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THE PAPER THAT MADE WIRELESS POPULAR

Popular Wireless

Every Thursday PRICE 3d.

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Special Features in This Issue

Workshop Gadgets **Television Developments**

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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.

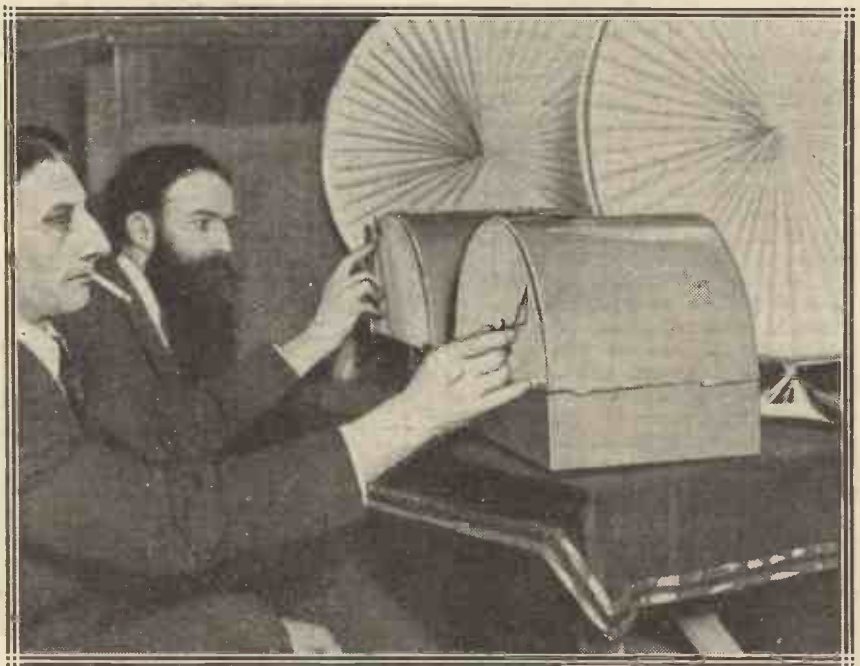
Not having heard this New Zealand wonder I cannot vouch for its warbling abilities, but I am not going to let myself hope for too much from this famous songster. It would be too bad to listen longingly for the Moki-Moki, and then find it was all Hoki-Poki!

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 Reue 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.

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.

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."

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.

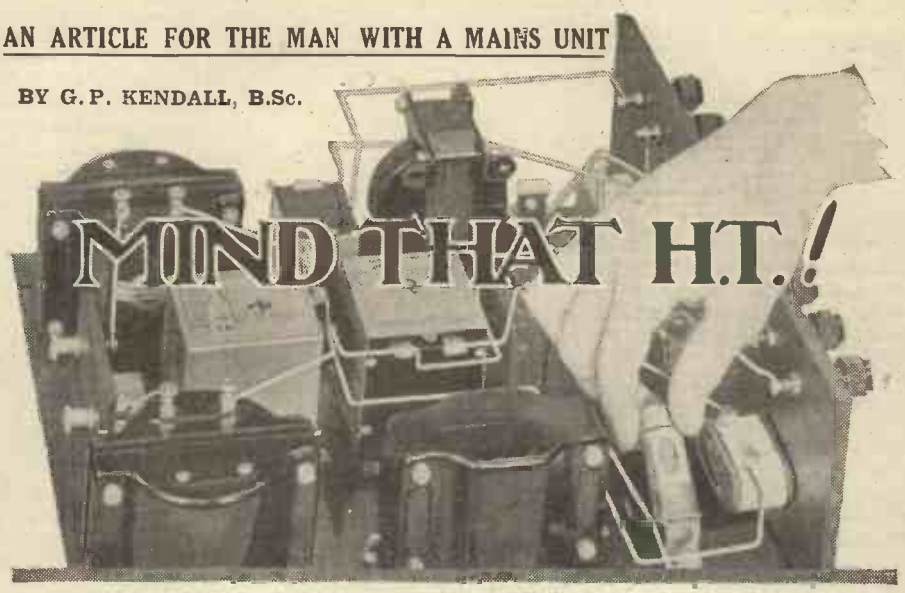
Sure an' I ought to be after tellin' ye that all the above were tuned in *on the loud speaker*. Space does not permit me to mention further details, but I can assure my seventeen-year-old correspondent that he has firmly convinced me of the healthy condition of short-wave reception in County Cork.

