerial is not connected directly to the first tuned circuit but is coupled by means of the inductive action between the two coils. Such a rearrangement of the aerial circuit very often effects a great improvement in selectivity.

AN EASILY-MADE LOADING COIL FOR 5 X X.

L. D. (Newcastle, Staffs).—"Can you tell me where I can get particulars for making a good loading coil suitable for making at home, and capable of bringing an ordinary set's wave-length up to that of 5 X X?"

The coil illustrated herewith is a home-made standard loading coil as used in the "P.W." Laboratory.

Brief particulars of such a coil appeared in "P.W." last week, in the article describing The "Sceptics'

Three." If, however, this description is insufficient for your purpose, you will find full particulars in the May issue of "Modern Wireless," under the title of "The 'M.W.' Standardised Loading Coil."

THE "ANTIPODES ADAPTOR."

J. H. R. (Brixton).—"I notice that in the theoretical circuit and wiring diagram of the 'Antipodes Adaptor' Star Model, described in 'P.W.' dated May 26th, 1928, the grid leak is shown as 3 megohm, and in 'Your Shopping List' as 2 megohm. Also you give both variable condensers in the wiring diagram as 'tuning condensers,' but in your article say that one of them is a 'reaction' condenser.

"I also notice that a plug-in coil is used as an H.F. choke, but you do not say how many turns this should have.

"As I wish to build this adaptor to use in conjunction with my present receiver, I should be much obliged if you would put me wise on these points."

In "Your Shopping List" the "2" megohm was a misprint for a 3, as it has been found that in most cases a 3-megohm leak gives far superior results to one of lower value. (Nevertheless, it is worth while trying a 2-megohm leak if you happen to have one on hand, because with certain valves it sometimes proves that a lower value than 3 gives maximum efficiency. As a general rule, however, and in cases where the grid leak is being specially bought, 3 megohms should be used.)

Regarding the tuning condensers, there is no real difference between a "reaction" condenser and a "tuning" condenser, as they both belong to the variable condenser family, and are named simply according to the work which they are generally called upon to perform. In the "Antipodes Adaptor" the types employed can clearly be seen in the photographs.

The advantage of a plug-in coil for an H.F. choke is that any value of coil may be tried easily. A choke which is ideal for one wave-length is not necessarily correct for another wave-length, so it is a good plan to use any plug-in coil on hand to discover by actual experiment which is the best for the particular wave-length in question.

The usual number of turns for the coil to act efficiently as an H.F. choke in the "Antipodes Adaptor" is 60, but some 60-turn coils give better results on one set than on another. If you have no plug-in coils at all on hand you should purchase a plug-in coil of 60 turns, preferably using one of the well-known makes in which self-capacity of the coil has been reduced to a minimum.

THE EFFECT OF S.L.F. CONDENSERS ON SELECTIVITY.

J. E. F. (Wendover, Bucks).—"I have built a good many sets one way and another during the past two years, but I must confess that I am just as crazy now as ever I was for long-distance stations. I am amazed at the great ease of tuning which a good slow-motion condenser brings and what excellent long-distance results it is now possible to get with a two-valve set.

"There is one thing I am still very curious about, however, and which I have never been able to solve to my own satisfaction. That is, does a straight-line-frequency tuning condenser really increase the selectivity of the set?"

Technically, no. The term selectivity really refers to the case with which a set tuned to any given wave-length responds to the transmissions made upon that wave-length, and, what is equally important, the difficulty with which other transmissions upon other wave-lengths find in forcing their way through to the telephones or loud speaker.

The shape of the vanes of the condenser does not actually affect this condition, and if a set is non-selective when it has a straight-line-capacity tuning condenser, it will be equally non-selective if the tuning condenser were fitted with straight-line-frequency plates.

Amongst the chief factors which affect the selectivity of a set may be mentioned the construction and design of the tuning coils, the amount of magnetic shielding which is present, the degree of coupling of the aerial circuit, the degree of interaction between the various circuits, and the quantity and kind of grid bias used.

Where the straight-line-frequency condenser does score, however, is in the fact that it automatically rearranges the positions of the stations on the dial. With the older fashioned types of variable condenser most of the stations upon a crowded wave-band were to be found near the bottom of the dial (you will notice that the lower stations are in the wave-length scale, the closer they are crowded by neighbouring stations).

There is a technical reason for allotting the wave-lengths so that the lower the wave-length the closer the stations are together, and the advantage of the straight-line-frequency condenser is that it automatically overcomes this tendency to crowd together at the bottom of the scale, and allows those stations which require little capacity for tuning to be separated by a movement of the dial as great as that degree of movement which obtains near the top of the tuning condenser's range.

THE LEAD-IN TUBE.

"REGULAR READER" (Stoke-on-Trent).—"Do you think I could use a glass tube for a lead-in tube? I can get one about the same size as the ordinary ebonite lead-in tube for just a few coppers, and I am told by people who have tried them that they are very good insulators, but I do not want to impair the working of the set by sparing a few pence, and if you think ebonite is better I will certainly use it. (The glass tube would be quite easy to fix the wire to, etc., because I can run a wire right through the middle of it, plug up the ends with dry wood, and seal them over with sealing wax.) Does that sound satisfactory to you?"

Glass is an excellent insulator, and we think you will find a tube of the kind which you describe quite as good as the ordinary ebonite ones.

TROUBLE WITH HOWLING.

R. F. (Hastings).—"I never get any trouble with howling unless my H.T. battery starts to run down, but every time this latter happens

(Continued on page 578.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 576.*)

the howling starts. As soon as I get a new battery the tendency to howl vanishes. Why is that ? "

When the H.T. battery starts to " run down " its voltage decreases and its internal resistance increases. The former is detrimental to purity, but the fact that the resistance increases rapidly is fatal to the correct operation of the set, for it generally means that in effect this resistance is inserted simultaneously into the plate circuit of several valves. Such a common resistance naturally gives rise to coupling effects which cause the howl complained of.

CURING HAND CAPACITY.

T. P. (Southsea, Hants).—" The set was a high-frequency and detector two-valver, and although it could pick up twenty or thirty different foreign stations (including one American) it was never easy to handle owing to the fact that when tuning it, taking away the hands from the dial caused it to whistle.

" The trouble was especially noticeable over long-distance stations and weak ones. But I always thought it was a necessary evil with a good long-distance set until recently, when a friend who does a lot of short-wave work looked inside the set and told me I ought to try the effect of reversing the leads to the high-frequency tuning condenser.

" After he had gone I did this, and I was astonished with the results, for the set is now half as good again as it was previously ! All the stations that it used to be possible to get with difficulty come in with hardly any trouble at all.

" In addition, I have bagged Warsaw, a station I have never previously heard, and the set's background is so quiet that I think I shall get plenty more. Why is it that a simple alteration to a tuning condenser lead like this can cause so much difference in operation ? "

As no doubt you are aware, the effect of tuning-in a programme results in setting up voltage variations across the tuned circuit. All the time the set is receiving a programme voltage changes are impressed across this tuned circuit, i.e. across the tuning condenser.

" P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set " Going Good " ?

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

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

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

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

You may not have noticed it, but it is a fact that all the ordinary tuned circuits are connected to earth, either directly (like the aerial circuit) or through the H.T. battery and by-pass condensers.

From a capacity point of view you yourself are connected to the earth, so that if your hand is brought near enough to the *non*-earthed side of a tuned circuit, we might expect this to affect the operation of the set.

Of course, a small additional capacity to earth via the hand of the person handling the set would make no difference to that end of the coil or condenser which is directly connected to earth. The opposite side of the coil and the opposite plates of the condenser would, however, be noticeably affected by this additional capacity, so that the hand should never be brought near to these points.

In the case of your own set, the placing of the hand upon the dial brought it close enough to one set of plates (probably the moving plates) to produce a noticeable capacity effect. As previously arranged, the wiring of the condenser connected the fixed plates of the condenser to earth. When you reversed the windings, the moving plates were connected to earth and the fixed plates were connected to the opposite side of the tuned condenser.

There is still a slight hand-capacity effect between your hand and the vanes of the condenser, but as these two points are now metallically joined it has no effect upon tuning and, consequently, the set is free from the irritating hand-capacity effects which formerly troubled you.

THE GRID LEAK.

G. R. C. (Henley-on-Thames).—" What real purpose in reception does the grid leak serve? "

The function of the grid leak is often twofold. When a valve is used as detector with grid-leak rectification, the grid leak forms a direct conducting path, permitting the passage of electrons which have been attracted to the grid by the positive voltages upon it.

If no grid leak were provided by means of which the electrons could return to the filament of the valve, they would rapidly accumulate on the grid of the valve, where their presence would have the effect of cutting off the plate current of the valve. (This is what happens when grid choking occurs, the trouble generally being due to a broken connection in the grid-leak return circuit.)

Another important function of the filament is to enable the voltage on the grid to be suitably adjusted, i.e. to enable the grid to be biased. The grid leak is used in both H.F. and L.F. amplifying circuits for this purpose, and in addition to these essential conditions of ordinary circuits, there are several other ways in which the grid leak can be of the utmost importance in the functioning of the various unusual or " stunt " circuits.

APPARATUS TESTED.

(Continued from page 575.)

additional items, but the wiring has been so simplified that only fifteen connections are necessary for the complete four-valve set. The six items are a rheostat, a variable condenser, a neutralising condenser, a coil mount, a filament bridge, and a universal coupling unit.

This last is a new universal coupling unit known as the type "C" WL734. A screen has to be used, but this is of a simple, straightforward nature, and presents no complications to the constructor. The H.F. stage is an efficient one and, being neutralised, is stable. It is a resistance-capacity coupling, the detector retaining its tuned grid circuit on to which its anode reacts. We could not squeeze this extra stage in the "R.C. Threesome" which we have on hand, so we connected the H.F. portion up to the set by external connections.

Nevertheless, using the R.C.2 valve recommended, the results were excellent. The sensitivity of the receiver was increased so that a large number of distant stations could be tuned in on the loud speaker. There was a high degree of selectivity. In most cases adding this new stage to the improved "R.C. Threesome" will necessitate a new and slightly larger cabinet, but the extension is very well worth while. As a four-valve set the combination is a remarkably simple one to assemble, and the full-size blue print and very clear instructions which Messrs. Ediswan supply makes the work very easy.

THE PHILIPS L.F. TRANSFORMER.

The new Philips L.F. transformer is a remarkable production. Its height is only two inches, it weighs only a few ounces, and yet it has all the thoroughbred points hitherto associated only with high-class L.F. transformers of large dimensions and considerable weights. To say that it is wonderfully suitable for portable receivers is a fact, but one which might indicate limitations. Actually its size and weight can only be regarded as an incidental advantage, for, although it is liable to give one's preconceived ideas a jar, the component takes its position among the highest class of this type of article irrespective of physical dimensions.

But that it is so compact and no larger than a medium R.C.C. unit is an added advantage in its favour. It has a ratio of three to one, and it is claimed that between 200 and 10,000 periods the amplification is absolutely constant, while at 50 cycles it is stated that it is well over half the maximum, and that beyond 10,000 periods it rapidly diminishes to zero, so that intermediate high-frequency oscillations are not amplified. And, as our readers will by now have judged, our tests show that the manufacturers' claims are by no means exaggerated. The price of the Philips transformer is 25s., and, in our opinion, it is a very reasonable figure. The Philips slogan "Little and Good" is a modest statement, and we are sure that the most critical amateur would not cavil at the addition of an adjective!

NEWS FROM SAVOY HILL.

(Continued from page 562.)

the country from the holidaymakers' rather than from the historical point of view. Later the same evening another talk on "Life in the Dominions" will be broadcast—the second on Australia from a man's point of view. Incidentally, it is understood that British seaside resorts have been taking serious exception to these special B.B.C. talks on holidays abroad. In order to placate home industry Savoy Hill has arranged a parallel series on holidays at home.

A Log Cabin Programme at Cardiff.

Mr. F. E. Weatherly, K.C., the writer of many popular songs, is arranging a programme unlike anything he has ever done for Cardiff listeners on Saturday, June 23rd. The scene is a log cabin in Colorado and Mr. Weatherly takes the part of Edward Somerset, an old Oxford man, and the owner of an undeveloped mine there.

While he dreams of the past he hears the songs he loved in the old days, and when his wife returns she brings home a newspaper telling of the development of Radio, whereby songs can be heard over miles of space. The songs in the old man's dream will be sung by Ethel Dakin, Glyn Eastman and the Station Male Voice Choir, and although the dream is to be considered as an anticipation of broadcasting, the setting will give a vivid picture of the boon wireless brings to those in the lonely parts of the earth.

Air Displays by Radio.

Colonel the Master of Sempill and Flight-Lieutenant Helmore will be the commentators for the B.B.C. in the special relay of the Air Force Pageant on the afternoon of Saturday, June 30th. Another Air Pageant, also on ambitious lines takes place at Blackpool on July 6th and 7th. Flight-Lieutenant R. L. Ragg, A.F.C., will give a running commentary of the events of the first day through Manchester Station.

The Return of the Old Testament.

The B.B.C. has decided, when the series of "Foundations of Poetry" readings concludes on July 8th, to go back to readings from the Old Testament on Sunday afternoons. It is not clear whether this is part of the policy of making programmes light and seasonable during the holiday period.

Sports Talks.

Every fortnight from July to September afternoon talks on sports will be given by London Station. The series will begin on Friday, July 6th, with a talk on the recent croquet tour "down under" by Lieut.-Col. Du Pre. Other sports to be discussed later include archery, tennis, golf, badminton, and hockey.

York Minster Again.

There will be an "S.B." relay of York Minster on July 1st on the occasion of a special service to commemorate the anniversary of the signing of the Covenant of the League of Nations. The Bishop of Winchester will preach, and the singing will be led by an amateur choir of about 300 voices drawn from various choral units of Yorkshire.

TECHNICAL NOTES.

(*Continued from page 562.*)

ordinary paper condenser with a capacity of, say, 5,000 mfd. would be pretty considerable, not to mention the enormous weight and cubic space.

A Step Forward.

For reasons such as these you will see that the electrolytic condenser, especially in the "dry" and sealed-up form which I have described, is clearly an important step towards the perfection of low-tension eliminators and brings these devices out of the realm of compromise or-"substitute" into that of, at any rate, something approximating to a real working equivalent to a low-tension accumulator supply.

Wooden Horns.

It is curious how ideas sometimes seem to go in cycles. I am thinking of the use of wooden horns or trumpets for loud-speakers and gramophones. In the early days (of gramophones, at any rate) metal trumpets were used as sound amplifiers, and then people began to find that wooden horns gave a more mellow and agreeable tone. These, of course, are still largely used, but various other materials have been employed from time to time, with the usual claims to superiority.

In the loud-speaker field the trumpet type of instrument is mostly equipped either with a metal or fibre horn, although here again wooden horns are still in use. In any case, the trumpet variety has now so largely given place to the cone type that the question of the most efficient horn has become of secondary importance.

Stepping Back.

I notice that some of the members of the United States National Lumber Manufacturers' Association are turning out loud speakers made throughout of wood. Some of the new "all-wood" speakers are made of cypress, shaped and carved in various attractive designs. According to a statement lately made by Mr. E. Dalman, one of the manufacturers of the new wood loud speakers, "Gramophone-makers have long known that by far the best sound amplifier for a gramophone is that made of wood, which has the same effect as in a violin, eliminating undesired vibration and enabling every note from the base upwards to be produced free from distortion. And again, as in a violin, the longer the wood speaker is used the better the tone becomes, as the wood gives to sounds a live, ringing and natural quality that grows richer, finer and deeper with age."

I give this information for what it is worth, but my readers, and especially those who are given to experimenting with different kinds of loud speakers, will have their own views on the relative merits of wooden horns.

Efficiency.

Whilst on the question of the comparison between horn-type and cone-type speakers, it is interesting to notice that, although we sometimes think of a horn-type of speaker as being efficient in the sense that it generally gives greater loudness (other things being equal) than a cone speaker using a more or less corresponding electro-magnetic unit, the actual efficiency of both of them, considered in the engineering interpretation of efficiency, is extremely small.

If we consider the amount of energy contained in the sound waves produced from the instrument and compare this energy with the energy which is supplied to the instrument in the form of fluctuating electric current, we find that the output energy is not more than two or three per cent, at the most, of the input energy. As a matter of fact, this figure is very high and in the majority of cases met with in actual practice, such as telephone receivers and ordinary loud speakers as used for radio purposes; the figure is more like a fraction of one per cent.

Of course, it does not matter very seriously, inasmuch as the total amount of energy dealt with is very small, anyway. By that I mean that it is not of any serious importance from the point of view of the running costs for energy supply, but it is of considerable importance in view of the fact that it becomes expensive, for other reasons, to use apparatus capable of delivering into the loud speaker much larger amounts of energy than are at present commonly used.

Causes of Inefficiency.

There are many causes for the very large percentage losses which take place in the loud speaker. Most of the losses occur in the electrical part of the unit itself and are due to the actual resistance of the unit (which manifests itself by the production of heat in the windings, although this is too small to be noticed) and to eddy currents and iron losses. Then there are losses in the actual diaphragm itself and also due to unavoidable mechanical defects such as "play" between moving parts. Finally, there is loss in the actual transformation from the motion of the diaphragm to the motion of the adjacent air, which again takes the form of the production of minute quantities of heat.

Resistance Capacity.

When using a high-impedance valve for resistance-capacity it is usual to put in a fairly high value anode resistance. It is sometimes stated that the resistance should be ten times that of the valve, but in practice it is found that best results are obtained with a much lower value than this, perhaps two to three times the impedance of the valve.

The grid-leak coupling condenser and anode resistance take the place of the windings of the low-frequency transformer in ordinary transformer coupling, and just as it is important in the latter case to have the correct ratio, so it is very important in R.C. coupling to use the proper value of coupling condenser. If the coupling condenser is of too small a value the reproduction is apt to become rather thin, whilst on the other hand care should be taken to avoid going to the other extreme and using too large a condenser. A commonly used value for this condenser is 0·005 mfd.

Coupling Condenser.

The capacity of the coupling condenser determines to some extent the best value of the grid leak and with a condenser of the capacity mentioned a grid-leak of about 2 megohms will generally be found best, although with proper adjustment of the grid bias a higher value of grid leak may be used if desired.

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. Registered as a newspaper for transmission by Canadian Magazine Post. Subscription Rates : Inland, 17/4 per annum ; 8/8 for six months. Abroad, 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. ; and for Canada : The Imperial News Co. (Canada), Ltd. Saturday, June 23rd, 1923.

R/R

POPULAR WIRELESS, June 30th, 1928.

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

HIGHEST REPUTATION, QUALITY AND CIRCULATION.

Popular Wireless

Every Thursday PRICE 3d.

No. 317. Vol. XIII.

INCORPORATING "WIRELESS"

June 30th, 1928.

IN THE "P.W." LABORATORY

This week's "P.W." cover photo shows some of the Technical Staff at work in our Research and Construction Department, where all sets, etc., are made and then tested before publication. The staff man on the extreme right is seen at work on the construction of

THE MOVING-COIL LOUD SPEAKER

which is fully described in this issue as well as

THE "SUBURBAN" TWO

Other features in this issue include :—

The "Conreac" Circuit—The "Fultograph" System
Making An H.F. Choke—Stopping Squealing

Popular Wireless

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RADIO NOTES AND NEWS.

The Old-Timer Speaks—The Sensitive Accumulator—A Question Answered—Radio and the Pork Trade!—Remember Olympia—Hearing Hilversum?—Radio Chewing-Gum.

The Old-Timer Speaks.

"MY boy," said the repentant old radio "fan" to his son, "it isn't the number of valves that counts, it's the power of the imagination, which can turn an R 2 'atmospheric' display into a complete Wagner programme, and make the word 'Stoke' sound like 'Rome.' The thought of all the confirmations I have had from U.S.A. stations of their programmes, when I realise that all I heard was the P.O. North Foreland station garnished with 'howls' from the next house, makes me afraid to kick the bucket."

Science Day by Day.

I SEE that I have started on a solemn note—quite fitting for the last days of the Month of Roses, and the eve of the rainy month—so I will now resume my skittish style, with due deference to the amiable gentleman who was gracious enough to write to the Editor, while I was holiday-making, to say that he regards my effusions as a blot on the "P.W." landscape because I thought the nightingale "stunt" was being overdone. Haste we to the point, which is science as reported by the "Daily ———"—no, I dare not.

The Sensitive Accumulator.

THIS delightful "daily," in reporting a demonstration of Professor M. Martinot's invention for converting radio "howls" into music, stated, *inter alia*, that "Beneath are accumulators which feel the electric vibration." Obviously a misprint for "feed," but I wish I knew the Professor's secret, because I could use it advantageously when my neighbour's housemaid gets busy with the three-valver which an affectionate chauffeur has installed in her kitchen. Love is—deaf.

"The Eight-Pound Look."

OUR esteemed contributor, Mr. B. Elston, whose recent article must have brought tears to many of you, has by now received the reply of our technical boys to his request for the "eight-quid set" which will convert him from a Laodicean lukewarmness to a DX temperature. Well, I hope he has his wet towel ready, besides the sackcloth and ashes he promises to wear with fitting humility. Our lads of the laboratory were on their mettle, and I have no doubt about the result of their labours, the "Sceptics' Three."

Friends, Americans and Electors!

I READ that if a man wants to broadcast his 100 per cent American views in regard to the U.S.A. Presidential elections throughout the whole of those closely United States, he has got to pay £2 5s. *per second* for the privilege. Say £8,000 per hour of oratory, including shots at the cuspidor and gargles of (very?) soft drinks. A mere nothing to a country which is bloated with British gold! Strange, is it not, that broadcasting should be so expensive in a country that has more stations than it knows how to shut down?

A Question Answered.

A READER of the "Middlesex County Times" propounded the following question to the man who runs its wireless section: "What causes the whistles in the air?" The wireless contributor promptly went off into an explanation of the causes of "howling," in spite of the fact that the correct answer is, "Our office-boy." Another simple question was, "How accurate is the usual wireless meter?" I should have been tempted to adopt the Socratic method, and to have replied, "What is a wireless meter; and, if so, when is it 'usual'?"

What is an Aerial?

I HAVE noticed here and there during the past few weeks references to an invention which, it is claimed, will eliminate the aerial. It is contained in a box. I suspect that the box contains wire in considerable quantity. Reception without an antenna or collector is impossible. But the antenna need not necessarily be *aerial*. Reception without an *aerial* antenna is no novelty, and generally a large measure of "reaction" is needed for it—or lashings of valves.

Radio and the Pork Trade!

BLESS me! What next? Who would have suspected that Marconi's youthful experiments in Bologna, where the sausages come from, would have any effect

(Continued on next page.)

"EAST IS EAST, AND WEST IS WEST!"

The photograph is supposed to show a radio party in Eastern Russia at a place called Tash Kent. In our own Kent, neither the wireless set, the crockery, nor the party manners of the gentleman on the right, would be considered quite up to standard!

NOTES AND NEWS.

(*Continued from previous page.*)

upon Canadian pork ? Even supposing that Bologna sausages contain pork—a thesis I am not competent to discuss ! Yet a notice I have received from Canada tells me that a Croydon boy emigrant, whose present job is to feed a litter of motherless (Tyrone, Ontario) piglets every two hours from a bottle, keeps himself awake during the night by listening to 5 S W, etc., on a special "Pigstye" set. Children doing well and grunting at Chamber Music already.

Remember Olympia.

I SHOULD hate to interfere with the kiddies' holidays, but do let me remark that the Radio Show of 1928 is going to be a bumper, and that it will be held at Olympia from September 22nd to September 29th, concluding on my birthday (what offers ?) and Michaelmas Day, God Save the King. Reliable evidence indicates there will be 41 more stands than in 1927 and many more exhibitors. It's a jolly affair, especially on the first and last nights, so reserve one or the other for the good cause. Short—and short-sighted—persons should bring step-ladders and field-glasses.

Radio on Tap.

THIS pernicious idea of communal radio is spreading like the poppies in my garden. I admitted a naturalised poppy in 1923 and now, at the time of writing, my garden has a sort of red glare about it. Clacton-on-Sea is the latest "nucleus," and there, I am informed, it is possible to listen to the B.B.C.'s fare for one-and-a-tanner a week, plus the cost of a P.O. licence. No trouble—but no excitement. I recommend the "Sceptics' Three" to Clac-on-S's red-blooded youth.

Empire Broadcasting.

MR. HANKEY, who has recently returned from a visit to the Antipodes on behalf of radio listeners, suggests that Empire broadcasting from 5 S W could be financed by the addition of threepence to the P.O. licence fee. Good ! I believe that few listeners-in in this country would object to that. Competent broadcasting authorities in Australia have advised him that for an additional sixpence to the Australian P.O. licence fee, the return programmes could be arranged. Hurrah for the "Diggers" ! Let's do it at once !

Hearing Hilversum ?

DURING the past week I have had quite a host of inquiries about P C J J, "the little station with the big range." Following its recent move, some confusion appears to exist about this station, so perhaps I had better explain right away that although P C J J's aerial is at Hilversum, the studio is at Eindhoven. The station therefore is called P C J J, Eindhoven, and although its transmissions are actually put on the ether at Hilversum it has nothing whatever to do with the main Hilversum station which works on 1,093 metres.

Times of Transmission from P C J J.

THE Station Director of P C J J, Eindhoven, tells me that starting from June 5th the following hours will be observed.

Tuesdays, 16.00 to 20.00 and 23.00 to 02.00.
Thursdays, 16.00 to 20.00.
Saturdays, 04.00 to 07.00 and 14.00 to 17.00. (All the above are in G.M.T.)

Welcome Back, Uncle Mac !

READERS who have admired those delightful "Nonsericks," written for the Children's Hour by Captain Derek McCulloch, and reviewed not long ago in POPULAR WIRELESS, will be glad to hear good news of the author. He has just come through his twenty-first war operation, and he tells me it's been a great success. Along with the kiddies, I welcome back "Uncle Mac."

SHORT WAVES.

A registrar was recently fined for using a wireless set without a licence. His defence was that he intended his aerial to remain a single wire.

* * *

"Please, m'm," begged the maid. "can I listen-in to the wireless next Sunday ? My nephew is singing in the choir."—"News of the World."

* * *

In a country village a certain proprietor has named his hotel : "The Listen Inn."

Probably one can always get a good "spot" there.

* * *

A correspondent writes to ask us what it is that puts the "ire" in wireless.

A Manchester reader suggests it may be 5 G B.

* * *

Mr. Jones (of apartment No. 1) : "Say, can't yon keep that radio of yours a little more quiet ? "

Mr. Smith (of apartment No. 2) : "We haven't any radio ; that was my wife you heard singing."—"Radio News."

* * *

"This radio set with a marvellous range, only £5." Advertisers really should make their ads. clearer, as numerous enquiries have been received asking whether it is a kitchen range or a rifle range that is given away with this set.

* * *

The Federal Radio Commission is considering halving the broadcast stations. Perhaps they might even go further. They could, for instance, have the announcers quartered and the sopranos minced !

* * *

Little Lennie, spending his first day in the country, watched a big spider spinning a web across two twigs.

"Hey, Pop ! Come here," said Lennie.

"Whatja want ? " says Pop.

"Look at this bug, Pop. He's gonna put up a wireless."

* * *

One listener complains that the Radio Dance Band plays too quickly when he is having his tea. He says that, being musically inclined, he finds himself masticating to the music, and is therefore getting indigestion. He suggests they should sometimes play Handel's Largo—"to give him a chance."

* * *

Come into the garden, Maud !
And watch the spinach grow.
It puts on an inch per day
By the use of radio.

John Henry's plaintive voice
Brings on the cabbage grand !
While for these cucumbers fine
I tap the Orpheans band.

My celery sticks all blanch
When the wireless "Annties" sing,
And the scarlet runners—well,
They run like anything !

"Yorkshire Observer."

Another Note for the "Ham" !

FOR the protection of mariners, wireless beacons are now being fitted round the coast at various points, but one of the papers slipped up rather badly in reporting this. The journal in question stated that "Lundy Island will have its wireless *bacon* by the end of the year." So if you hear any sizzling or fryin noises you will know where they come from !

Radio Chewing-gum.

HEARD the latest from the States ? They say that the chewing-gum manufacturers out there are checking the output of the machines by making the chewing-gum act as the dielectric in a condenser ! Any inequality in the gum is instantly shown up on a wireless receiving set connected to the chewing-gum-producing machine. Say Bo', ain't that just too cute ?

Schenectady's Surprise.

ACCORDING to "New York Times," the famous American station at Schenectady has already started television broadcasts. An official said that these broadcasts were taking place upon a wave-length of 380 metres. But, although naturally there has been a good deal of interest aroused during the first week of television broadcast, not one report of reception of the moving images has been received ! Further details of this stunt should prove very interesting.

The Clock Struck Twenty-Four.

A LISTENER, who ought to go in for the art of "sleight of hand," has reported to the B.B.C. that on midnight on June 5th he tuned in Copenhagen and heard the first stroke of twelve, then changed over to Daventry and heard the first stroke of midnight on Big Ben. Next, he reverted to Copenhagen for the second stroke and then back he went to Daventry for the second stroke, and so on till he had heard the whole 24 strokes ! I should like to overhear Mr. Elston's comments when he reads this ! By the way, the value of the "publicity" we have given him is about £73 11s. 4d. Who says "P.W." is niggardly ?

"Ariel's" Selections.

JUNE 29th : 5 G B. Variety programme, including Clapham and Dwyer, and Tommy Handley. July 1st, 5 G B, and July 2nd, 2 L O. A novel entertainment by the Society of Ancient Instruments. July 1st, 2 L O. League of Nations' Service from York Minster. July 2nd, 5 G B. Excerpts from nine musical comedies.

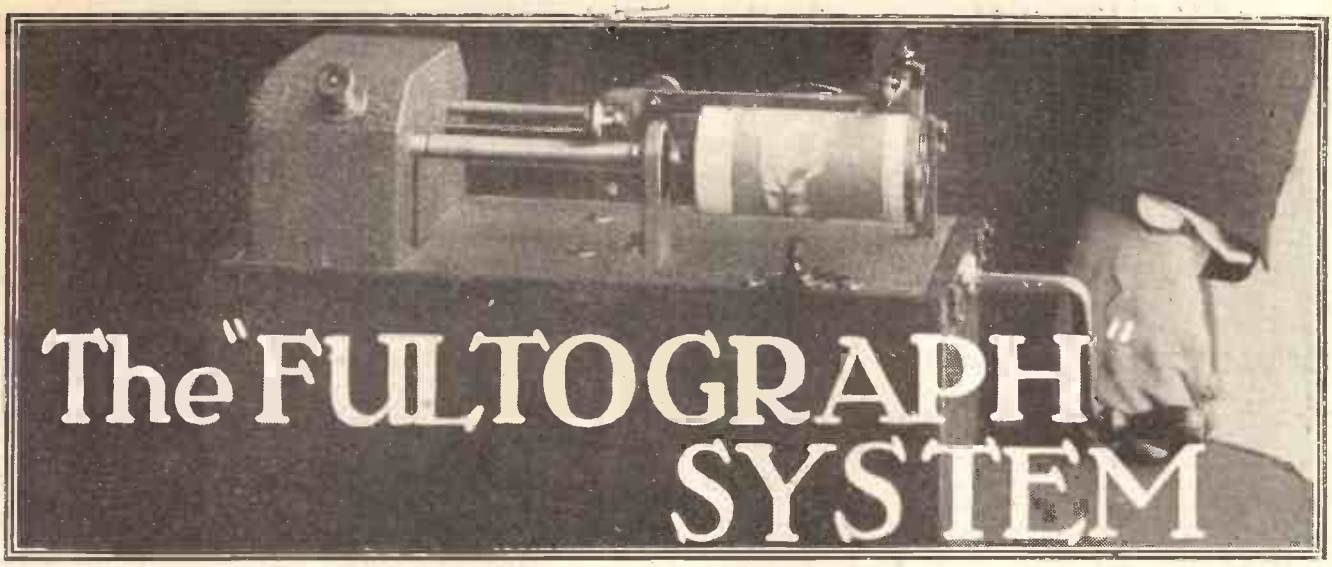
A Case for the Wave-meter.

S. H. (Sydney, Australia) writes to say that on his "P.W." "All-Purpose" Two he thinks he picked up 2 L O on April 26th, broadcasting John Henry. Well, 2 L O broadcast John Henry on April 25th, and it was relayed by 5 S W, which was the station S. H. probably heard. I suggest to all keen "fans" that the use of a wave-meter would clear up many of their queries. This relaying business renders the wave-meter a *sine qua non*, in my opinion.

Statistical Note.

THERE are 25 broadcasting stations in Germany, which has about a quarter of a million less licensed listeners than England. At the end of 1927 Hungary was using about 45,000 sets, or 54·5 sets per 10,000 inhabitants in country districts and 287·8 sets per 10,000 inhabitants in towns, the capital having 435·6 sets per 10,000. I look to the "Daily Mail" to improve all this.

ARIEL.



The "FULTOGRAPH" SYSTEM

Some details of the radio picture system invented by Capt. Fulton, which is already being used by Continental broadcasters.

From A SPECIAL CORRESPONDENT.

"MY apparatus is as simple as a cart—to a cart there are only the wheels and the body, and if you take either of them away it is not a cart any more," said Captain Otto Fulton to me, in Vienna, when he was demonstrating to me his wireless picture apparatus which it is reported the B.B.C. are now considering employing for broadcasting pictures.

On the top of a box is clockwork which revolves slowly a cylinder like the cylinder of an old phonograph machine. Semi-absorbent paper dipped in a chemical solution is placed round the cylinder and a platinum needle traces out in 3½ minutes an easily recognisable portrait.

Preparing the Pictures.

Within a mile of the broadcasting station, Captain Fulton told me, a one-valve receiving set is sufficient, and beyond that distance a two-valve set is suitable. The receiving apparatus can simply be substituted for the loud speaker when the time for broadcasting pictures comes along.

When a photograph is to be transmitted a negative of it is printed on a sheet of zinc or copper foil coated with sensitised fish glue. During the printing the glue exposed to the light becomes insoluble. Washing the foil removes the glue which has not been exposed to light, and is thus soluble, and an image in insoluble glue is left. Various methods have been used to make this glue image permanent. "Burning in" is one device, and Mr. T. Thorne-Baker used to print his glue inages on tin foil about 12-thousandths of an inch thick and then submit it to great pressure between polished steel plates. The image then sank into the tin.

The glue picture is wrapped round the cylinder of the transmitter—an apparatus very similar to the receiver—and as the cylinder revolves a metal stylus moves over it. The glue acts as an insulator, but when the stylus touches the metal foil a current passes and is transmitted.

You will see that in the receiver an electric current will pass between the platinum point and the cylinder when the stylus at the transmitter is touching an uncovered part of the picture on the foil. Several chemicals decompose on electrolysis, and pole-finding paper gives an example of chemically prepared paper which changes colour on the passage of an electric current. Potassium iodide and starch solution gives a paper coloration with the passage of a current of less than two milliamperes.

Captain Fulton places his paper, while still wet, round the cylinder of his receiver and the platinum point traces out the picture in brown.

For some years Captain Fulton worked with Mr. Thorne-Baker, but recently he has worked separately. He has fourteen assistants in his laboratory in Vienna, and is manufacturing home sets in Vienna. The early apparatus used by himself and Mr. Thorne-Baker had a pendulum to obtain synchronisation. Both receiving and transmitting instruments were fitted with a pendulum, which made an electric contact at every beat of 1½ seconds and released the cylinders for a new revolution.

Vienna's Daily Transmissions.

This system, however, made absolute stability essential. With his new electro-magnetic system of synchronisation, Captain Fulton was able to take his apparatus on the Danube steamboat "Helios," and during the five days journey receive pictures broadcast from his Vienna laboratory. At one time he tried using a flat disc at the receiver, but returned to the cylinder.

"All the time I have tried to simplify radio picture apparatus for the man at home," he told me. The present Fultograph will cost about £15, and anyone will be able to use it. It is being used already in Vienna, where every day a news picture, a sport picture, and a fashion plate or children's joke picture are being broadcast. The received pictures are 4½ in. by 3½ in.

Will the B.B.C. adopt the system and broadcast pictures? Captain Fulton told me he was going to try to coax them to do it, and if they would not he proposed to broadcast pictures from Paris at a strength sufficient for British wireless enthusiasts to receive. He certainly intends to place his home sets on sale here.

It has been stated that the B.B.C. has examined the "Fultograph" with a view to its use in this country. Whatever the outcome, it is interesting to note that Captain Fulton (shown in centre above with one of his instruments) intends to market the device in England, and that pictures are to be broadcast from Paris

THE B.B.C.'s FIRST REPORT.

The first annual report issued by our broadcasters contains some very interesting information. The subjects of the Regional Scheme and Radio Education are extensively dealt with and the following article discusses the main points raised.

By THE EDITOR.

THE B.B.C. has just published its first annual report (Stationery Office, Cmd. 3123, price 3d.), and it makes interesting reading. In it we find an explanation of the Regional Scheme which *is* an explanation—a pleasing difference to the article on the same subject which appeared in the B.B.C. Handbook.

It is pointed out, *inter alia*, that the areas served at present can no longer be extended by erecting more stations, in view of the restricted number of wavelengths available, and the inevitable interference between home and foreign stations. In general, the present system restricts listeners with simple apparatus to the reception of one programme. Under a plan drawn up by the Office International de Radiophonie, Great Britain has the use of ten wave-lengths, and the regional scheme is designed to supply the maximum advantage from them, by giving the greatest possible number of listeners an uninterrupted service of two programmes.

Entertainment Enterprises.

According to the Report, broadcasts from all stations covered over 68,000 hours in 1927. Entertainment, of course, formed the bulk of all programmes, but there was a strong and growing demand for other features. Special attention was paid to the technique and presentation of programmes as a whole. Great advance was made in adapting existing forms of art to broadcasting. There was a due proportion of familiar works, but many first performances were also given, and, in addition, music and plays were specially written for broadcasting. In all parts of the country full respect has been paid to national and local sentiment and tradition, and local resources have been drawn upon where suitable. Music formed about two-thirds of all programmes. The Corporation carried on the annual Promenade Concert Season in the Queen's Hall, which would not otherwise have taken place.

* * *

A balance of £128,338 is shown in the report. Details of the balance-sheet are as follows:

INCOME.	
Licence Income	£800,959
Revenue from Publications	£93,686
Total Income	£901,626

EXPENDITURE.	
Cost of Programmes ..	£489,728
Maintenance of Plant ..	£131,036
Total Expenditure ..	£773,289

To be exact, the total revenue for 1927 was £901,626 14s. 2d., of which £800,959 5s. was derived from licence income, while £93,686 10s. 1d. was derived from the sale of publications. The total expenditure was £773,289 16s. 8d.

Other items of expenditure were:

	£	s.	d.
Administration Salaries and Expenses	50,903	18	6
Governors' Fees ..	6,100	0	0

* * *

The Report points out that educational work, as a prominent feature in broadcasting, gained steadily in importance and in popularity. This is of two kinds—broadcasting for schools and adult educational broadcasting. About 4,000 schools were known to listen to London and Daventry schools transmission alone, this being twice the number for the previous year. For elementary schools courses were broadcast in music, English literature, French, Nature study, geography, social history, and Empire history. For secondary schools courses were given in anthropology, elementary geology, international affairs, and biographies of literary men.

Admiral of the Fleet Earl Jellicoe, G.C.B., O.M., addressing British Legion Boy Scouts, Girl Guides and kindred organisations at the Old Englyshe Fayre at Alexandra Palace. He is speaking into a microphone which is part of the Marconiphone Public Address System installed for the occasion.