ARIEL.

AN ARTICLE FOR THE MAN WITH A MAINS UNIT

MIND THAT H.T.!

BY G. P. KENDALL, B.Sc.



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.

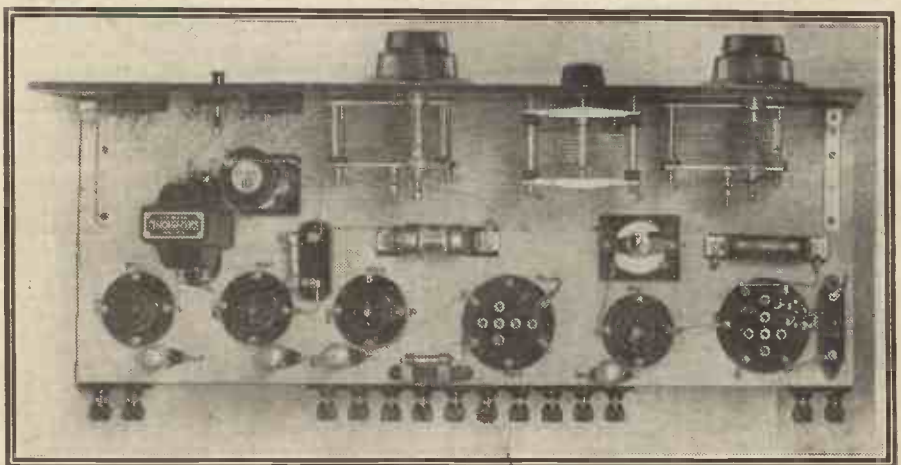
This only produces a reduced voltage when current is actually flowing, and if for any reason no current is being drawn from the eliminator the voltage on each terminal rises to the full maximum available across any part of the internal circuit. This, in the case of a unit for direct-current mains, means 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.

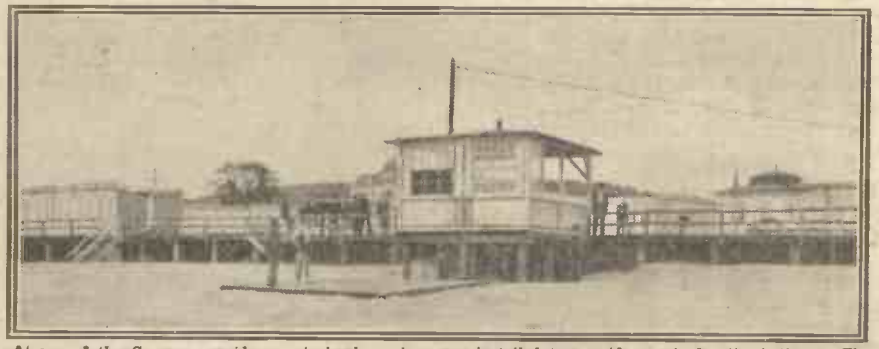
Manchester's new studio will be one of the largest in the country. It will be, roughly, 54 ft. long and 34 ft. wide. London already has this large double-decker studio, but the new Manchester one will be first of its kind among B.B.C. studios by possessing a gallery for the accommodation of listeners.

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,

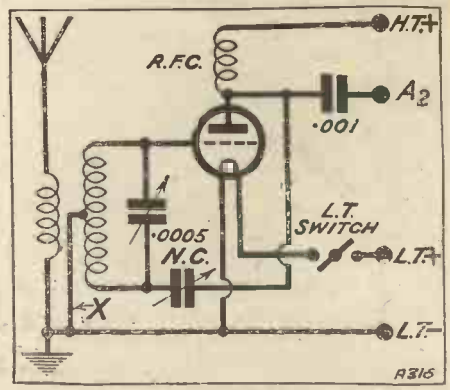
no reaction at all, unless your aerial is a very bad one. As a "counsel of perfection" this is all very well, but most of us feel inclined to ask whether there is a way out of the difficulty which is not so expensive and which, perhaps, does not involve taking on such a big piece of constructional work.

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

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, Camco, 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.)