The Kent Education Committee undertook an inquiry into the efficacy of schools broadcasting, with the assistance of a grant from the Carnegie United Kingdom Trust., The report of this inquiry, when received will deal with the educational possibilities and present practice of broadcast lessons in schools.

Educational Activities.

Nearly 1,500 adult education bodies co-operated in the distribution of the sessional talks programme. Adult education talks were usually arranged in a series of either six or twelve, the subjects including history economics, social science, philosophy, biology, and astronomy. In addition to the programme of talks and lectures, whose circulation reached 60,000 copies a session, aids to study pamphlets containing notes, illustrations, book lists, and summaries of lectures were issued. The total number of these distributed during 1927 was 193,000. Also, many of the adult courses were followed by small discussion groups started in various parts of the country.

Some Interesting Figures.

Other interesting items from the Report are:

No fewer than 886,000 copies of libretti of studio operas were issued.

Of 802 S O S messages broadcast, 340 were successful. 396 unsuccessful, and in 66 the result is unknown.

Sunday evening appeals on behalf of charities were known to have brought in subscriptions of £40,000, but the actual sum raised was much larger.

Four thousand schools listened to London and Daventry schools transmissions, this being double the number for the previous year.

Licences at the end of 1927 numbered 2,395,174, an increase of 217,000.

Letters from listeners totalled 60,000.

* * *

A reserve of £100,000 for the Regional Scheme is down in the Report as having been appropriated from revenue, so obviously the B.B.C. has an optimistic view of the future as regards the Scheme, despite the fact that, as is well known, the Post Office has now shown itself to be more or less hostile to the B.B.C.'s plan for the erection of the full five high-power twin-wave stations. However, the results of the Potter's Bar stations will probably decide the issue. If the station is not a genuine success we may definitely anticipate a good deal of trouble between the B.B.C. and the Post Office before the other four stations are erected.

The P.O. "Rake Off."

The P.O. prople seem to think that the full Regional Scheme will mean greater jamming and that listeners with average sets will not be able to separate the stations.

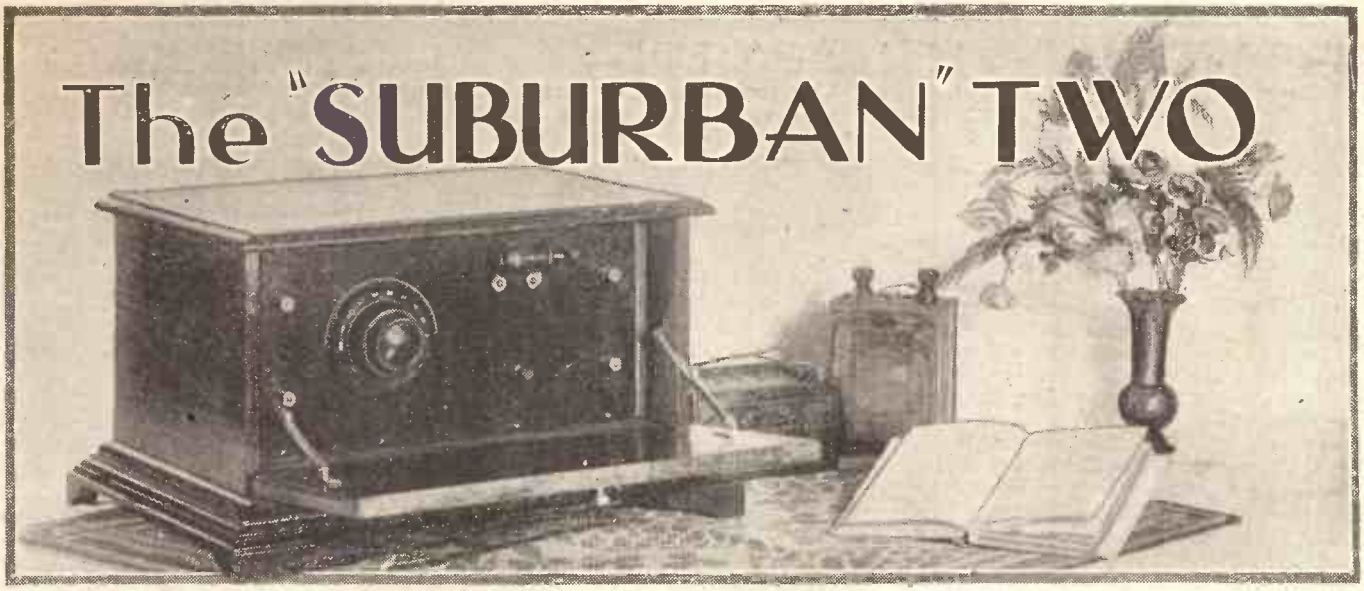
The B.B.C. maintain—and we believe rightly—that the separation between the wave-lengths is more than adequate, and that the P.O.'s fears are unfounded. Well, we shall see.

Meanwhile, we congratulate the B.B.C. on a very fine report, and we also congratulate the P.O. on the very substantial "rake off" it has acquired, thanks to the increase in the number of licences.

This question of Post Office "rake off" is rapidly becoming a first-class scandal. Do listeners realise that if the licence figure reaches four million, the P.O. will take fifty per cent of the revenue?

This is nothing more or less than an iniquitous entertainment tax levied by a Government department. And it's about time the whole question of the raid on licence money was re-opened and thoroughly investigated.

The "SUBURBAN" TWO



MANY listeners who at present have only crystal receivers would like to work a loud speaker if no added complications in operation were entailed. To these, the set described in this article will be found ideal, as apart from the switch to turn the set on the control is identical to that of an ordinary crystal receiver. This has obvious advantages when other members of the household, who are used to working a crystal receiver, desire to set the loud speaker going.

An easily-made, single-control two valve-crystal set that has a special appeal for those who desire pure and powerful reproduction of the alternative programmes.

By A. S. CLARK.

COMPONENTS REQUIRED.

- **1 Cabinet, 14 in. × 7 in. × 7 in. deep (V. C. Bond used for original set. Artcraft, Camco, Caxton, Makerimport, Pickett, Raymond, etc.).**
- **1 Panel for same, 14 in. × 7 in. × $\frac{3}{16}$ in. (Radion, or other good branded material).**
- **1 ·0005 variable condenser with dial (J.B. in original. Any good make).**
- **1 Cat's-whisker type crystal detector (G.E.C. in original set).**
- **1 L.T. switch (Benjamin, Igranic, L. & P., Lissen, Lotus, etc.).**
- **4 Terminals.**
- **2 Anti-phonic valve holders (Ashley, Benjamin, Bowyer-Lowe, B.T.H., Burndept, Burne-Jones, Igranic, Lotus, Marconiphone, W.B., etc.).**
- **1 Baseboard-mounting coil-socket (Burne-Jones, Lotus, Peto-Scott, etc.).**
- **1 R.C.C. unit (Mullard in set. Any standard make with anode resistances of about 250,000 ohms, and grid leak of about 2 meg., Dubilier, Lissen, R.I.-Varley, etc.).**
- **1 L.F. transformer (Mullard in set.)**
- **1 20-henry L.F. choke. Any good make, R.I.-Varley, etc.).**
- **1 1-mfd. fixed condenser (T.C.C. in set. Dubilier, Ferranti, Lissen, Mullard, etc.).**
- **1 Battery plug and socket (Burne-Jones, Lewcos, Wearite, etc.).**

Quite apart from the above, there are the advantages of simplicity of construction, and the low cost to be considered. There are also many who prefer crystal detection because of its purity. No complicated wiring is involved, and the constructional work is such that anyone may undertake it with the greatest confidence.

The set is constructed on the upright panel and baseboard style, the panel carrying the controls and terminals for aerial, earth and loud speaker. Instead of a row of terminals being provided at the back of the set for battery connections, a multiple plug connector is utilised. This plug enables the set to be quickly disconnected, and is so arranged that it is impossible for the batteries to be joined up incorrectly.

Reference to the theoretical circuit diagram will show that whilst the circuit follows quite standard principles, there are several refinements which are highly desirable in such a set. For instance, a variable degree of selectivity is obtainable by using a centre-tapped coil or an X coil. Selectivity is necessary since it is possible to get loud speaking with this receiver up to 80 or 100 miles from the Daventry stations.

The Circuit Used.

Another point which calls for comment is the output filter. Not only is this desirable from the point of view of quality, but it will be found convenient when extension leads are employed. It also avoids to a great extent the possibility of slight shocks being received from the loud-speaker terminals.

The first L.F. valve is coupled to the crystal detector by means of an ordinary L.F. transformer. This provides the necessary step-up in signal strength which is required when small initial signals are to work a loud speaker.

The last valve is coupled to the first by an R.C. coupling unit. This enables pure amplification to be obtained easily, and cannot cause trouble by coupling effects with the L.F. transformer.

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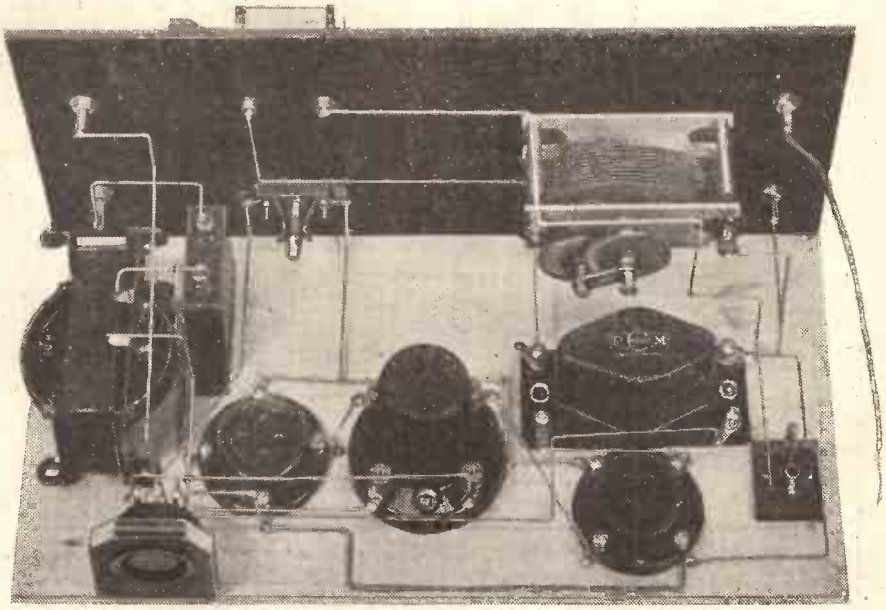


Simplicity is the keynote of the design of the "Suburban" Two, which is capable of providing really pure reproduction of the broadcast programmes.

THE "SUBURBAN" TWO.

(*Continued from previous page.*)

A list of the necessary components will be found in another part of this article. The makes mentioned are those which will be found quite suitable, since it is not necessary to keep to the same components as used in the original set. As a matter of fact, the set will not be found at all critical where components are concerned, and any of the parts which the reader may have on hand can be utilised.

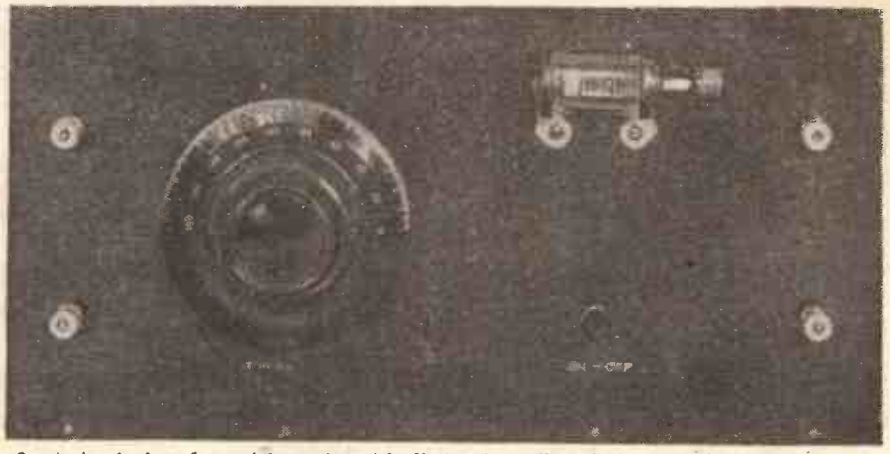
One component which is important is the crystal detector. It is desirable that this should be as sensitive as possible, and for that reason it is advised that one of the cat's-whisker type be used. The detector should have a micrometer type of adjustment and care must be taken to see that the crystal is a sensitive specimen.

Of course, if particularly desired, terminals may be used instead of the special battery plug.

A Panel Point.

Dimensions for the panel drilling will be found in the special drilling diagram provided. Do not forget that as the panel has to be marked out on the back the hole positions must be reversed.

No dimension is given for the distance apart of the holes for the crystal detector screws, as it will naturally depend on the type of instrument employed. If the variable condenser chosen is not of the single-hole fixing type, it is probable that a drilling template will be found inside the box.

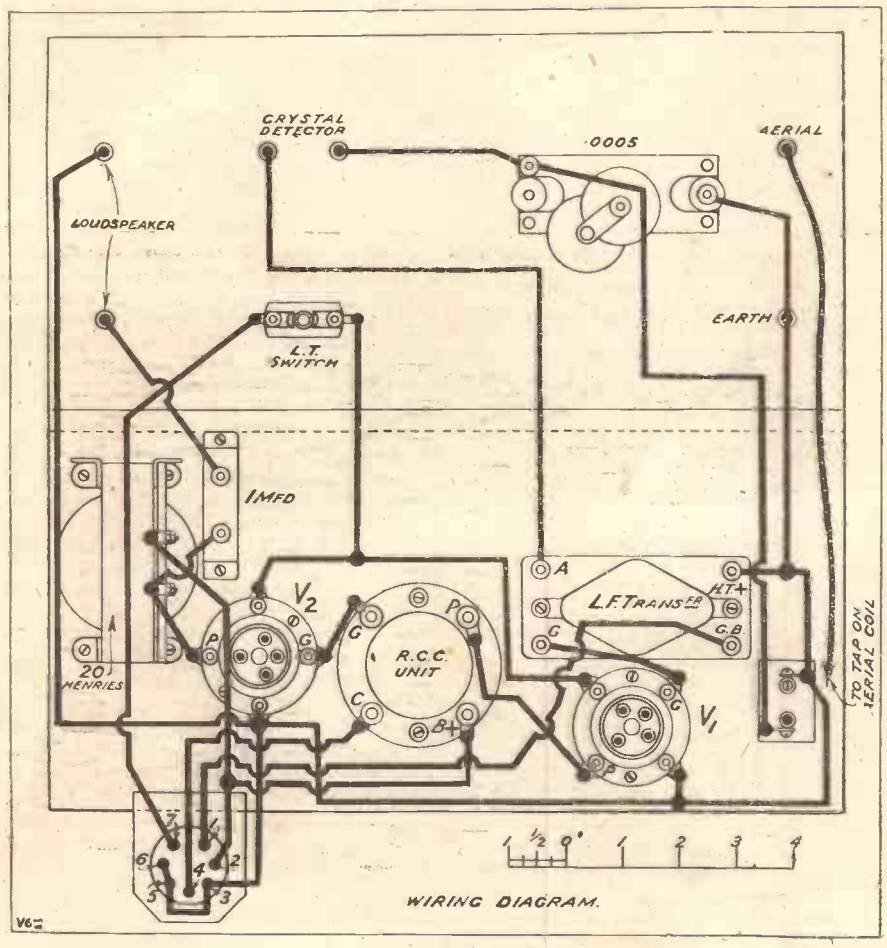


One tuning knob, and very infrequent crystal adjustment, are the only "variables" be side the on-off switch with which the constructor has to contend.

Having prepared the panel for the components, these may now be mounted, after which the panel should be screwed to the baseboard. The battery plug is mounted in a piece of wood which is screwed to the back of the baseboard. The size of this piece of wood is not important; the approximate dimensions for it, however, may be obtained from the photographs and wiring diagram.

The final step before the wiring is to fix the necessary components on the baseboard, their disposition being gathered from the wiring diagram.

The set may be wired up with practically any type of wire desired. The original was 16-gauge tinned copper wire. If, however, the constructor does not feel very confident of his wiring abilities, it is as well to use one of the special insulated wires which are on the market, or to insert the wiring in insulating sleeving. Follow the wiring as shown in the wiring diagram very carefully; it may be checked afterwards from the point-to-point list.



POINT-TO-POINT WIRING INSTRUCTIONS.

Join contact 6 of battery plug socket to contact 5 and contact 3 of socket, to one filament connection of each valve holder, pin of coil mount, H.T. + of L.F. transformer, fixed vanes of variable condenser, and earth terminal.

Join contact 7 of battery plug socket to one side of L.T. switch. Join other side of L.T. switch to two remaining filament contacts of valve holders.

Join flex lead to aerial for terminal on coil.

Join socket of coil mount to moving vanes of variable condenser and one side of crystal detector. Join other side of crystal detector to terminal A (Plate) on L.F. transformer.

Join grid of first valve holder to G terminal on L.F. transformer. Join G.B. — terminal of L.F. transformer to contact one of battery-plug socket.

Join P of first valve holder to terminal P on R.C.C. unit. Join terminal B + on R.C.C. unit to contact 2 on battery plug socket and to one side of L.F. choke.

Join G of second valve holder to terminal G on R.C.C. unit. Join terminal C on R C.C. unit to contact 4 on battery plug socket.

Join P of second valve holder to remaining side of L.F. choke and one side of 1 mfd. fixed condenser. Join other side of 1 mfd. fixed condenser to one L.S. terminal. Join other L.S. terminals to wire joining contacts 3 and 5 of battery plug socket.

(*Continued on next page.*)

THE "SUBURBAN" TWO.

(*Continued from previous page.*)

The connections to the battery plug are all marked, the numbers corresponding to those on the socket. It will be noticed that two H.T. +'s are provided and one G.B. negative. As in this receiver only one H.T. + is required and two G.B. negatives are necessary, the H.T. + No. 1 has been utilised as G.B. — 1.

Valves to Employ.

The first valve should be of the R.C.C. type, or of the H.F. type. The former will generally be found to give slightly greater volume than the latter, although it is desirable with the R.C.C. type to use a coupling unit with a fairly high anode resistance. The last valve must be of the small power type. As the set is not intended to give super loud-speaker strength, there is no point in using a large power valve; in fact, such would be bad practice, as signals would not be so loud.

The type of coil to use depends on how near the set is to be used to the local station, and therefore how selective it must be. A centre-tapped or X coil should be employed, the latter giving the greater selectivity. It is desirable, however, to use as large an aerial winding consistent with sufficient selectivity as is possible. For the lower broadcast band a No. 60 coil of the above types will generally be found the correct size, whilst a No. 250 should be used for 5 X X.

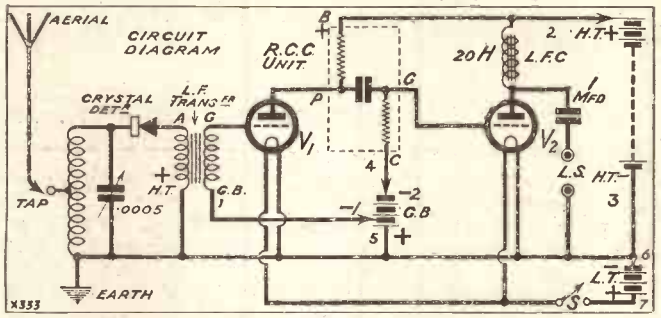
The voltage of the accumulator employed may be 2, 4 or 6 volts, according to the voltage of the valves employed. Do not try to economise in H.T., as you will do so at the expense of volume and quality. Between 120 and 140 volts should be employed.

Continental Stations Received.

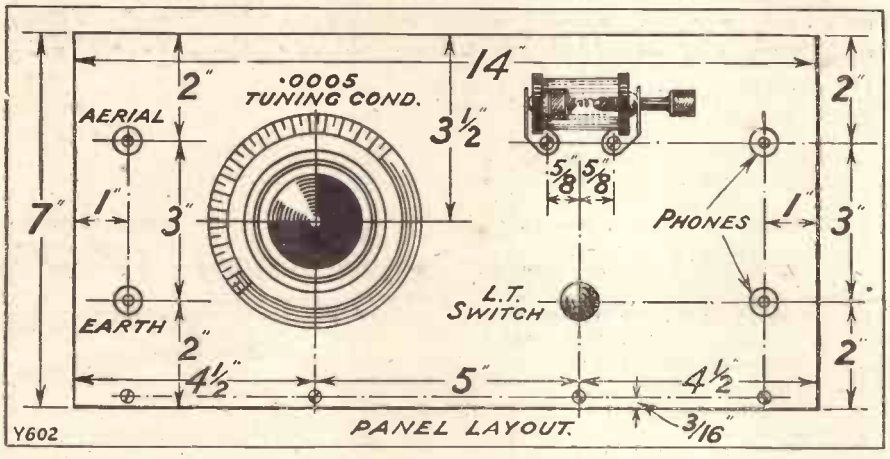
With the types of valves already mentioned, G.B. — 1 will require 1½ or 3 volts, and G.B. — 2 about 6 volts.

There is very little that need be said about the operation of this receiver, as it is to all intents and purposes the same as working an ordinary crystal set. The grid-bias values should be finally adjusted by trial once the set is working properly. Just a word of warning if you are used to a crystal set. Do not forget to switch the set off when the broadcasting station closes down.

In order to be sure of not giving the set a test under better conditions than usually exist, it was tested on a small aerial in a loft about nine miles S.E. of 2 L O. This station came in at full loud-speaker strength, and while it was working it was possible to receive 5 G B, also at good loud-speaker strength, without interference. 5 X X was a little louder than 5 G B. In all the above cases X coils were employed, so that with an outside aerial and where conditions permit the use of centre-tapped coils, real alternative programmes should be available without any trouble.



As an interesting experiment, the set was tried with 'phones on the aerial previously mentioned, when the English broadcasting was finished. Two Continental stations were heard, one being identified as German. A vernier dial was employed on the original set, and, while this is not necessary, it will sometimes be found to facilitate tuning on stations other than the local.



THREE TECHNICAL TIPS.

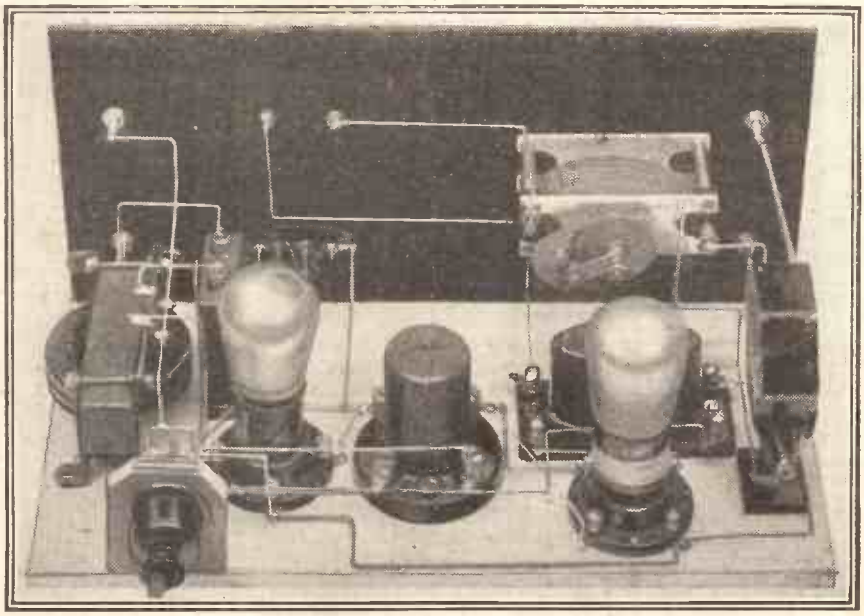
All aerial and lead-in wires should be supported by insulators so that they are at least six inches away from walls, ceilings, gutter pipes, etc., if maximum results are to be obtained.

* * *

When drilling a hole through a window frame for a lead-in tube, remember that if the tube is arranged to slant sharply upwards on entering the house, moisture will tend to drip off the aerial at the outside and not run across the lead-in tube and so impair its insulation.

* * *

In America the low-tension battery is called the "A battery," the high-tension battery the "B battery" and the grid-bias battery the "C battery."



The battery connections are made by means of a multiple plug and socket, a completely efficient, and at the same time, "fault-proof" scheme.

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

IMPORTANCE OF BY-PASSING

THE MYSTERY PICK-UP—METHODS OF L.T. SUPPLY—HOW WIRED WIRELESS WORKS, ETC., ETC.

Importance of By-Passing.

ALTHOUGH the better-grade manufactured receivers to-day are including by-pass condensers with a view to obtaining greater efficiency, the value of this practice is not always fully appreciated by the set-builder and experimenter. Both high-frequency and audio-frequency currents should be provided with the shortest possible path, in all cases avoiding circuitous and high-resistance detours through batteries, mains supply units, transformers, and so on. Moreover, the audio frequency should be kept out of the H.F. end, and the high frequency should be kept out of the L.F. end.

L.F. By-Pass.

Taking the detector and first L.F. stage as a typical case, by-pass condensers may be used to keep the radio-frequency component out of the transformer primary, and to keep the audio-frequency component out of the high-resistance H.T. supply unit or H.T. battery. A suitable H.F. choke is inserted between the plate of the detector valve and the transformer primary together with a small by-pass condenser on the plate side of the H.F. choke connecting with the filament negative.

The audio-frequency energy is by-passed by a one-microfarad condenser between the H.T. positive and the filament negative. This will be found to improve the tone quality and also generally the volume. The by-pass for the H.F. end invariably provides greater sensitivity and volume, particularly with a regenerative detector which may sometimes fail to oscillate freely in the absence of such by-passing.

Volume and Sensitivity.

By-passing for the L.F. component is provided by a filter condenser of 1 or 2 microfarads between the H.T. positive and the filament negative leads. The use of a by-pass in this position results in better tone quality and a reduction of background noises, whether with H.T. supply unit or partly-run-down H.T. batteries. Generally, an amplifier not so equipped may be materially improved by by-passing all H.T. positive connections to the filament negative.

Finally, an H.F. by-pass arrangement which is not so often employed, but which will increase sensitivity and volume to a considerable extent in many cases, is to place a by-pass condenser of ·006 mfd. between the filament negative and the H.T. positive lead which goes to the primary of the H.F. transformer. This will be found specially useful in cases where the H.T. battery or the H.T. supply unit has considerable internal resistance.

The Mystery Pick-up.

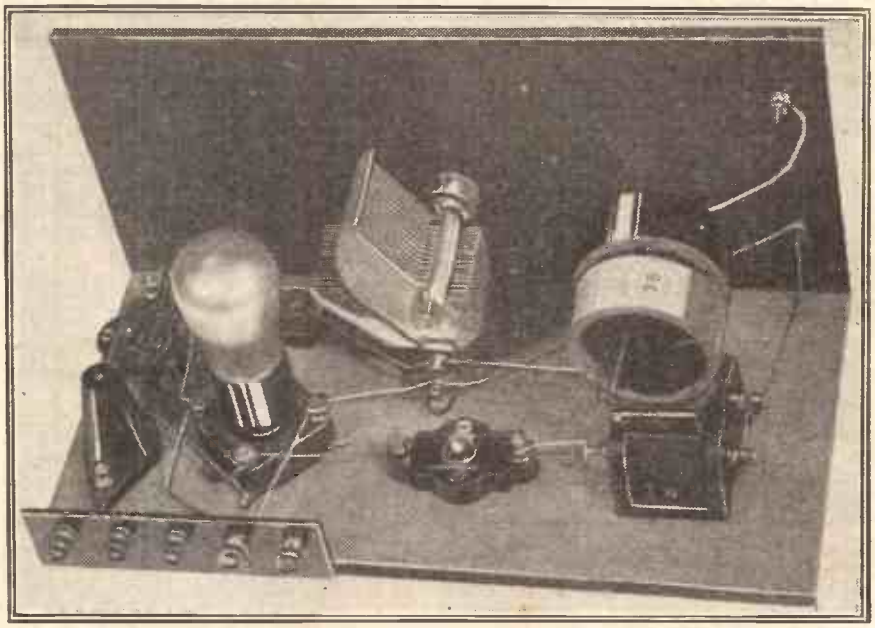
Everyone is familiar with the electrical pick-up which may be used with any ordinary standard type gramophone and which enables the sound to be reproduced through the low-frequency amplifier of the radio set. There is no secret about the principle of these devices, which are as a rule of the magnetophone type. They operate on the same principle as an ordinary telephone receiver, except that the action is reversed—that is, instead of being supplied with electrical energy and producing vibrational energy they are supplied with the latter and produce the former.

There is another type of electrical pick-up, however, which is simplicity itself so far as its operation is concerned, but the exact *modus operandi* of which appears to be something of a mystery; it has, indeed, been referred to as the "mystery pick-up."

The ordinary gramophone has, as you know, a needle which runs in the groove or track and takes up the side-to-side or swaying motion as the record rotates. If an electrical pick-up is used, the motion of the needle vibrates the armature of the pick-up and induces currents in the magnet windings

(*Continued on page* 611.)

CONSTANT REACTION RECEIVER.



This interesting receiver is a one-valve experimental model used by "P.W.'s" Technical Editor, Mr. G. V. Dowding, in his experiments with his new system for obtaining constant reaction. Details of this circuit are given in an article which appears on page 597.

NEWS FROM SAVOY HILL. FROM OUR OWN CORRESPONDENTS.

THE B.B.C. REPORT FOR 1927

"ON SEVERN'S BANKS"—BROADCAST EDUCATION IN SCOTLAND—SOME INTERESTING LONDON TALKS, ETC., ETC.

The B.B.C. Report for 1927.

FOR a document of the kind this appeared in a most curious way. It is the custom of the B.B.C. to take the most elaborate pains to secure thorough publicity for their work and reports. But the Annual Report was disregarded by Savoy Hill, the Stationery Office being left to push it out anyhow. The document is sufficiently dull, "careful" and uninspiring to suggest that Savoy Hill is not proud of it.

"On Severn's Banks."

Shortly before his death Sir Herbert Brewer, organist of Gloucester Cathedral, expressed a wish to conduct in the Cardiff Studio a programme dedicated to those musicians of the twentieth century who were born within sight and sound of the Severn. Among them are Sir Edward Elgar, Sir Hubert Parry, Dr. Basil Harwood, Gustav Holst, Vaughan Williams, Herbert Howells and the great musical historian, Sir Henry Hadow.

Unfortunately Sir Herbert died before his wish could be realised, but a programme on the lines he had planned, which must now be regarded as dedicated to his own memory as much as anything else, will be given from Cardiff and 5 G B on Sunday, July 8th, and the title of the concert is "On Severn's Banks."

It will include music of the Shires of Gloucester, Worcester, Salop and Somerset, one orchestral item being "Barton Fair," by Brent-Smith, a native of Brookthorpe,

(*Continued on page* 608.)

STOPPING SQUEALING

This week our contributor further discusses the question of instabilily in wireless receivers and gives the results of some interesting investigations.

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

RECENTLY I discussed the question of neutralising in H.F. circuits, and led up to a new type of split-secondary winding that has given excellent results.

The circuit of a two-stage H.F. amplifier using this system is shown in Fig. 1. The three secondary windings, L_2, L_4 and L_6, all consisted of 60 turns on a 2¼-in. former, the tapping points on the two inductances L_2 and L_4 being at 15 turns from the neutralising condenser end of the winding. The taps were taken to the two ends of a potentiometer, the slider of which was connected to L.T. negative. With the slider approximately at the centre of the winding no trouble whatever from parasitic oscillations was experienced, even when using valves having a fairly high mutual conductance and a high amplification factor.

The primary windings, L_3 and L_5, were, of course, suited to the valves being used, and Reinartz reaction was used in the detector circuit.

I found that this amplifier gave a far greater degree of amplification than the

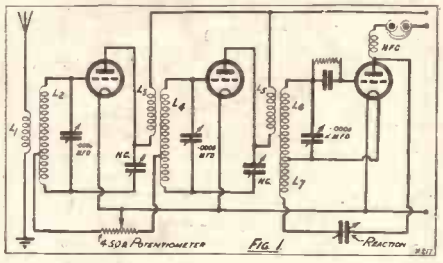


Fig. 1

usual split-secondary circuit with a centre tap such as I originally used in the Monodial Receiver.

I have always had a preference for the split-secondary type of circuit on account of its greater inherent stability as compared with the split primary in my experience, and also the great degree of selectivity that appears to be obtainable with it, although it is assumed by many that this system does not give quite the same degree of amplification per stage as is usually obtainable with a split primary.

With the circuit shown in Fig. 1, however, I found that I obtained a far greater degree of amplification per stage, and the difference between this and a two-stage split-primary amplifier was not noticeable under actual practical reception conditions.

Comparative Amplification.

It was rather difficult to determine the actual amplification per stage given by the split-primary amplifier owing to certain difficulties in the question of neutralisation which will be dealt with later on, but as far as I could tell an amplification per stage of 8½ was obtained with a split-primary circuit with the particular components in use, and I was able to obtain an amplification of 8 with the Fig. 1 circuit, using similar types of components.

It will be seen, therefore, that the scheme I have outlined enables an H.F. amplifier retaining the advantages of the split-secondary circuit to be constructed, but having its amplification brought up to a far higher level than has hitherto been obtained.

For the benefit of those who may be somewhat doubtful as to the particular advantages of a split-secondary circuit, I may state that, firstly, the coupling between primary and secondary circuits is not nearly so important from the neutralising point of view, provided that it is not too tight.

Satisfactory Selectivity.

In view of the added selectivity that is required nowadays owing to the continuation of the Daventry Experimental transmission this is of little consequence, whereas with a split-primary transformer it is necessary to have the coupling sufficiently tight if satisfactory neutralisation is to be obtained.

This means that extreme selectivity by the use of very loose coupling between the primary and secondary circuits is not satisfactorily obtained with complete stability in a multi-stage amplifier using the split-primary circuit.

The split-secondary circuit is moreover far more suitable for reflexing than the split-primary circuit, since this latter is likely to give much more trouble from low-frequency oscillation than the former.

Having evolved a split-secondary circuit which could be fully neutralised on the higher frequencies and under neutralised at the lower ones, I next determined to see whether I could do the same thing with a split-primary circuit by shifting the H.T. tap on the anode winding.

The most serious difficulty that I came up against, however, was owing to the fact that when the valve was neutralised cold it was not necessarily stable hot. Thus with the standard connections to the primary and neutralising windings I found when the valve was hot that it was actually under-neutralised when the neutralising adjustment had been made with the valve cold. If I reversed the primary and neutralising windings then I found that the reverse was the case.

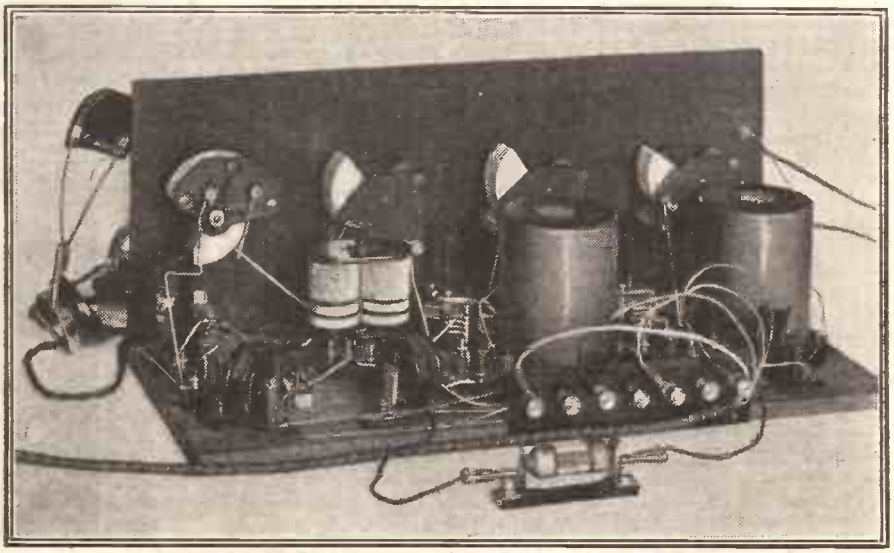
An Important Point.

An exceedingly important point with regard to the split-primary circuit must be dealt with here. This will be simplified by a consideration of Fig. 2. This shows the bridge formation of the split-primary neutralising arrangement.

In order to make the various connections clear, grid, plate and filament have been indicated at three corners of the bridge. Cp-g is the plate to grid capacity of the

(Continued on next page.)

PREVENTING INTERACTION.



Copper covers on coils used to be the regular way employed to prevent interaction between H.F. circuits. This introduced serious losses, and more modern methods should be employed if full efficiency is required.

STOPPING SQUEALING.

(Continued from previous page.)

valve while N.C. is the neutralising condenser, and the two inductances L_1 and L_2 are the two halves of the primary winding. By neglecting the H.T. battery, the primary winding can be taken as being connected directly between plate and filament.

Average Amplification.

Now it is clear that the plate to filament capacity is in parallel with the coil L_1, and this is shown at Cp. We have, however, another element to consider which is the plate-filament impedance of the valve

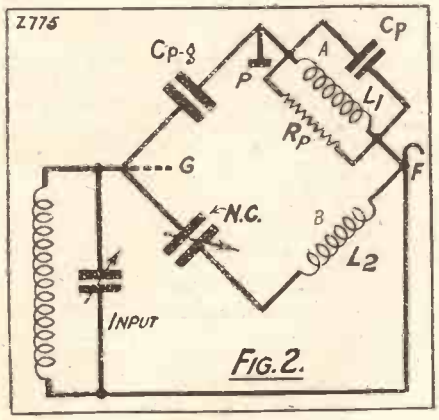


FIG. 2.

itself. This can be represented by a resistance and is shown shunted across the coil L_1 at Rp.

This makes it fairly clear, I think, that the split-primary neutralising method is not a bridge method at all, but merely a form of negative reaction by means of which stability is obtained. If however, we like to connect a capacity across the coil L_2 equal to Cp, which is across L_1, and a resistance which would be equal to Rp, we should then have a bridge.

Under these circumstances, however, I think we would find that the average amplification obtainable per stage would be very low indeed owing to the extra damping resistance thus introduced, whilst the selectivity would also be bound to suffer. In practice we should also have the adjustment of an additional condenser, since the capacity connected across L_2 would have to be variable so that it might be adjusted to match up with the particular valve in use, while the resistance across it again would need to be variable, since the impedance of a valve varies under different conditions.

Thus, every time you altered the high-tension supply to the H.F. valve or the filament current the impedance would alter and, therefore, the resistance shunted across L_2 would need to be altered again so as to be equal to Rp.

A Further Point.

A further point which also introduces difficulty in the split-primary circuit is that due to the mutual inductance between the two windings (L_1 and L_2 in Fig. 2). This effect is, of course, on all fours with that described with regard to the Fig. 3 diagram, and though its effect (in both cases) is not serious in a multi-stage amplifier, it becomes cumulative and may, therefore, be by no means inconsiderable.

I made some experiments, however, with the valve cold in each case, as I concluded that this would afford some indication of the performance of the amplifier with the valve hot.

I, therefore, wound up a special split-primary transformer in which a number of tappings were provided so that the H.T. tapping could be shifted up and down the coil as required. I found, however, that the shifting of the H.T. tapping had no appreciable effect except as regards the actual setting of the neutralising capacity for obtaining a neutralised point.

Shifting the Tap.

Thus with the tap closer to the anode far less capacity was required to obtain a balance point, but with the tap nearer to the neutralising condenser end of the winding more capacity to obtain a balance was required. The greatest care was taken in obtaining a point of balance, but it was found impossible to find any variation occurring as between high and low frequencies.