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,

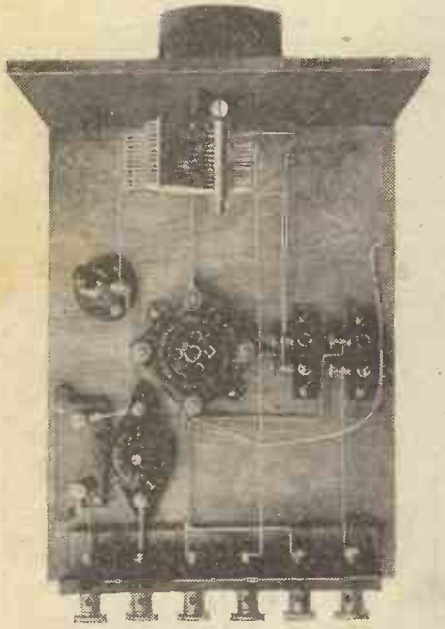
(*Continued on next page.*)

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.

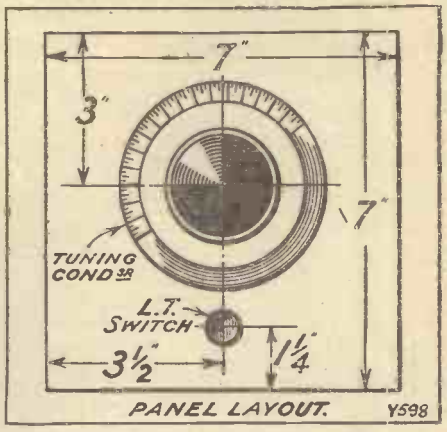
Simple but Efficient.

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.

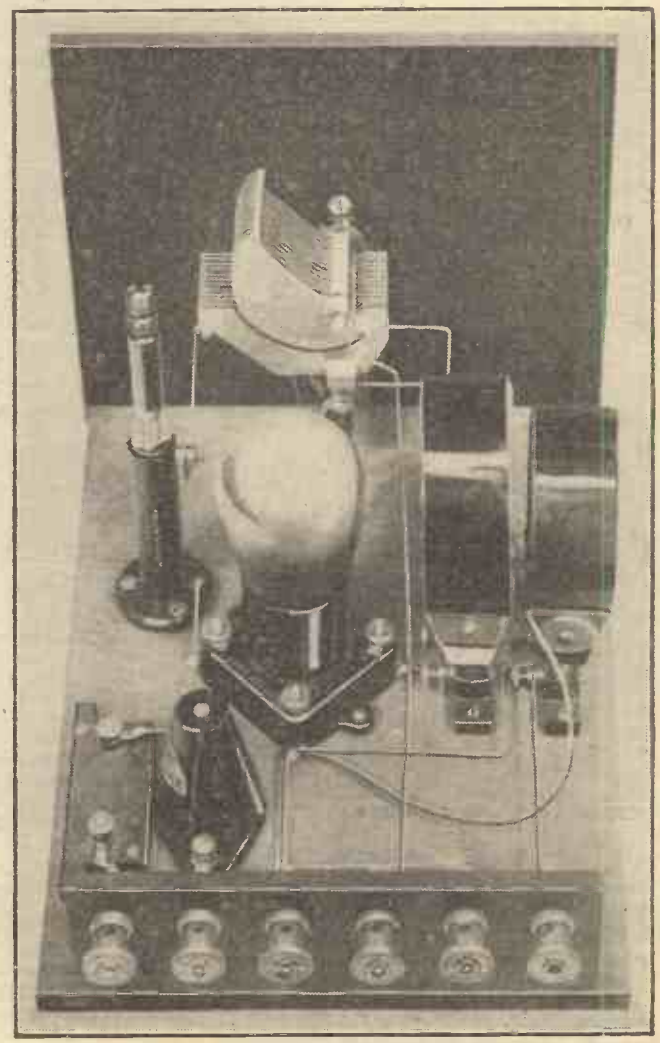
The construction of this little unit is a very simple matter, and you will probably find that you can complete the whole job in one evening without the slightest difficulty. There are only two holes to drill on the panel, one for the one-hole fixing variable condenser (assuming that you use one of that 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