It was further extremely difficult to determine what effect on the amplification resulted from shifting the tap. Although the reading I took showed that greater signal strength was obtained by shifting the tap nearer to the neutralising end of the winding, it must be remembered that the effect of doing this was also to increase the size of the primary portion of the winding, thus tightening the coupling between the primary and secondary circuits.

We would therefore expect this to increase the signal strength. At the same time the fact that the valve when neutralised cold was not stable hot made it difficult to determine whether the valve was correctly neutralised after stability had been obtained by re-adjusting the neutralising capacity so that any readings obtained under these circumstances would have a somewhat fictitious value.

The Final Circuit.

The shifting of the tap had apparently but little effect on the generation of parasitic oscillations, though as far as I could tell a slight improvement was obtained by using a larger anode winding and a smaller neutralising winding. The improvement noticed was no doubt in no way due to the proportion of the windings, but merely due to the fact that the symmetrical arrangement had been upset, the most symmetrical arrangement being the one which tended most to produce parasitic oscillations.

The tapped-grid circuit I have evolved is far less prone to parasites owing to the asymmetry of the windings, while the great advantage in making initial adjustments is due to the fact that when neutralised cold the valve is stable hot.

Combined with the fact that a really satisfactory degree of amplification is now obtainable from this circuit, this gives the set-designer a circuit of great value for use in single or multi-stage H.F. amplifiers.

A MULTI-PURPOSE PLUG.

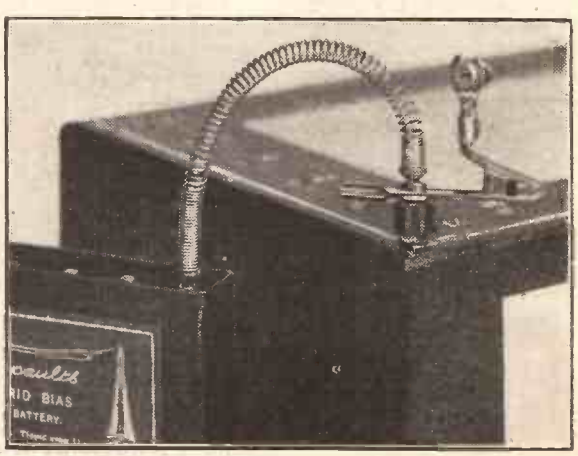
THE ingenuity of the home constructor is always being brought into play by his efforts to devise ways and means to meet those contingencies which arise during the course of his ever interesting wireless experiments. This factor is all to the good, and to my mind one of the greatest pleasures of wireless, and the one which makes it superior to all other hobbies is the fact that one can always be adding to and improving one's receiver and trying out fresh "hook-ups." It is perhaps in connection with the last-named that we can call into service so many little ideas that facilitate the work, for unless one's connections can boast of a fair degree of reliability, the results are apt to be misleading.

In view of this, the little device illustrated in the photograph accompanying this article will no doubt prove useful. One is frequently called upon to make several connections to one point, and it often happens with experimental work that two or three leads have to be joined to one tapping on an H.T. battery. To give only one instance, we may quote the common connection between H.T.—, L.T.—, and G.B.+, and for this and other emergencies I keep the multi-purpose plug handy.

Any Kind of Connection.

The illustration is almost self explanatory. Obtain a wander plug with a metal collar or shoulder at the top, and between this collar and the insulating sleeve secure an "eye" tag provided with a hole to take a wander plug at its cylindrical end and the fork end of a Ward & Goldstone spring clip. With this pattern clip there is provided a channel-shaped end into which can be soldered a spade tag. The spade tag in turn will now conveniently accommodate a small terminal complete with nut and screw, the clip end being bent vertically so as to allow connections to be made quite easily.

We now have available alternatives whereby common connections can be effected according to the type of lead terminations. The eye tag will take another plug, while bare leads may be gripped in the terminal or clipped jaws, and as a final addition, a spiral spring connector will enable two batteries to be linked together with the assurance that sound electrical connections will result.



Showing how the plug is used to connect two batteries together.

SHORT WAVES AT CYPRUS.

The Editor, POPULAR WIRELESS.

Dear Sir,—I wrote to you a little while ago describing my experiences with a long-wave set (1 H.F., Det., 1 L.F.). I said I was going to make a short-wave set. I have now made the set, and I thought that perhaps you might like to know the results that I can obtain with it. The set is made up from a circuit supplied by you. It is a three-valve set (Det., 2 L.F.) Reinartz. The tuning condenser is rather large for short-wave work, being ·0005 mfd., which makes tuning rather difficult. I have not had it working long, but I am quite pleased with the results.

My best station is 5 S W, which I can get at about R9–10 on two valves and at moderate loud-speaker strength on three valves. Next in order of merit comes P C J J, which comes in at R.10 on three valves. I can also get 2 N M and Radio L L Paris, both at R.6. Last Sunday night I had a great thrill when I picked up 3 L O testing on 32 metres. I first picked up his carrier at about 9.15 p.m. when I heard a contralto singing. I then heard the announcer say: "This is 3 L O, Melbourne, Australia, testing on 32 metres." They were broadcasting gramophone records and I have sent them in a full report of what I heard. Reception was not good, there being a lot of mush, but I managed to make out most of the announcements. Strength was about R.3, sometimes rising to R.6. Wishing "P.W." every success, I am,

Yours sincerely,

Skouriotissa, Cyprus. J. H. D.

SHORT-WAVE RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have read with interest your readers' letters published from time to time on short-wave reception, and was very interested in J. C. G.'s letter concerning short-wave work with swinging-coil reaction. My set is a three-valver, the detector circuit being the straight valve circuit which you published in your "What's Wrong?" diagram column on March 24th. The last two stages are L.F. and power amplification. On long waves I have received at loud-speaker strength Angora, Radio-Paris, Daventry, Motala, Lahti (testing), Zeesen, Kalundborg, Hilversum, and Leningrad. Between 200–600 metres, about forty stations all at speaker strength (varying).

On short waves, using a four-turn coil in the aerial and an eight-turn coil reaction, short indoor aerial, and ·0005 variable condenser in series with a ·0001 fixed condenser, I have received 2 X A F, 3 L O, Vienna, 2 N M, Radio-Vitus, P C J J, Copenhagen, 7 M K and 7 R L, K D K A (43 metres and 66 metres), and a score or so of amateurs.

My short-wave coils are mounted on ordinary broadcast coil plugs, which are first matted with emery paper, and a two-way Lotus coil holder is used.

With a ·0003 variable condenser in series with my outdoor aerial I can tune down to 40 metres.

Yours faithfully,

Bristol. C. L. P.

HOME CHARGING.

The Editor, POPULAR WIRELESS.

Dear Sir,—Referring to the article, "Charging by Daniel Cells," which appeared in your columns recently.

May I mention I made this charger from instructions given in the "P.W." last August. I am pleased to mention it works fine.

NOTES WORTH NOTING.

It was just about ten years ago that the first radio telegram was sent from Carnarvon to Sydney, Australia, 12,000 miles away.

* * *

Important radio developments are expected as a result of a four months' cruise in the Atlantic undertaken by Senatore Marconi in his yacht "Elettra."

* * *

The new giant German airship, LZ 127, will carry an absolutely up-to-date wireless installation, and will work upon wavelengths of 500 and 2,100 metres.

* * *

Recent improvements in the technique of loud speakers are being extensively used by the railway companies in connection with platform arrangements, and at several of the London termini times of departures are now announced through giant loud speakers.

CORRESPONDENCE.

SHORT WAVES AT CYPRUS

HOME CHARGING—
A 4-ELECTRODE SHORT-WAVER.

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.

For readers who made the above, or those who might wish to make it: They will find it to their advantage by placing the copper solution in the porous pot, instead of the outer jar. Secondly, sal ammoniac works better than Epsom salts, and this should be placed in the outer jar.

In the first case, we only use half the quantity of copper sulphate, and get the same current.

In the second case, Epsom salts, after four days or so, choke the zincs, by leaving a rusty case, which has to be scraped off, and the cells fail to work.

Sal ammoniac on the zinc forms a soot which falls to the bottom of the jar, thus the cells are always active. Change the copper solution every twenty-four hours. Use a syringe, draw off the old, and replace from solution ready made.

Wishing your paper every success,

Yours faithfully,

Hitchin. H. D.

A 4-ELECTRODE SHORT-WAVER.

The Editor, POPULAR WIRELESS.

Dear Sir—I have recently seen several references in POPULAR WIRELESS with regard to the adaptability of the Unidyne to short waves, and in this connection the submitted 4-electrode circuit might interest "H.O.L." and others.

As will be seen, the circuit is not of the conventional Unidyne type, and the essential particulars are: Aerial coil, 5 turns; secondary, 7 turns; tuned with Ormond ·0005; "H.T." is 6 to 10 volts; valve, a foreign ·06 at 3-volt type run off two large cells; and a variometer is included in the plate circuit; filament resistance a microstat which is the reaction control incidentally. Using these values of coils and the ·0005 condenser and valve the circuit tuned down to approximately 35 metres, but somehow I was unable to coax it to go below this.

For the broadcast band of wave-lengths, the circuit is modified by inserting between 'phones and variometer a high-frequency choke, which

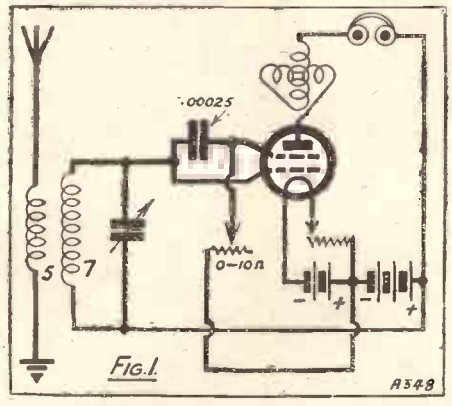


FIG. 1. A548

consists of a large coil (such as is used for 25,000 metres reception) in the plate circuit. On this coil a circular piece of tinfoil is laid and is connected to "H.T.+". With this arrangement the plate circuit seems to be always in an oscillatory state, but this does not enter the A.T.I. unless filament temperature is increased. With this arrangement the set is very sensitive. In one set however, the capacity effect between the tinfoil and choke coil was not needed, whilst in another it was essential as without it the set was quite "dead."

The "local" stations come in well for a one-valver, considering the distances are: Johannesburg, 450 miles; Durban, 700; and Cape Town, 1,000 miles (distances approximate and not guaranteed to three places).

I have logged most of the F.O.s on short waves, and a couple of overseas Australians, etc., during the short time I used the set on short waves. I also logged K D K A and a couple of other S.W. broadcasters. I think "H.O.L." will find that this is what he was looking for, and I hope it works as well with him as it did when I hooked it up.

Yours faithfully,

Bulawayo, S. Rhodesia. B. M. ORR.

A "SHOCKING" SPARK.

The Editor, POPULAR WIRELESS.

Dear Sir,—Re your answer to A. J. B. (Saltley, nr. Birmingham) in "P.W." No. 314.

Your correspondent raises an interesting point when he states he was surprised to see a distinct flash at the same time as he felt the shock (through wearing headphones with faulty insulation).

I have had several instances when I have distinctly seen a bright green flash in front of my eyes which I could never account for—always occurring at the same time as the shock is felt.

Can any of "P.W." readers account for this phenomena?

My only explanation is that it is an optical illusion.

Thanking the staff of "P.W." for the good fare it provides.

Yours truly,

Scarborough, Yorks. R. A. C.

THE "ANTIPODES ADAPTOR."

The Editor, POPULAR WIRELESS.

Dear Sir,—Results here have been on L.S.:

K D K A on 45 metres fades.
2 N M on 32 metres.
N F N (Rome, Italy).
7 R L, on 42 metres.
5 S W, on 24 metres.
A F K, Doberitz, on 23 and 37 and var. metres.
L L, Paris, on 61 metres.

I see Mr. F. Binney (Herts), in your issue for May 26th, asks for 5 S W coil. This comes in here on original coil 12 turns and 6 reaction on 7th turn of 12 coil. I have been using this plugged in the Cossor "Melody Maker."

5 S W can be got 12.30-1.30 p.m., but it is no good until 8 o'clock, when it comes in at R 7.

Yours truly,

Kentish Town, N.W.5. "A READER."

P C J J REPORTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—You recently published a letter from us asking for reports on reception of Radio Station P C J J to be sent to us and, as a result of this letter, we are pleased to inform you that we have received reports from all over the world.

Amateurs in such places as Montreal, Ceylon, Shanghai, and all parts of the British Isles have responded to this appeal.

Yours faithfully,

Philips Lamps Limited,
F. J. HAUGHTON,
Publicity Department.

BELL WIRE AERIAL.

The Editor, POPULAR WIRELESS.

Dear Sir,—A good many flat dwellers know that one of the wires of an electric bell provides a quite efficient aerial in town; but probably not all are aware that the second wire can be used as an earth; provided that a small variable condenser (say ·0003) is inserted in one of the leads to prevent the bell ringing. A variable condenser is best, as the tuning is rather sharp.

Faithfully yours,

South Kensington, S.W.7. F. H. M.

MORE INTERESTING ITEMS.

Radio valves are not included in the list of imported articles which the Standards Committee of the Board of Trade recommended should bear the country of origin.

* * *

In order to prevent pandemonium it had again been decided that no loud-speaker demonstration shall be allowed during the National Radio Exhibition at Olympia in September next.

* * *

In order to broadcast from the Cenotaph, two lines have been laid by the B.B.C., one underground to a spot in the roadway near where the lectern is placed during a service, and another at the foot of a nearby tree. Here the concealed microphones will be placed, the two points being connected by buried lines to a nearby garage where the outside broadcast motor-van will function.

The "CONREAC" CIRCUIT

Here is a very simple solution to the problem of "constant sensitivity." The scheme is applicable to practically any standard circuit arrangement, and should arouse considerable interest.

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

A STRAIGHTFORWARD valve detector circuit is not particularly sensitive, and has few advantages over a simple crystal arrangement. And to operate a valve one needs batteries, batteries which necessitate constant maintenance. But where the valve detector scores is that with it one can use reaction. Reaction, feed-back, regeneration, oscillation, as it is variously termed, is, in a sense, H.F. amplification, and when it is introduced a valve detector circuit can assume a very considerable degree of sensitivity.

When there is too much reaction, however, the circuit bursts into oscillation, a state of affairs which causes those nightly shrieks and screams in the ether. The set is in its most sensitive condition when the reaction adjustment is carried right up to the "edge" of this oscillation condition. A dangerous point for other listeners, and one that should be avoided by the operator also, for the more personal reason that pure reproduction is impossible in such circumstances. A moderate degree of reaction carefully applied is, however, permissible.

Why Sets "Whistle."

In ordinary conditions one has to vary the reaction control, which, in most modern sets, is in the form of a variable condenser, simultaneously with the variations of the wave-length tuning control in order to maintain a uniform degree of sensitivity; and it is this balancing of controls that, in the case of the inexpert operator, frequently results in bringing the set into a state of oscillation.

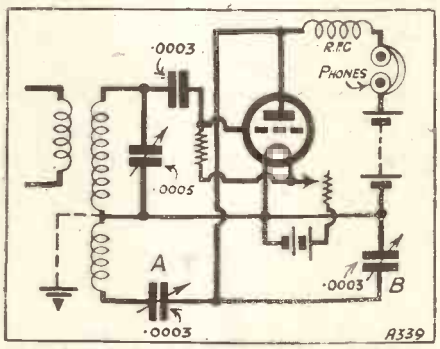
In one sense this is pardonable, for the tyro cannot be expected easily to identify that most sensitive condition of the set which precedes its bursting into self-oscillation. In order to eliminate the risk of this, and also to do away altogether with the necessity for a front-of-panel reaction control and thus generally simplify a radio outfit, a number of attempts have been made to achieve a constancy of reaction effect, and with varying degrees of success.

"P.W." readers will remember, for instance, the Loftin-White constant-reaction circuit which was followed by an ingenious arrangement due to Mr. Percy W. Harris. I have myself devoted a fair amount of time to the problem, and, after a considerable amount of experimenting, evolved more or less by accident the circuit which is illustrated in the accompanying diagram.

A Useful Component.

At first sight you will see that this looks very similar to an ordinary so-called Reinartz reaction detector circuit; but you will also notice that instead of using one reaction condenser I employ two variable condensers, both of which have something to do with the anode circuit of the valve—exactly what I will explain later. The arrangement is made practical only by the arrival of the compression type of variable condenser. Two of these can be purchased for less than the cost of one normal variable.

You will understand that the compression type of variable is all that is needed, because when they are used in this particular circuit they only have to be adjusted once, after which they can be disregarded. They are, of course, mounted on the baseboard behind the panel. The initial adjustment is made when the set is placed in commission, and then they take their places with all the other "static" components, such as L.F. transformers, grid leaks, etc. Even changing the H.T. battery and the L.T. battery—as is, of course, frequently necessary—does not upset things.



The compression type variable condensers "A" and "B" can be mounted on the baseboard, and, once these are adjusted, a remarkable uniformity of sensitivity is preserved through the whole tuning range of the receiver.

As I have said, this "Conreac" circuit, as I have called it, resembles a normal capacity reaction detector arrangement, with the exception that the one variable condenser "B" is added. This is connected between the anode of the valve and the filament or earth. The theory of the hook-up is simple and quite straightforward.

First of all disregard the "B" ·0003 mfd. variable condenser. The amount of feed-back from the plate of the valve to its grid, a rough and ready way of referring to reaction, can be controlled by the variable condenser marked "A." The greater the capacity of this component the more will be the feed-back at any one particular frequency and the less the capacity the less the feed-back.

You see, as you increase the capacity of this component so you decrease the H.F. resistance of the circuit between the anode and the grid of the valve. To this brief explanation I must add in parenthesis that I am disregarding the coil couplings, H.T., L.T., and other vital but "set" conditions. Now supposing we tune the grid circuit of the valve by means of a ·0005 mfd. variable condenser to a certain wave-length. You can then set the reaction condenser "A" so that a maximum sensitivity results; but in order to maintain this condition when you increase the wave-length tuning you will find it necessary to increase the capacity of the reaction condenser, and when you decrease the wave-length tuning you will need to decrease the reaction condenser capacity accordingly.

Balancing "By-pass."

Now the additional variable condenser "B" acts as a by-pass between the plate of the valve and earth; it by-passes the whole of the reaction circuit, including the reaction coil. The amount of energy that this by-pass condenser will side-track to earth from the plate of the valve will depend upon its capacity. The greater its capacity the more it will by-pass, and the less it will leave for feeding back to the grid of the valve. And its H.F. resistance will increase with decreases of frequency and decrease with increases of frequency. Therefore, this by-pass path will side-track more and more energy with decreasing wave-length tuning, for lower wave-length means greater frequency. It, therefore, counterbalances the ordinary reaction control effect.

You must forgive me for this very brief and sketchy explanation of the circuit, for space does not permit of my going into greater detail. Suffice it to say that the condensers "A" and "B" can readily be adjusted so that the reaction effect remains uniform over the whole movement of the dial of the tuning variable condenser. It is necessary, however, to have specific sizes of grid and reaction coils in order to maintain more or less complete constancy.

An Important Question.

But does the average constructor require "constant reaction"? Would he feel happy without a reaction control on the panel to convince him that he actually is at the point of maximum sensitivity? I would be grateful if readers would let me have their views, and also trust that at least they will find this "Conreac" circuit of mine interesting.

It can very easily be tried out, for you will find that a large number of existing arrangements can be converted merely by adding one compression type variable condenser ("B" in the accompanying diagram). You may find it necessary slightly to vary your reaction coil sizes.

MAKING AN H.F. CHOKE

A vital component which can be made at home easily and economically.

From A CORRESPONDENT.

IN these days of capacity-controlled reaction, the H.F. choke is a component in great demand. But, alas, like everything which is in demand, it is rather highly priced, and this naturally causes many who would otherwise make a few experiments with this form of reaction to leave it alone. Admitted, a standard plug-in coil will function well in this capacity, but it needs to be well separated from the tuning coils to prevent any stray fields from upsetting things.

Being recently in need of an H.F. choke, and also being handicapped by a lack of space, which precluded the use of a plug-in coil, a search was made for a suitable former, and eventually a Kodak film spool was brought to light. This was baked, and afterwards varnished with a good quality shellac to ensure that it would not absorb moisture.

It was then mounted on a length of 2 B.A. studding, locked at either end by nuts, the studding held by the chuck of a wheel-brace, which was in turn clamped in the vice.

Easy Method of Winding.

The end from a spool of 32-gauge silk-covered wire was threaded through the long slot, and made fast to the 2 B.A. studding. The winding consisted of five sections, each containing 100 turns. It may sound a trifle complicated to speak of the winding being carried out in sections, but really "bunches" would be a better term, as it gives a clearer impression of the actual form of the winding.

The wire was allowed to follow its inclination for the first few turns, and was then made to ride up over them, and so forth, until the first 100 turns were completed. In this connection it would be as well to mention that to ensure the correct number of turns being wound on, it is advisable to count the number of revolutions made by the chuck for each turn of the handle, and counting the revolutions of the handle necessary to wind 100 turns on the former, which is of course rotating at the same speed as the chuck.

The remaining four sections are wound on in a similar fashion, and the end is made fast, with a few inches left over for the purpose of making connections. Two brass-headed cheese bolts which were a driving fit in the ends of the spool were then found, and the two ends of the winding soldered into the slots in the head of each screw.

It was then possible to mount the choke in the holder normally used to accommodate a wire-wound anode resistance. A piece of non-inflammable celluloid was used to protect the winding, but this, of course, is purely a matter of personal choice.

An Acceptable Accessory.

By the way, there are many every-day things which may be turned to account for use by the home constructor as time-saving devices, and a brief description of some such adaptions will probably be acceptable to the majority of those who like to do things for themselves.

One of the most serviceable items one can pick up from a junk stall is a pair of serviceable forceps known, I believe, as artery forceps to those who are accustomed to use them in the manner for which they are intended. In appearance they seem to be a compromise between a pair of scissors and flat-nosed pliers, with the addition of a small ratchet above the scissor-grips, which is to keep them locked in position when gripping anything.

Owing to their long and narrow construction, they will be found of the utmost assistance in getting at inaccessible screws, nuts, and so forth.

SHORT-WAVE NOTES.

By W. L. S.

THE spell of bad conditions is still "in force" at the time I write, and I cannot remember such a long spell on short-waves ever before. Conditions for really long-distance reception "faded out" on about May 7th, and certainly have not returned as yet. I am keeping a detailed log of the conditions prevailing daily, both with regard to 2 X A D and the other broadcasting stations, and to the lower-powered amateur stations.

It should make rather interesting reading by the end of the year. Personally, I am inclined to predict another spell of good conditions roughly as long after the longest day as May 1st was before it. May 1st was the very best day I have ever known, and if there is any justification for my idea, conditions should reach a kind of maximum again by August 6th.

It really seems incredible that these "conditions" should have baffled all our radio men for such a time. Candidly, in spite of much talk, I do not believe we are any nearer the solution of the problem of their existence than we were before broadcasting commenced. As the great short-wave "chase" goes on, and the stations all move to higher and higher frequencies, new sets of difficulties and new kinds of "conditions" arrive, and we either stand still or move slightly backwards in this particular line of "progress."

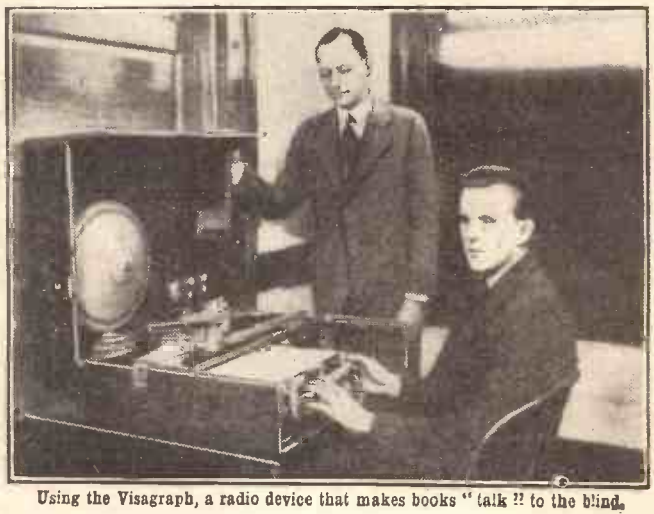
Amateur stations the world over are now getting themselves and their aerials into trim for the new wave-bands which will come into use at the end of the year or before. We shall all have to compress ourselves into bands much narrower than those which we use at present, and this will naturally mean that stations using raw A.C., or broadly tuned and unsteady telephony, will have to mend their ways or be boycotted.

It will be up to us all to adapt ourselves to the new conditions, and much good may come of it, since the search for more selective and more sensitive receiving apparatus, as well as for greater selectivity on the transmitting side, will probably lead to valuable improvements over the present methods being discovered.

5 S W's Wave-length.

I am speculating over the fate of 5 S W. I do not know whether a special provision has been made for short-wave broadcasting stations under the new regulations, but it seems quite on the cards that 24 metres will no longer house this country's "big noise." Incidentally, I think myself that he could hardly operate on a more inconvenient wave-length, and I think, from letters from Colonial readers, that the general opinion is that a change in wave-length, either upward or downward, is bound to be an improvement.

Occasionally, one hears of people who receive 5 S W at a distance at a better strength than 2 X A D, but I am afraid that the general opinion is that our 5 S W is a little bit of a disgrace to us!



Using the Visagraph, a radio device that makes books "talk" to the blind.

HOW TO MAKE A MOVING-COIL LOUDSPEAKER

Here is a really high efficiency moving-coil speaker which you can make with the simplest tools and the greatest of ease. It incorporates a special scheme which overcomes the whole difficulty of centring, and makes adjustment very simple.

By THE "P.W." RESEARCH DEPARTMENT.

IN the course of the last twelve months or so the moving-coil type of loud speaker has come to be invested with a sort of magic significance for most of us, so that we think of it automatically whenever we hear anyone mention loud-speaker reproduction of especially fine quality.

Probably the great majority of those listeners who have had sufficient experience to realise the importance of really good reproduction will by now have conceived an ambition to possess one of these instruments, for it must be granted that a good moving-coil speaker, worked from the right kind of set, renders possible a standard of realistic and faithful reproduction unequalled by practically any other type easily available to us.

There has been a tendency, however, to regard this sort of speaker as a kind of miraculous solution of the whole problem, as though all that one had to do was to assemble any one of the sets of parts on the market and so achieve almost perfect reproduction immediately.

Unfortunately, the facts are far otherwise, and it must regretfully be pointed out that to follow this course without due discretion may be merely to land oneself in greater difficulties than ever, with the practical certainty of ultimate disappointment.

Early Troubles.

The fact is that a proportion of the sets of parts being marketed lack certain features which are absolutely essential if the result is to be a success in the hands of the average listener, and a keen regard for the interests of our readers led POPULAR WIRELESS to adopt from the first a very cautious attitude in the matter until it had been very carefully investigated. We early found that considerable disappointment was resulting from the fact that many constructors were being encouraged to enter a difficult subject long before the vital experimental data had been obtained, and this strengthened us in our determination to proceed cautiously, especially when it was remembered that a good deal of expense was involved in the construction of these instruments.

Ever since the moving-coil speaker first began to attract general attention we have been working upon it as opportunity offered, and investigating thoroughly all those points which it seemed must be cleared up before a design could be approved as being really suitable for the average home constructor, within his usual limit of tools, time and cash. Much valuable information has been accumulated, chiefly in regard to three vital questions: (a) Which parts of the instrument is it wise for the constructor to try and make for himself? (b) What technical features of the design are essential to success under ordinary home conditions? (c) How must the design be arranged to render it easy for the average handy man to construct?

In due course a reasonably satisfactory answer was obtained to each of these questions, and a clear idea grew up of the kind of instrument which was needed. It was evident that the following requirements must be satisfied.

(1) Reasonable cost.

(2) Real ease of construction without special tools or much skill.

(3) Ease of adjustment to the correct working setting when finished.

(4) High sensitivity and satisfactory reproduction.

Finally, a model has been produced which we consider provides a practical solution, and we have arranged to make it available to our readers by taking one of the already available sets of parts (the Goodman) and modifying it to incorporate our own special developments. The makers have arranged to supply these sets of parts incorporating the special features mentioned, so that you can build up a complete speaker exactly like the one to be described by a perfectly simple process of assembly, the only tools needed being a screwdriver, a pair of pliers, a pair of scissors, a pocket-knife and a soldering outfit.

How It Was Done.

This brief list of tools will give you an idea of how completely requirement No. 2 above has been met. It should be explained that this is largely due to the fact that it has been decided that it is essential that certain of the vital parts shall be supplied ready made, for the simple reason that to learn to make them usually involves spoiling anything up to half a dozen of each finding out how to do it, and even then the final product may be considerably less efficient than one turned out by a skilled worker.

You will find, therefore, that in the set of

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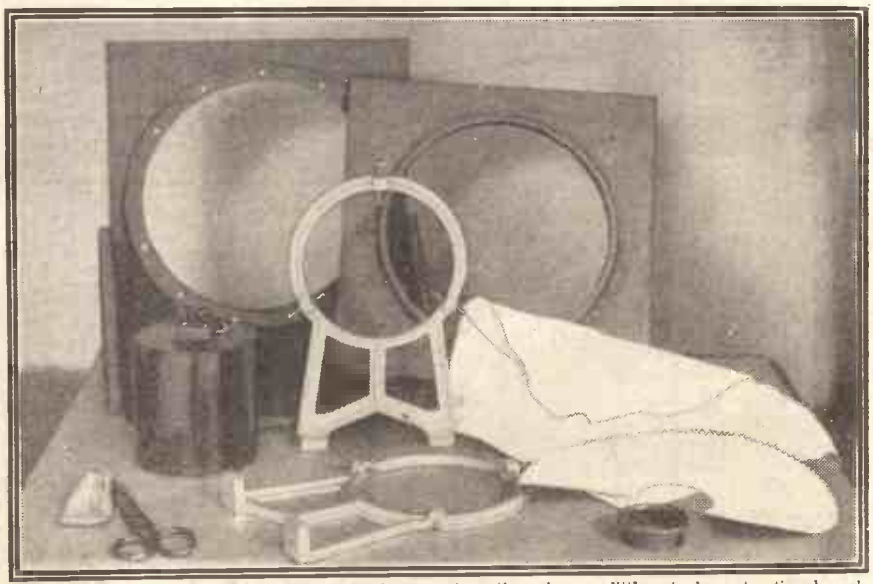


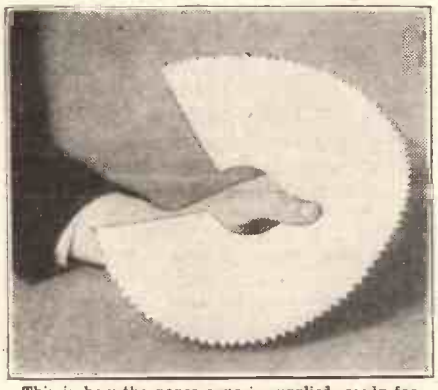
The starting point. The assembly is extremely easy, since there is very little actual constructional work to be done. Even the paper cone is supplied ready cut to shape.

HOW TO MAKE A MOVING-COIL LOUD SPEAKER.

(Continued from previous page.)

parts there is a piece of special paper (the material is most important) cut out ready for sticking together to form the cone diaphragm, a complete moving coil wound ready for sticking to the small end of the cone, a field magnet "pot" ready wound, and a wooden framework on which the whole apparatus is mounted.

As regards requirement No. 1, the cost of the set of parts is in the neighbourhood of four pounds, while the remaining two points (Nos. 3 and 4) have also been met in a satisfactory fashion. By experiments on the size of the gap in the field magnet in which the moving coil works, tests to arrive at a powerful but economical field magnet winding, others to secure a satisfactory winding for the moving coil, experiments with the material, shape and size of the cone, and so on, an instrument has been turned out which is well up to the standard which we set ourselves as regards sensitivity



This is how the paper cone is supplied, ready for the two straight edges to be stuck together. Note the serrated edge on the outside.

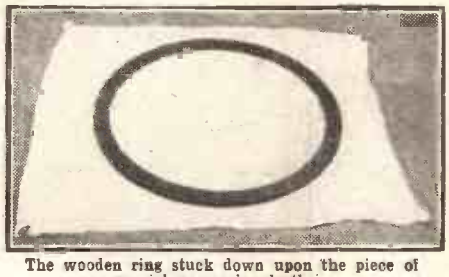
and perfection of reproduction. It may be taken that it will give a really fine performance with any set capable of giving fairly powerful and undistorted signals, but fuller details on such matters should be sought in an article which will appear in a future issue.

The Main Difficulty.

As regards "ease of adjustment to the correct working setting when finished," we must begin a more detailed examination of the design to appreciate just how the main difficulty here has been overcome.

Now almost the most important feature in any moving-coil loud speaker is the suspension of the diaphragm round its edges and the means of adjusting things so that the moving coil is perfectly centred in the gap in the field magnet, in order that it may move to and fro without rubbing anywhere, and it is here that so many of the previous designs have failed hopelessly. Endless troubles may be met in trying to overcome the inherent difficulties at this point, and many people seem to have gone completely astray.

It is usual, of course, to suspend the paper cone by means of thin, soft leather, rubber, oiled silk, etc., at its edge, and it has been found extremely difficult to get things just right here, for not merely is there the difficulty of getting a suitable amount of tension into the suspending material, but there is the fact that these materials are very prone to sag, stretch or perish, and to change in tautness with the weather, so upsetting the adjustment which has been obtained. One



The wooden ring stuck down upon the piece of special suspension leather.

way out of the difficulty is to use a rather stiff and tight suspension, but this restrains the motion of the cone in an objectionable way.

Many schemes have been tried for overcoming this trouble, and also the centring difficulty, the expedients suggested in this latter detail being particularly numerous, but in most cases not too successful, since most have been difficult to adjust, difficult to make, or bad from the point of view of quality of reproduction.

Accordingly, it was decided that something entirely fresh was needed for the adjustment of both the tautness of the suspension and the centring of the moving coil, and after many days this was found in our old friend, the drum.

A Simple Way Out.

As everyone knows, a very simple screw adjustment scheme is used for bringing a drumhead to the desired state of tautness, and it has been found that a form of this same method can be applied with great success to the adjustment of the suspension of the cone of our moving-coil speaker.

This device has been incorporated in the final design, and has proved highly successful, removing all the difficulty from the operation of stretching the suspension material, and also enabling it to be readjusted if it sags or is affected by damp or extremes of temperature. The whole operation can be performed in a few moments, and without any special skill, since it is merely a matter of turning some adjusting nuts.

Although the scheme was first thought of as a good cure for the suspension adjustment difficulty, we soon found that it possessed a further unsuspected virtue, namely, it actually provided a well-nigh perfect centring adjustment, and so solved two awkward problems at one stroke. To see how this comes about we must go a little further into details and understand how the special tensioning device works. Briefly, this is as follows: Round the edge of the paper cone there is an area of soft thin leather, and behind this is arranged a wooden frame carrying a ring which can be drawn forward by means of adjusting screws until it presses into the leather all round, and so stretches it to any desired degree of tautness.

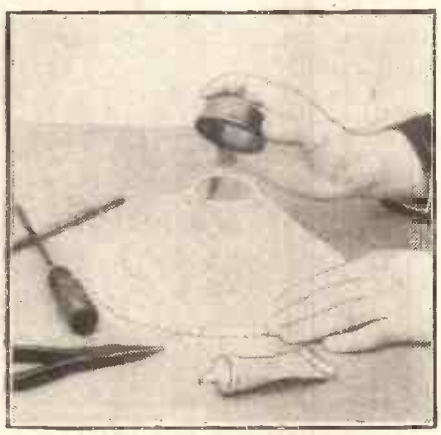
Easy Centring.

Now there are four adjusting screws provided for this purpose, and since they are equally spaced round the loud speaker it is obvious that by tightening them up slightly unequally it is possible to cause the cone to tilt very slightly up or down or to right or left, and so centre the moving coil in its gap with great accuracy, an operation

Sticking the edge of the cone to the suspension leather. Be careful to press all the little serrations down into proper adhering contact.

which is very easily done by looking into the front of the speaker and noting whether there is an equal clearance all round inside the moving coil. The acual tilting of the cone involved, of course, is extremely small, and there need be no fear whatever of any ill effects from unequal tensioning of the leather suspension.

The condition at which you should aim in adjusting the suspension is this: The slack should *just*, and only just, be taken out of the leather, and it must *not* be really tight. On the contrary, the cone should be quite free to move in a dead and "floppy" sort of way, so that you can make it swing in and out by blowing into it strongly. Do not be alarmed, by the way, if you find that in putting the loud speaker together you have accidentally stretched the leather too tightly even before the tensioning ring is brought into use. The remedy is very simple. Bring up the ring and screw it forward until it stretches the leather very tight indeed, and leave it so for a few hours. At the end of that time you will find that it has stretched considerably, so that when you



When you stick the moving coil to the apex of the cone be careful to get it on quite square and true.

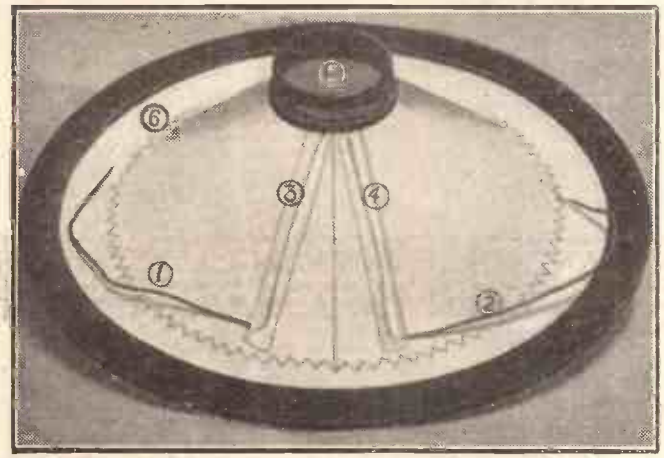
(Continued on next page.)

HOW TO MAKE A MOVING-COIL LOUD SPEAKER.

(Continued from previous page.)

release the tensioning ring a little the leather will be quite slack.

It now remains to run briefly through the actual constructional details, and then you will be ready to start. First of all, examine the wooden assembly, and you will see on the back of the main frame a flat wooden ring held in place by a large number of small screws. Take out these screws, and remove the ring, and smear it thickly with Seccotine all over the surface which was against the main frame, i.e. so that if you were now to put it back it would be Seccotined in place as well as held by the screws. Put the ring aside for a few moments.



The finished cone and suspension assembly, with the moving coil in place and the leads brought out. 1 and 2 are the flex leads, 3 and 4 are the thin leads from the coil stuck down under paper strips, 5 is the moving coil while 6 denotes the ring of suspension leather.

Don't Rush It!

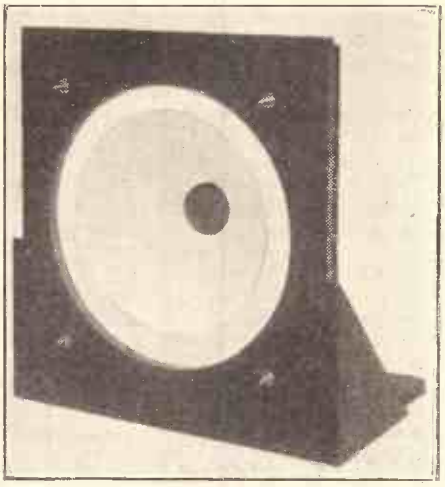
Now take the sheet of soft leather and spread it out as evenly as you can on a smooth table. Next take up the ring again and place it, sticky side downwards, on the leather and press it well down all round. While you are doing this see that the leather is evenly drawn out under the ring without any wrinkles or noticeable slackness anywhere, but do not draw it out too strongly. You do not want the leather to be at all tightly stretched. Put some heavy books on top and leave everything to set for a few hours, preferably over night (it is a great mistake to hurry any of this work. Give the adhesive all the time you can).