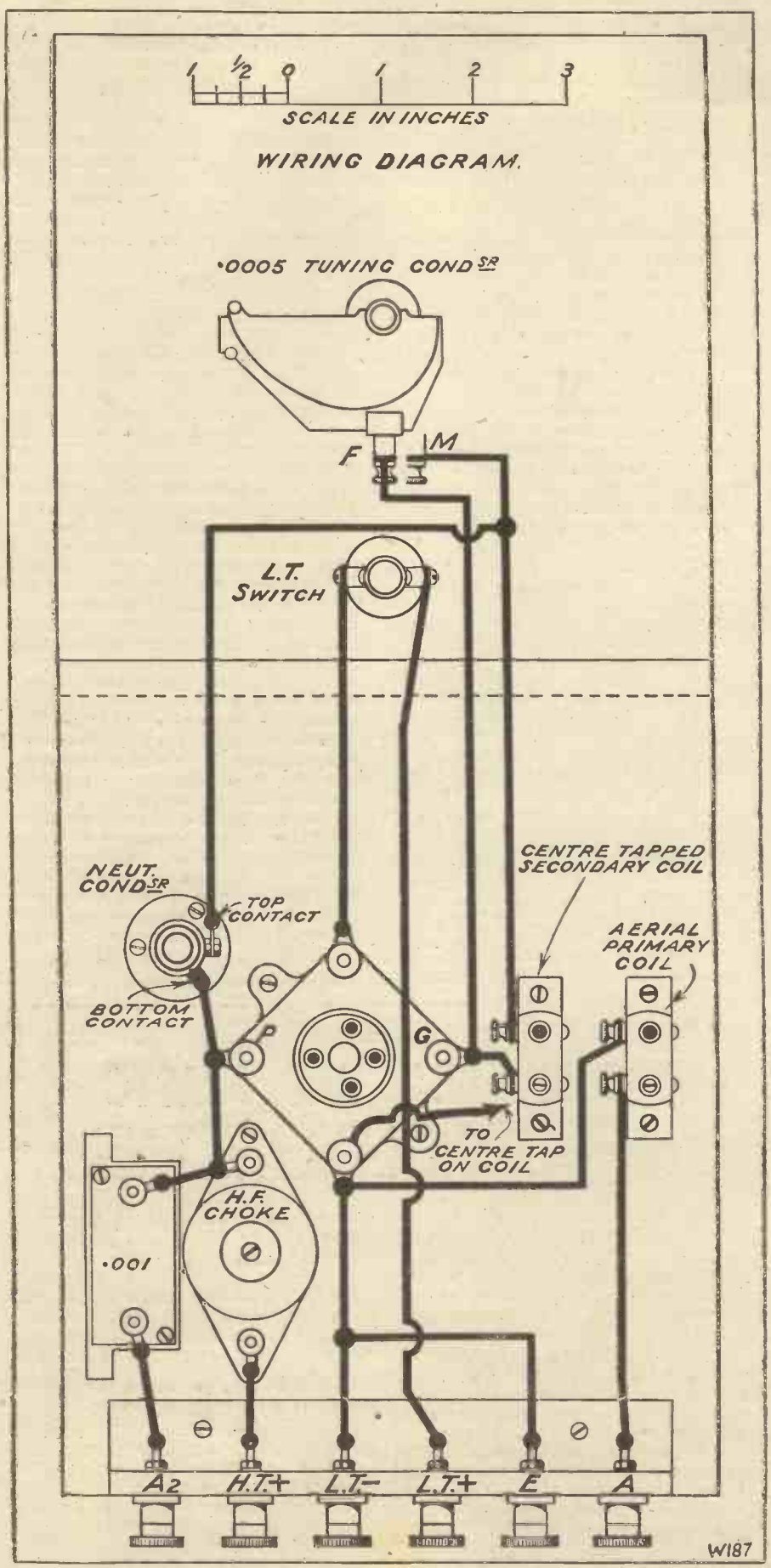


nothing difficult about the wiring up, either, and you can use either bare wire, one of the specially prepared, easy-soldering materials like Junit, bare wire and Systoflex or Glazite, as you wish, and just a little pains taken in seeing that the wires run straight and are nicely spaced from one

(*Continued on next page.*)



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.

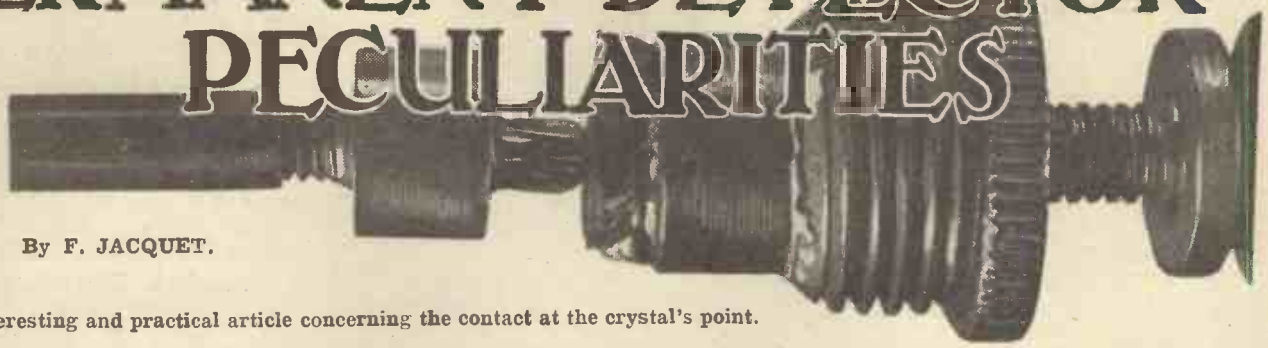
It often happens that some topical talk becomes available long after the programmes have been made up, or that a prominent theatrical or vaudeville "star" is able to accept a one night engagement at short notice. Such items have always been difficult to fit into the programmes, but with a definite time 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.

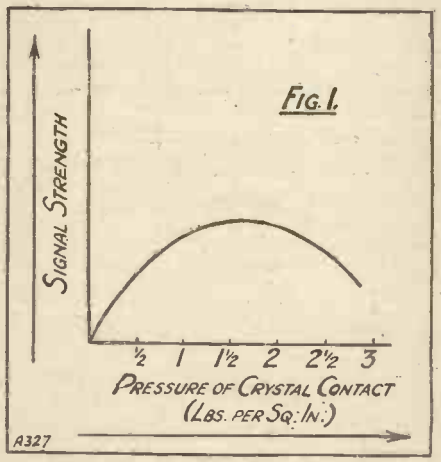
An interesting and practical article concerning the contact at the crystal's point.

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.

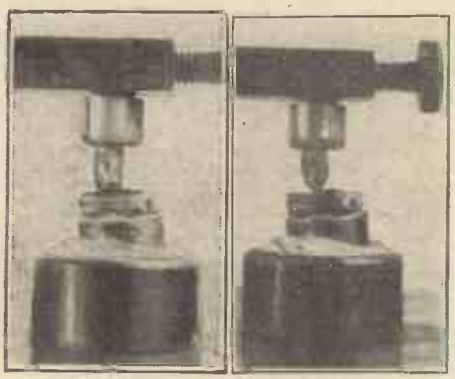


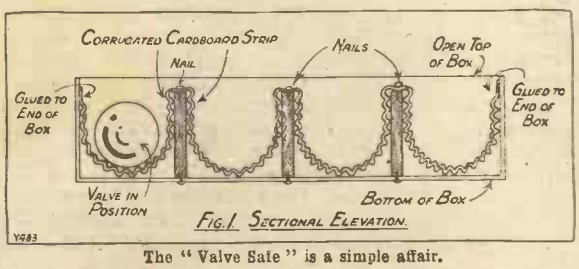
Fig. 3 (to the left) shows the other extreme, and in this case the tellurium is too flat. In Fig. 4 (right) a mean has been obtained, and the crystal is neither too pointed nor too flat, in which condition its rectifying action will be at a maximum

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.

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.

FOR YOUR NOTEBOOK.

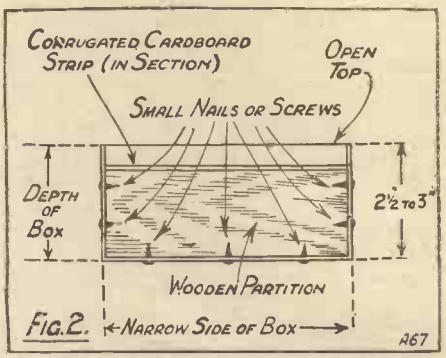
A good earth is just as important as a good aerial, especially if you are using a crystal set.

* * *

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.

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.

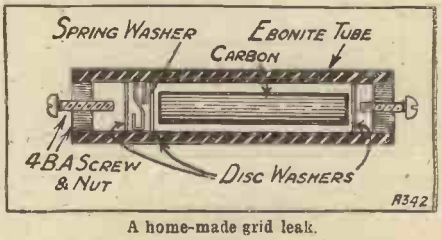
The assembly may be followed from the drawing. The nuts at each end are forced in by first warming the ebonite tube slightly and tapping the nut in.