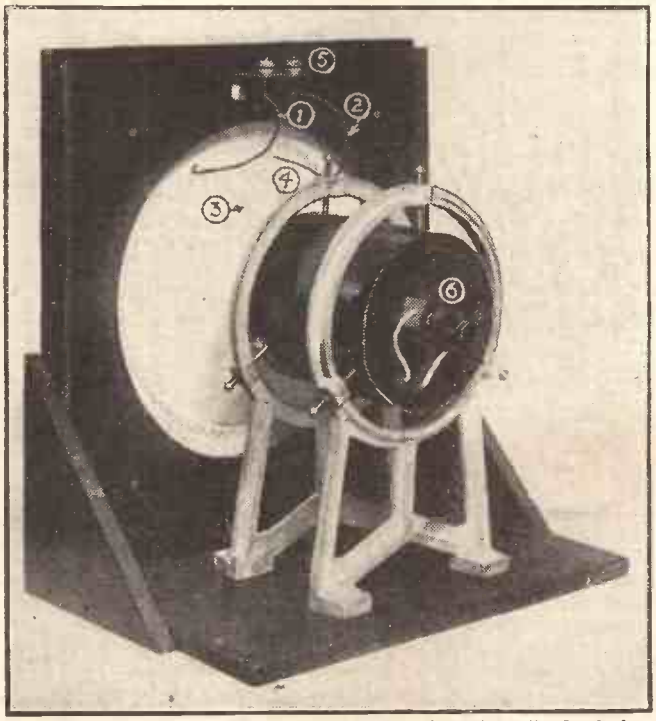
This being done, you can next turn to the prepared piece of paper and proceed to the second step, which is to stick the two straight edges together to form the cone. Seccotine the two overlapping edges in a band about a quarter of an inch wide all the way down, and stick them together, pressing them carefully all the way with the fingers. Keep on squeezing them together until they begin to adhere firmly, and then set the cone aside to dry.

It will be sufficiently set in about half an hour, and then you can go on to attach the moving coil to the small end of the cone, again with Seccotine. Use plenty of adhesive, and smear it liberally on both the paper and the inside of the sloping shoulder of the coil former. Next put the coil in place and take great pains to get it on square and level, then put a book on top to keep a little pressure on it and leave everything to set for, say, an hour. At the end of this time run more Seccotine all round the join between the paper and the coil former, put the book on again and leave the assembly over night to set thoroughly.

Next day take the ring and leather portion and cut carefully all round the outer edge of the ring with a pair of scissors, removing the superfluous leather. Place this on a flat surface with the ring upwards and leather downwards. Now take the cone and smear plenty of Seccotine on the front surface of all the projecting paper points round the edge. Next place the cone carefully in the middle of the stretched leather and press down all the Seccotined points round the edge, continuing to do so until they begin to stick firmly to the leather, and then put it all aside for half an hour to dry, again with a book on top of the coil as a weight.

Now draw each of the two projecting ends of the coil out straight (you will find several inches of wire left over for the connections), and run them down the side of the cone about an inch or an inch and a half apart, and stick over the top of each a narrow strip of paper running down to the very edge of the cone. Stop about half an inch from the edge of the leather, however, and cut off the fine wires. To each solder a piece of light single flex about six inches long, then stick down the rest of the paper strip so that the joint is covered and only the remainder of the flex is left projecting. Again put the assembly aside for a few hours to set properly, first going over all recently stuck joints and squeezing them firmly together.





A general key to the completed speaker assembly. 1 and 2 are the flex leads from the moving coil, 3 and 4 the leads stuck down under paper strips on the cone, 5 indicates the input terminals, and 6 the field current terminals.

Final Assembly.

When you are sure everything is well dried take the assembly once more, and with a small, sharp pair of scissors (curved nail scissors are very convenient) cut away all the leather inside the cone, and pierce holes to match the screw holes in the wooden ring. You can now attach the finished cone assembly to the main framework by replacing the screws through the wooden ring, and take the flex leads to a pair of terminals mounted in a small piece of ebonite attached at a convenient point on the framework. (See photo.)

The remainder of the work will soon be done. All that you have now to do is to replace the loose frame with its tensioning ring, screw down the two metal ring brackets which hold the magnet pot, and fix the pot therein. This last should be done with a little care, so that the moving coil just disappears inside the working gap in the end of the pot, and is roughly centred therein. You have then only to make the final adjustments of tension and centring which have already been described, and the speaker is ready for use.

(See also notes in "Radiotorial.")

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

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

QUESTIONS AND ANSWERS.

A SIMPLE METHOD OF NEUTRALISING.

A. L. M. (Derby).—"My own set is a one-valver, but I have just received a surprise gift of a four-valver from a friend who is leaving this country for Australia. I am having the set, valves, batteries and everything, as they are too bulky for him to take.

"It is a 'neutralised' set, H.F., Det. and 2 L.F., and I don't understand the method of finding the proper position for the neutralising condenser. How should this be done?"

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

Set the reaction control at minimum, and likewise the neutralising condenser. Now, on setting the tuning condensers so that the two tuned circuits are in step with each other it will probably be found that the set is oscillating.

To test for oscillation, touch one of the sets of plates of the tuning condensers (this may be either the fixed or moving, according to the particular set). If the set is oscillating a loud click will be heard in the 'phones or loud speaker every time it is touched, but this click will be absent if the set is re-adjusted so as to throw it out of oscillation.

You will probably find that the set will only oscillate under the above conditions when the two circuits are in tune with each other, and this can be used as an indication.

It is convenient to perform the neutralising operation at some point near the middle of the tuning range. Having made the set oscillate, increase the capacity of the neutralising condenser. (In the case of such condensers as the Gambrell "Neutrovernia" this means screwing downwards).

Test at intervals for oscillation as this is done, and you will presently find that the set has ceased to oscillate, and will not recommence even when the tuning dials are slightly re-adjusted.

Now increase the reaction a little, until the set once more oscillates, and again increase the neutralising condenser setting until oscillation ceases.

Slightly re-adjust the tuning condensers again to make sure that the set is completely stable once more. Proceed in this way, until it is found that the correct adjustment of the neutrodyne condenser has been "over-shot."

Once this point has been passed it will be observed that further increases of the neutrodyne condenser setting no longer stop oscillation, but cause it to become stronger.

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

(It is to be understood that in the preceding notes, where a reaction condenser is spoken of, any form of reaction *control* may be understood).

(*Continued on page* 604.)

BURNDEPT WANDER PLUG—NEAT ON-OFF SWITCH — RAYMOND VARIABLE CONDENSER — NEW MODEL RIPAULT CONDENSER.

* * *

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

BURNDEPT WANDER PLUG.

IN view of the many patterns of wander plug already on the market one might consider it almost impossible to design a new variety. Nevertheless Burndept Wireless Limited have produced an entirely new pattern. Its overall length has been cut down to a minimum, and the result is a very neat article. A screw passing down the centre of the device secures the lead, which can be of practically any gauge of wire. Not the least attractive feature is that the plug has a most excellent gripping power in the socket of any battery. The plug can be supplied in any one of seven different colours and the retail price is 2s. 6d. per dozen.

NEAT ON-OFF SWITCH.

An on-off switch of the push-pull variety, which strikes us as being more than usually robust, is the improved R.D. 39 type, due to the Jewel Pen Co., Ltd., of 21-22, Gt. Sutton Street, London, E.C.1. It can be panel mounted by means of one hole, and occupies little space. The contact springs are unusually thick and springy so that, although the action of the switch is quite easy, the contact is very definite and clean. The two terminals are widely spaced and accessible. As the makers say, there is never any doubt as to whether you are on or off with this switch, and we are inclined to agree with them when they add that at the popular price of 1s. 6d. they feel sure that the switch will have a big sale.

THE "LORIODAPTER."

A complete trickle charger at 4s. 6d., readers will agree, sounds something of a bargain but this is the price of the Loriodapter due to Messrs. A. W. Stapleton, 19a, Lorrimore Buildings, Lorrimore Street, London, S.E.17. It is for use only with D.C. mains and is a very simple arrangement. It consists of an adaptor device fitted with two leads. You remove the lamp from an ordinary lamp holder and replace it by the Loriodapter and then insert the lamp in the Loriodapter. You can then join the two leads to an accumulator, making sure that they are the right way round, and then you have the battery in series with the light and enjoy, while using the light, the benefits of free charging.

Of course, the current available will only be that taken by the lamp in use, and this will be fairly low in the case of the ordinary metal filament half-watt variety. But at no very great cost you can leave the one light on throughout the whole of the twenty-four hours and provide a trickle charging

(*Continued on page* 608.)

Come on and dance—

TO LISSEN'S NEW PORTABLE GRAMOPHONE

LISSEN has entered the gramophone trade—with a determination to make good in it. The first productions are two portable gramophones in different price fields. These are LISSEN'S first contributions to the gramophone buying public. LISSEN has got to make good in gramophones right from the very beginning, and you can be sure therefore that there is fine value for money concentrated in the two portable models illustrated on this page.

TAKE A LISSENOLA PORTABLE WITH YOU ON YOUR HOLIDAYS

Do this year what you may never have done before—take a portable gramophone with you on your holidays, and be sure it is a new LISSENOLA portable. On the river, in the car, in your garden, use it indoors. You can take the LISSENOLA portable gramophone with you everywhere. The large model is better than many indoor table grands sold at double the price.

THE LISSENOLA portable will happily pass away many of your leisure hours, no matter where they may be spent. The range of tone reproduction is wider in the LISSENOLA than in any other portables sold at double the prices, because the horn in each LISSENOLA is longer than any portable horn, except the most expensive kind. There is a fine sound-box fitted to each LISSENOLA model. The motor is strongly made and silent running. Fittings are bolted on, not merely screwed in. They therefore do not come loose. Heavily nickel-plated fittings through- out. Case is covered in black morocco grain leather cloth. Every LISSENOLA portable is compact, easy to carry, light, handsomely finished. The lid of each machine carries eight 10 in. records. Each machine plays up to 12 in. records.

Should your music dealer be unable to give you prompt delivery ORDER AT ONCE DIRECT FROM FACTORY. Kindly give dealer's name and address. State machine required. Remittance may be sent with order, or the machine will be sent by return C.O.D. merely on receipt of your order on a postcard.

7 DAYS' APPROVAL

If you are not entirely satisfied with your LISSENOLA Portable Gramophone after trial you can return it to factory within 7 days of purchase, and your money will be willingly refunded in full.

LISSENOLA GRAMOPHONE

THE LISSEN TRADITION FOR FINE QUALITY AND BIG VALUE FOR YOUR MONEY IS FULLY UPHELD IN THESE TWO NEW LISSENOLA PORTABLE GRAMOPHONES.

LISSEN LIMITED,
9/16, FRIARS LANE, RICHMOND, SURREY.
(Managing Director: Thos. N. Cole)

LISSENOLA MODEL No. 1
(Thorens motor)
12½" × 10½" × 6"
£2-2-0

LISSENOLA MODEL No. 4
(Garrard motor)
14" × 11½" × 7½"
£3-7-6

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 602.*)

MOVING-COIL LOUD SPEAKER.

R. K. (Landudno).—"Is a baffle board really necessary with a moving-coil speaker, and should a step-down transformer be used with one of the low-resistance type? Also the question of "field" magnet—can any type of current be used for this?"

A moving-coil loud speaker of the type described elsewhere in this issue of "P.W." *must* be used with a step-down transformer between the output terminals of the set and the input terminals on the instrument (the Ferranti 25 to 1 model will be found very suitable).

Again, it is to be understood that all speakers of this type are intended to be used with a "baffle board." This is simply a large wooden board of plywood or other suitable material, not less than ¼ in. in thickness and about 3 ft. square screwed to the front of the speaker. In the centre a hole must be cut the same size as the opening in the front of the speaker, and four other holes must also be bored to enable access to be obtained to the tension adjusting screws.

As regards the supply of current to the field magnet "pot," it will be found that pots can be obtained wound either for running from a 6-volt accumulator (a fairly large one is needed, for the current is rather heavy) or for direct connection to D.C. mains (this latter is the better arrangement of the two). Where A.C. mains are available it is best to obtain a pot wound for 100 or 110 volts D.C. mains and instal a suitable rectifier.

It is hoped to publish some details of a suitable instrument of this kind in "P.W." shortly.

THE "P.W." "RANGE STRETCHER."

J. M. (London, E.10).—"I am making the 'Range Stretcher' in this week's issue (June 23rd). What coils are required for the long-wave stations, and what is meant by the X shown in the circuit diagram on page 559?

"I see also that there is no H.T. negative terminal on the unit. Is that all right?"

Regarding the coils, for the 5 X X range you will require a No. 75 or 100 in the aerial socket, a smaller size giving greater selectivity but somewhat reduced signal strength. For the secondary you will require a No. 200 or 250 centre-tapped coil, a smaller size being recommended if it is desired to tune down to such stations as the aerodrome stations, working on 900 to 1,000 metres.

The point X is marked because of one of the minor troubles which sometimes occur with the split-secondary circuit—namely, what are called parasitic oscillations. It would take up too much time to go into this question very fully on the correct theoretical aspect, so we will concern ourselves with the practical side.

The fact is that in some cases these circuits go into oscillation on very short wave-lengths, being the natural frequency of the two halves of the centre-tapped coil. This does not often happen when the unit is used in front of a plain detector and L.F. receiver, although it has been done before even in such a case.

Where it is used in front of a set which already contains one H.F. stage, it does happen in a certain proportion of cases, so a remedy was provided for these. If you find that the unit is behaving in an erratic sort of way, occasionally going into violent oscillation with a plop and completely spoiling signals, which cannot be controlled by means of the neutrodyne condenser or the reaction control upon the receiver, you may suspect the presence of parasitic oscillation.

The remedy is very simple, being merely the provision of one extra component upon the base-board. This is a 100,000-ohm anode resistance, which can be mounted on the baseboard between the two coil sockets and the panel, where a blank space has been arranged for it.

This is wired into circuit as follows. Take a flex lead from the filament, which goes otherwise to the centre tap on the coil and connect this instead to one side of the resistance. Now connect the other side of the resistance to the centre tap and the job is complete.

As you will see, what we do is simply to connect the 100,000-ohm resistance in series between filament and the centre tap, the point-to-point connections being as follow. Negative side of filament to one side of 100,000-ohm resistance. Other side of 100,000-ohm resistance to centre tap on coil.

It was intentional that there should be no high-tension negative terminal on the H.F. unit. Such a terminal is quite unnecessary in view of the fact that the necessary connection between the batteries is made on the receiving set itself, where H.T. — will be normally wired to L.T. negative or positive.

To provide yet another H.T. — on the unit would merely be to run the risk of shorting the batteries since the connections of the unit may not happen to agree with those on the set it is to be employed with. All that you need to do then is to join the H.T. + terminal to a suitable point on the battery, and not to trouble about H.T. —.

In this way you can be quite sure that it is perfectly safe to use the unit with any receiving set whatever, and that no shorting of batteries can possibly happen.

SPLIT-PRIMARY H.F. TRANSFORMER FOR 5 X X.

S. S. (Caterham Valley, Surrey).—"How many turns of wire, what gauge, etc., shall I need for winding a standard split-primary H.F. transformer for the Daventry 5 X X range?"

For the secondary winding, which is connected across pins 1 and 2, you will need 30 turns of No. 40 S.S.C.

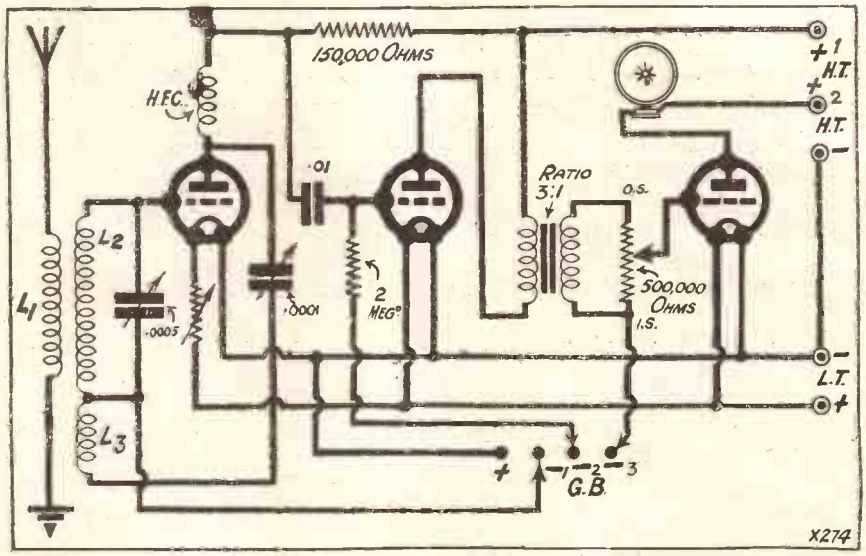
The "neutralising" and "primary" windings should each consist of 75 turns of No. 36 D.S.C., the "neutralising" section being joined across 4 and 3, and the "primary" across pins 4 and 5.

The reaction winding should consist of 100 turns of 36 D.S.C., connected between numbers 2 and 6.

The neutralising and primary windings are wound round the small central former, which is placed centrally inside the secondary. (The reaction section is wound on below the primary.)

GOOD CIRCUIT FOR LOUD-SPEAKER RESULTS.

S. G. W. (Lincolnshire).—"Can you give me a good circuit for three valves capable of really good loud-speaker results, with some form of smooth volume control?



"I have on hand a 150,000-ohm anode resistance and also a 3 to 1 low-frequency transformer. If possible, I should like to use these in the circuit.

The accompanying diagram gives the connections for an excellent set of the kind you require, using the components named.

THE CONSTRUCTOR'S OUTFIT.

"PATER FAMILIAS" (Newmarket).—"My boy is anxious to try his hand at really making wireless sets (not just 'assembling' parts and connecting them) from the descriptions given from time to time in your periodical.

"It seems to be understood that I am going to help him, though I have never done anything of the kind in my life before! What tools shall we need to do the job properly, without incurring unnecessary expense?"

Very few tools are required—anyway, at first—and we should start off by making either a one or a two-valve set, working up as you get more proficient. You will require the following tools.

A soldering iron. (Get one with a good heavy end, not one of the very light ones which are sometimes sold for wireless work, but which will not keep hot long enough to use.)

A tin of Fluxite or similar soldering paste, with directions as to use.

A pair of "cutting" pliers. (Those known as "side-cutting" are very convenient, but the "flat-nosed" variety are invaluable for tightening up small nuts, etc.)

A pair of round-nosed or "bending" pliers, (for making loops in the wire where it is required to bend round terminal shanks, etc.).

A flat file (for cleaning the soldering iron, etc.).

A hand-drill for drilling panels, etc., and set of drills for same.

A couple of screwdrivers, one fairly large, one small.

There are many other tools which will come in handy later, or which can be found in the household tool-box—a vice, hacksaw, etc.—but much will depend on which sets you decide to build.

With the above you will be able to make a good start—and we can't help envying you, for we shall never forget the thrill of making our first set, overcoming the little snags and difficulties of construction, and then the final triumphant "try-out."

A CHOKE OUTPUT FOR LOUD SPEAKER.

T. W. J. (Huntingdonshire).—"I am thinking of installing a proper moving-coil loud speaker for the set, but before I do this I understand that I ought to have a loud-speaker output, so that the windings are not placed directly in the plate circuit of the valve.

"I have seen several of these arrangements described in 'P.W.' at various times, but I should like to know which one you prefer as being the best to use with a 4-mfd. condenser which I have on hand, used in conjunction with a 20-henry choke. What are the point-to-point connections of such a circuit?"