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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with his Orchestra, relayed from the Hotel Victoria,

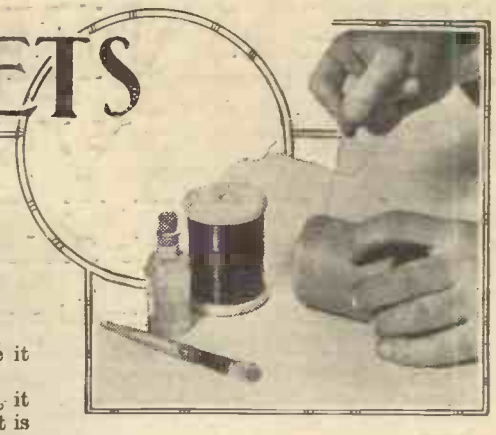
You must not let his exquisite rendering be lost—while he plays see that you use only pure Lissen Battery power for your H.T. The current of this battery is noiseless, smooth flowing, steady, sustained and lasting. It will keep every note of music clear. You will enjoy true tones and natural reproduction throughout. For only in the Lissen Battery do you get the new process and the new chemical combination which produces the pure D.C. for which this battery is famous.

And conveniently for you this pure H.T. current is put into battery form by Lissen. 10,000 radio dealers have it available for you. If, next time he broadcasts you would like to hear Emilio Colombo *really* playing to you ask at your nearest dealers for a Lissen New Process Battery and show plainly by the way you ask for it that you will take nothing else.

60-volt (reads 66)	.. 7/11
100-volt (reads 108)	.. 12/11
60-volt Super Power	.. 13/6
9-volt Grid Bias ..	.. 1/6
4½-volt Flash Lamp,	each 5d.
„ „ „	„ per doz. 4/6

LISSEN LTD., 8-16, Friars Lane, Richmond, Surrey. *Managing Director: Thomas N. Cole.*

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

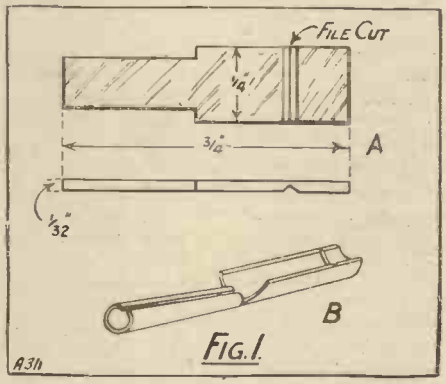


FIG. 1.

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.

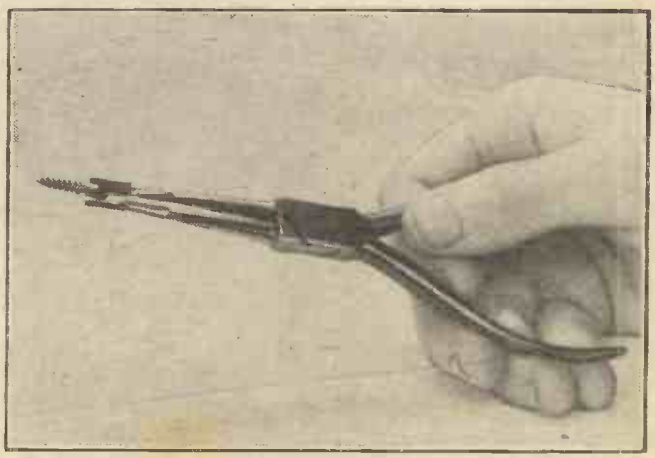
When screwing receiver components on to the wooden baseboard, it happens frequently that if is rather awkward to get the screws slipped into the screw holes. When the lay-out is such that the components are cramped, it is impossible to hold the screw between the fingers and insert it into place, while 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.



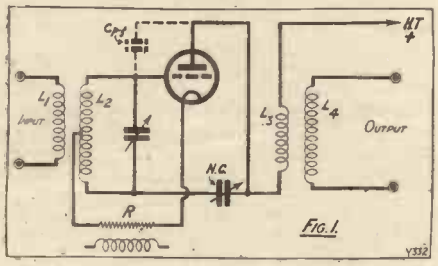
By fitting these simple and easily-made "jaws" to an ordinary pair of round-nosed pliers otherwise awkwardly placed screws can be tackled without trouble.