Of the two loud-speaker terminals on your set, one is at present connected directly to the plate of the last valve, and the other one is connected to H.T. positive. The choke circuit which we recommend for your purpose will very easily be fitted up if the following modifications are carried out.

The 20-henry low-frequency choke should be connected across the two present loud-speaker terminals. Then that end of the choke which is now connected (internally) direct to the plate of the last valve should be connected to one side of the 4 mfd. fixed condenser. The remaining side of this condenser should go either direct to one side of the loud speaker or to one of a pair of new loud-speaker terminals.

The remaining side of the loud speaker (or if terminals are to be used, the remaining new loud-speaker terminal) should finally be connected to H.T. negative. This completes the wiring.

With regard to the last connection mentioned above, i.e. from the loud-speaker terminal to H.T. negative, there is no need to take the lead actually to the H.T. terminal. This terminal will be connected to the filaments of all the valves and to earth, so that our purpose will be served just as well by taking a lead from the loud-speaker terminal to any of these points.

In fact, if the loud speaker is to be worked at some distance from the set it is often an advantage not to connect it to the set at all but to connect it to a new earth. (As all earth points are at the same potential—because there is a coductor between them—the lead going into a good earth at any point even outside the house can be considered as going to the earth terminal of your own set.)

WIRELESS AND WEATHER.

D. C. N. (Cardiff).—"Being an invalid I listen in a great deal more than most people, and I have noticed a thing about wireless

(*Continued on page 606.*)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 604.*)

which I have never yet seen referred to in print. It is in regard to the little sizzling noises and crackles which are commonly called atmospherics, I believe.

"These have often interested me, especially since I added an H.F. valve to my set and specialised in getting long-distance transmissions. But, while listening to the atmospheric crackles, I have noticed there seems a curious inter-dependence between these and the weather.

"There is one peculiar rattly sort of atmospheric that I never get except when we are going to have rain. And similarly I have noticed that when we get a sudden change from warm to cold, or cold to warm, it is often preceded by a certain liveliness in atmospherics. Is there any scientific explanation for this ?"

Yes, the atmospheric variations that you have noticed are undoubtedly due in part to the meteorological conditions. The fact that certain weather changes are accompanied by characteristic outbreaks of atmospheric disturbances has also been noticed previously.

The whole subject is a very interesting one, but although ambitious attempts have been made to work out the relation between the atmospheric and approaching weather, the subject is by no means fully understood.

It is interesting to note that a year or two ago an absolutely continuous watch was kept for several months, in various parts of the globe, in an attempt to discover by means of direction-finding apparatus whether atmospherics were world-wide in their effects, or only of local character; and if the former, in what part of the world the disturbances generally arise.

Although much information of great use was obtained, and although it was definitely settled that certain forms of atmospherics were heard simultaneously in places thousands of miles apart, the main object of the test, which was to discover some means of overcoming atmospheric disturbances, was not accomplished.

SWITCHING OVER TO 'PHONES.

D. D. W. (Kentish Town, London, N.W.).—"The set is quite a simple straightforward loud-speaker one, which I built from a diagram sent to me by the Query Department about a year ago. Before that, the aerial lead was connected to a tuning coil, but the Query Department advised me to use two coils, one with the tuning condenser across it, and the other a smaller one to which the aerial lead was connected.

"The only trouble with the set is that I have the accumulator maintenance service for it, and the day on which the man calls for the accumulator is a bad one from a listening point of view, because I do not get home till late in the evening and my mother cannot listen-in during the day. She has been worrying me to let her listen-in on the 'phones, and if you could tell me of a simple way of switching over to 'phones this would get over the difficulty.

"Can such a scheme be worked without much expense or trouble ?"

Yes. It is quite easy to arrange for reception on 'phones only, and all that you need extra in the way of apparatus is a crystal detector and two terminals. These two terminals should be mounted in some convenient position near the tuning coil.

The crystal detector also should be accessibly mounted on the front of the panel and then one side of the detector should be connected to that side of the tuning coil which is not connected to filaments or earth. The other side of the detector should go to one of the new terminals.

The remaining new terminal is then connected to the earth terminal on the set. This completes the additional wiring.

To listen-in on 'phones when the accumulator is being charged, all that you have to do is to connect the telephones to the new terminals. There is no need to alter the tuning or to make any other adjustments. Simply connect up the telephones and listen in.

When you want to use the set with the accumulator connected again, simply remove the 'phones from the terminals, and the valve set is then connected up in the ordinary way; the crystal detector or the additional terminals will not affect your reception at all.

As a matter of fact, no particular damage would be done if you left the telephones connected while the valve set is working, but the results would not be so good as when the set is restored to its original form—which is done by removing the 'phones—so that this simple form of bringing in the 'phones can be recommended for general use where such a modification is required.

A COUNTERPOISE EARTH.

"HUMMING NOISE," (Burton-on-Trent).—"I am told that I should try a counterpoise earth for the humming noise which has been

(*Continued on page 610.*)

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good" ?

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

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

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

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

NEWS FROM SAVOY HILL.

(*Continued from page 592.*)

Gloucestershire, and inspired by the annual fair held in Gloucester. Winifred Fisher (soprano) will sing, with orchestra, Sir Herbert's work entitled "A Gloucestershire Song Cycle," the words of which were written by F. W. Harvey, a Gloucestershire poet, in addition to other items by some of the composers already mentioned.

"Something in the Air."

Harold Simpson, author of the "books" of many famous revues, including "The Nine O'Clock Revue," "The Little Revue," "Dover Street to Dixie," and of the words of "Four Songs of the Hill," which includes "Down in the Forest," set to that charming music by Sir Landon Ronald, has written a special revue entitled "Something in the Air," which is to be broadcast from 5 G B on Wednesday, July 11th, and from London and other stations on the following Saturday. This is not his first radio work by any means, several revues by him having been produced for the microphone with Stanley Holt, his musical collaborator.

Broadcast Education in Scotland.

The thorough efficiency with which those in charge of broadcasting in Scotland are tackling their jobs is again evidenced by the determination to interest school teachers in the most practical way in the special transmission designed to supplement work in the classrooms.

This takes the form of a series of special demonstration transmissions for the benefit of teachers attending the Summer School at St. Andrews in July, when the teachers will be able to judge for themselves the utility of what the B.B.C. is attempting to do.

For the first demonstration on July 10, a simple French lesson will be given by Mlle. Pontet, and everything will approximate as closely as possible to the conditions under which the average schoolclass listens, even to the extent of the teacher conducting follow-up questions in the usual way. This demonstration and subsequent lessons on "Border Ballads" and "Music" will, it is hoped, convince new teachers, and the few who may still be sceptical, of the immense value of school transmissions.

Some Interesting London Talks.

Switzerland, most popular among the holiday playgrounds of Europe, has its place in the next of the series of talks on Holidays Abroad, arranged by the London Station for Tuesday, July 10th. Every year more and more people are visiting the Alps for their summer vacation, and those who may soon be going for the first time, or may like to learn something of the lesser known, but well worth considering parts of the country, will find much that is interesting and indeed valuable in the talk to be given by Mr. Douglas B. Connah, who knows his subject inside out, having acted, on many occasions, as a practical guide.

On the same evening the second of her series of talks on "Life in the Dominions" will be given by Miss Ross-Hume, who has chosen the title of "Women's Life in New Zealand," which promises to be, like her first talk on Australia, eminently suited to intending emigrants, as well as of absorbing interest to listeners generally.

APPARATUS TESTED.

(*Continued from page 602.*)

sufficient for the majority of outfits employing the modern economical dull emitters at but little cost.

The leads on the Loriodapter are supplied with ingenious combined wander plugs and spade terminals, so that they can be joined either to an H.T. accumulator or an ordinary L.T. battery. We have found the Loriodapter useful for one or two other purposes than for those for which it was produced. One frequently desires to take current from the mains and have a lamp in series for safety or other purposes. For instance, this is sometimes necessary in the case of moving-coil loud-speaker field windings

RAYMOND VARIABLE CONDENSER.

At one time, and not so very long ago at that, variable condensers were very expensive and, for the most part, very unsatisfactory components. It is comparatively recently that most of the "snags" have been eliminated and prices brought down to reasonable levels. Many constructors will remember that for something round about £1 one could in, say, 1925, purchase an electrically efficient variable, but one which was at the same time full of mechanical defects. We have always pointed out that in the variable condenser mechanical perfection is a primary consideration. Indeed, it is one of the very few essential radio devices which relies for its usefulness on its mechanical action.

We were reminded of these "obviousities" by the arrival from Messrs. K. Raymond (well-known "P.W." advertisers) of a variable condenser which, complete with a nice, large dial, retails at 7s. 6d. And, shades of pre-broadcasting days, this most attractively priced article has ball bearings, a flexible "pigtail," corrected vanes, metal-end plates, a minimum of solid insulation and all those other little points one looks for (and sometimes, let it be whispered, in vain) in a modern production of this nature.

There are three capacities available at the above price, viz. ·00025 mfd., ·0003 mfd. and ·0005 mfd. The action of the Raymond variable is smooth, it is designed for one-hole panel mounting, it is provided with comfortably-sized and accessibly-placed terminals, and in short, appears to be just that sort of component which will appeal to the home constructor who, rightly, wants good value for his money.

NEW MODEL RIPAULT CONDENSER.

We recently received a new model of the ·0005 mfd. lateral action variable condenser due to Messrs. Ripaults Ltd., of King's Road, London, N.W.1. The action is square law and the movement is excellently smooth and positive. It will be remembered that the principle on which the Ripault lateral action condenser operates is that two sets of rectangular plates are made to intermesh with a lateral action. This is supplied by large cams through the control shaft and, in effect, a gearing of two to one is automatically obtained. This contributes in no small measure to the velvety action of the variable. Another advantage is that plates can easily be removed and the capacity range of the condenser decreased. This feature should appeal strongly to the amateur experimenter.

(*Continued on page 610.*)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 606.)

troubling me for some time. Has this any advantage over an ordinary waterpipe earth, and if so, how should it be connected?"

A counterpoise is a sort of capacity earth connection. It is made of insulated wires, upon the same lines as an ordinary aerial, but is placed near to the ground.

The counterpoise is used in place of the direct earth connection, and is very useful in places where interference from earth currents due to neighbouring electric plant is experienced. The best place for a counterpoise is directly underneath the aerial.

If there is plenty of room for it we should recommend you to use several strands of wire—say half-a-dozen—spaced out like a multi-wire aerial, well insulated, and placed more than seven feet above the ground. All the wires should be connected together just like an aerial, and a common lead should be taken direct to the earth terminal on the set.

Such a method very often sharpens the tuning as well as lessens humming interference.

THE ANONYMOUS OFFENDER.

H. A. (Oxford).—"A boy friend of mine (whose name I do not wish to give) shares with me a two-valve set upon which we hear a lot of whistles. They are very loud and interfere badly with the programmes we receive, so we asked about it, and we cannot find out whether we are causing the whistles or whether it is one of the neighbours. Is there any way of telling?"

The interfering whistle which you hear may be caused by one of your neighbours who is allowing his set to oscillate, or it may be due to the way you are handling your own set. You can soon find this out for yourself as follows.

As soon as you hear a howl take your hand away from the reaction control (whether this is a reaction condenser or a reaction coil does not matter), but keep one hand upon the *tuning* condenser. Slowly turn the tuning condenser dial and note particularly whether this has any effect upon the sound of a whistle.

If, as you turn the condenser (either to the right or left), the whistle gets shriller and shriller the further you turn, the trouble is due to the fact you are using too much reaction on YOUR set. If however, the whistle does not go any higher, but keeps the same note, and simply gets possibly a little weaker or a little stronger as you turn the tuning dial, the interference is not caused by your own set, but by one of your neighbours.

AN EFFICIENT EARTH CONNECTION.

"CRYSTAL SET USER" (Walton, Liverpool).—"I was surprised the other day to see it stated in print that the earth lead was as important as the aerial. Is this true, and if so what are the important points to watch with regard to the earth connection?"

Yes, it is true that the earth connection is quite as important as the aerial, because the earth connection is really a part of the aerial circuit and therefore it is impossible for the latter to be good if the former is not.

The object of the earth connection is to obtain a really good contact between the buried "earth" or the water pipe and the moist soil surrounding it. (The moisture is essential for good connection or otherwise resistance at this point will be high.)

Bearing the foregoing in mind it will be seen that the chief point about the earth connection will be to use short direct wiring, with as few joints in this as possible. There should be a good sound contact from the earth terminal of the set via a stout wire direct to the earth plate itself, or to the water tap connection.

If the lead is taken to a water pipe it is essential that no paint be allowed to remain on the pipe where the joint is made. In dry weather a buried earth plate should be kept moist by means of water poured over it.

APPARATUS TESTED.

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WET L.T. BATTERY.

Some time ago we mentioned in these columns that we had on test low-tension batteries of the sac Leclanché variety. These we received for the purpose from the Wet H.T. Battery Co., of 12-13, Brownlow Street, London, W.C.1. We have had two complete batteries under observation, each consisting of two cells assembled in a wooden cabinet. The one outfit, complete with electrolyte chemicals, is being sold at 26s. 6d. Each cell is similar in appearance and design to the standard H.T. sac Leclanché, which will be familiar to a great number of readers, but it is, of course, of a very much larger size. The complete two-cell battery provides three volts, and the maximum current output is approx. ·25 amp.

One of the sample batteries was placed in use with a two-valve receiver of the Det.-L.F variety, employing valves the consumption of which are almost exactly ·25 amperes. The other battery was used with a one-valve set, the L.T. consumption in this case being ·12 amperes. In both instances, the supply is a complete success; the two-valver has been in constant use for two, three and four hours daily, and at the end of nearly two months the battery still looks as good as new.

The supply of current has been steady and noiseless. A particularly commendable feature of the battery is, in our opinion, the very stout zincs which are supplied. The lives of these will be long, and even when they are worn out replacements are available at the reasonable price of 1s. 3d. each. New electrolyte is but a matter of 9d. a "dose." These batteries should be of great interest to country listeners and should solve the problem of L.T. in many quarters.

BI-DUPLEX SUPER-POWER RESISTANCE.

Messrs. R.I.-Varley have produced a series of resistances incorporating their patent Bi-Duplex windings and suitable for use in H.T. mains units where heavy currents have to be handled. These components are, of course, wire-wound and scientific measures for the dissipation of heat have been taken in the design. When the largest currents encountered in the ultimate stages of super-power valve-driven receivers are handled there is no noticeable temperature rise. The samples tested by us have resistances of 1,000 and 2,000 ohms. The resistance is clipped in a neat holder which can be mounted either vertically or horizontally. On this latter are two accessible and very widely spaced terminals.

The Di-Duplex Super-Power resistances are certainly most excellent productions. The constructor need have no hesitation in including them in his mains unit for they are apparently of the highest possible class.

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—these currents are sent through the primary of the first L.F. transformer of the radio set. Sometimes the detector valve is left in the set, and regulation of its filament makes a sort of by-pass of the plate-filament resistance, thus regulating the volume.

Simplicity.

In the "mystery pick-up" referred to above, all this is done away with. You simply have a needle held lightly in the record groove, without intimate or accurate contact therewith, and electrically connected to the grid of a valve, whereupon a receiver in the plate circuit reproduces the music!

This so-called "mystery pick-up" was invented by Mr. T. W. Case, of Movietone fame, and is described in United States Patent 1,593,690. Mr. Case himself does not profess to understand the exact way in which the thing works, but he expresses the opinion that frictional electricity is generated between the needle and the groove owing to the fairly rapid relative motion.

An alternative theory is that the record is charged to begin with, and the lightly-held needle just "tips" the ridges and takes off a charge sufficient to activate the grid, the "frequency of the ridges" (so to speak) giving the frequency of the note. This type of electrical pick-up consists of nothing more than a short length of wire sufficient to connect the needle and the grid.

Methods of L.T. Supply.

There are now, broadly speaking, three main methods of supplying the filament current for a radio receiver. The original and probably still most widely used method is to employ an accumulator, generally with charger and sometimes with automatic power-control switch; in this way the battery is automatically charged when it is not supplying current to the set.

The second system, which is also gaining favour, uses the so-called "low-tension eliminator" or low-tension mains supply unit. This is essentially a step-down transformer, to bring the voltage to approximately the correct value for the filaments, and then a rectifier and a suitable filter circuit consisting of chokes and condensers.

A.C. Valves.

The third method, and one which has not gained favour so rapidly as might have been expected, is to use the special alternating-current valves, which have electrical characteristics similar to standard valves, but which are designed for operating from a low-voltage source of alternating current which may be obtained from a small step-down power transformer.

It is possible to operate a receiver at high efficiency by any of these methods, but each has features which render it unsuitable in certain conditions.

A.C. "Hum" Remains.

The low-tension mains supply units or low-tension eliminators generally give good service but, in spite of claims to the contrary, I have not yet found that there is in all cases a complete absence of A.C. hum. Moreover, most people already possess accumulators and it means discarding these and purchasing a low-tension eliminator,

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which is usually two or three times as costly as an accumulator-plus-charger. Furthermore, the accumulator-plus-charger, although requiring a certain slight amount of attention, does give *absolutely perfect D.C.* supply and there can be no question of any A.C. hum, since the charger may be disconnected from the accumulator whilst the latter is serving the receiver.

There are many listeners who already use a low-tension accumulator, but when it comes to having this permanently connected to a charger, a certain problem arises. Some listeners use the set continually and are, therefore, constantly discharging the battery, whilst others use the set very little and may therefore be constantly overcharging the battery.

Automatic Power Control.

It is to cope with this problem that a new type of power control relay has been invented. With this relay a full-rate charger is used. The relay automatically turns on the charger when the set is turned off, and turns off the charger when the battery is fully charged. If the set is used a great many hours during the day, the full-rate charger brings the battery back to full charge before the set is used next time.

If, on the other hand, the set is seldom used, the charger does not operate any longer after the battery has been fully charged up. In other words, the charger with this automatic relay switch keeps the battery fully charged at all times, but never overcharges it. In this way the provision of the filament current is reduced almost to its simplest possible form.

How Wired Wireless Works.

I have mentioned once or twice the system of wired wireless which is gaining ground considerably in the United States as well as in other parts of the world, and readers have from time to time asked me how this system is worked.

It is really very simple, and in principle the system consists in feeding the radio-frequency energy into existing lines such as telephone lines or power lines instead of sending it out from an aerial broadcast as in ordinary radio transmission. By using high-frequency currents it is possible to super-impose these upon suitable lines or circuits which are normally carrying other currents, such as telegraph, telephone or power circuits as just mentioned. This can be carried out without interfering in any way with the normal use of these lines.

An ordinary radio transmitter is coupled to the circuit which is to be used as the medium for the transmission of the signals, and the action of the power lines (for example) is merely to serve as a guide for the radio-frequency energy between the transmitting and receiving stations, instead of allowing this energy to be radiated in all directions.

Important Coupling Connections.

The transmitter is generally coupled to the line through coupling condensers, or it may be coupled by means of a wire stretched near and parallel to the power line, but suitably insulated from it. Coupling condensers are better, since they provide greater security and are not affected by atmospheric conditions.

A coupling transformer is connected to the radio transmitter, and the low potential terminals of this are connected (each through a coupling condenser) to the line which is to carry the wired wireless. It is found better in practice to bridge the output of this transformer by a 3-electrode spark gap, the central electrode of which is connected to earth, so that in a case of breakdown or accidental flash-over, no excessive voltage will be applied to the radio apparatus.

Carrier-current operation has an advantage over ordinary wire communication in that it is less liable to interruptions during storms—which, of course, are much more violent in the United States than here. Furthermore, when there is a break in the line, there is often sufficient capacity across the gap to convey enough energy to be picked up at the other end by the receiver.

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. Registered as a newspaper for transmission by Canadian Magazine Post. Subscription Rates: Inland, 17/4 per annum; 8/8 for six months. Abroad, 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.; and for Canada: The Imperial News Co. (Canada). Ltd. Saturday, June 30th, 1923.
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