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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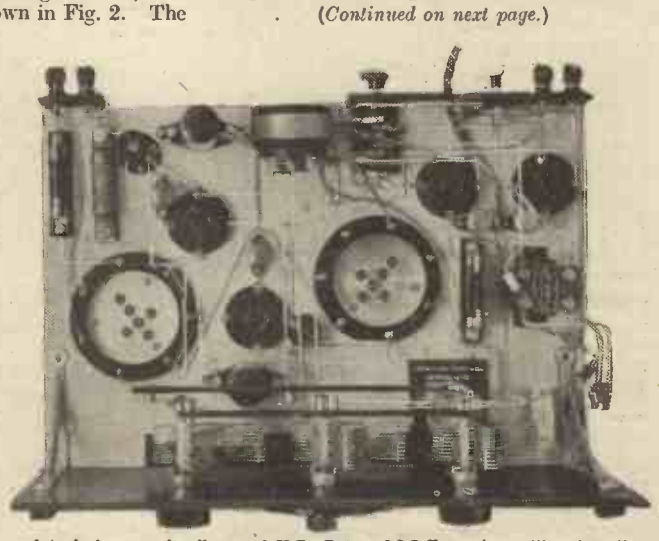


A typical screened-coil ganged H.F., Det. and 2 L.F. receiver with automatic reaction control.

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

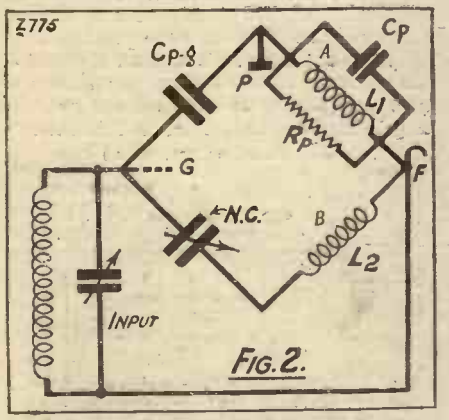


FIG. 2.

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

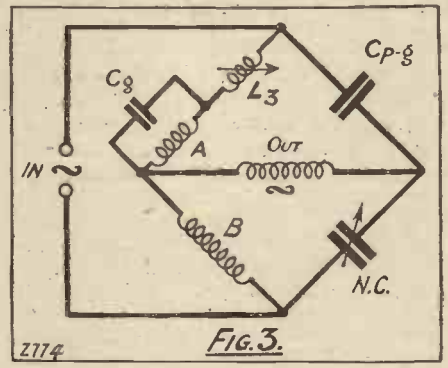


FIG. 3.

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.

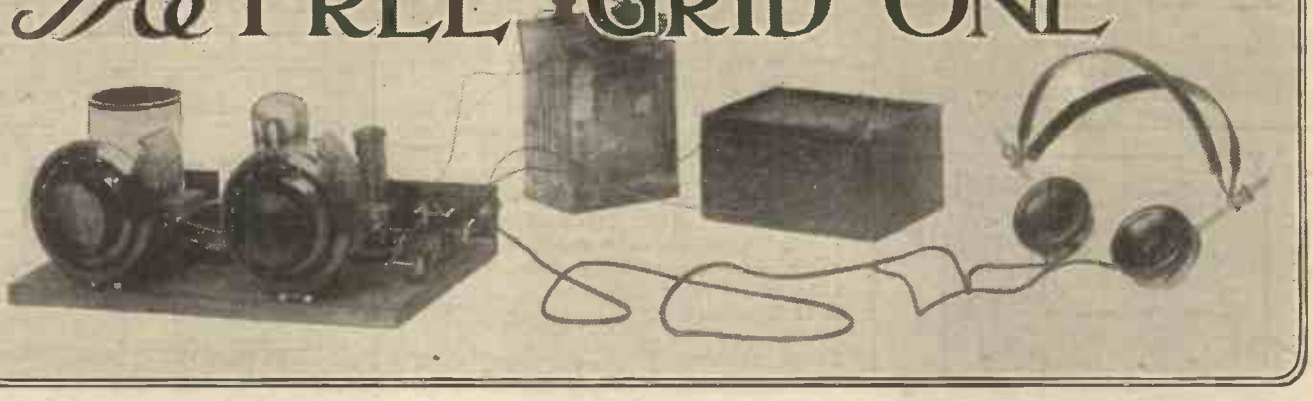
Wood Panels.

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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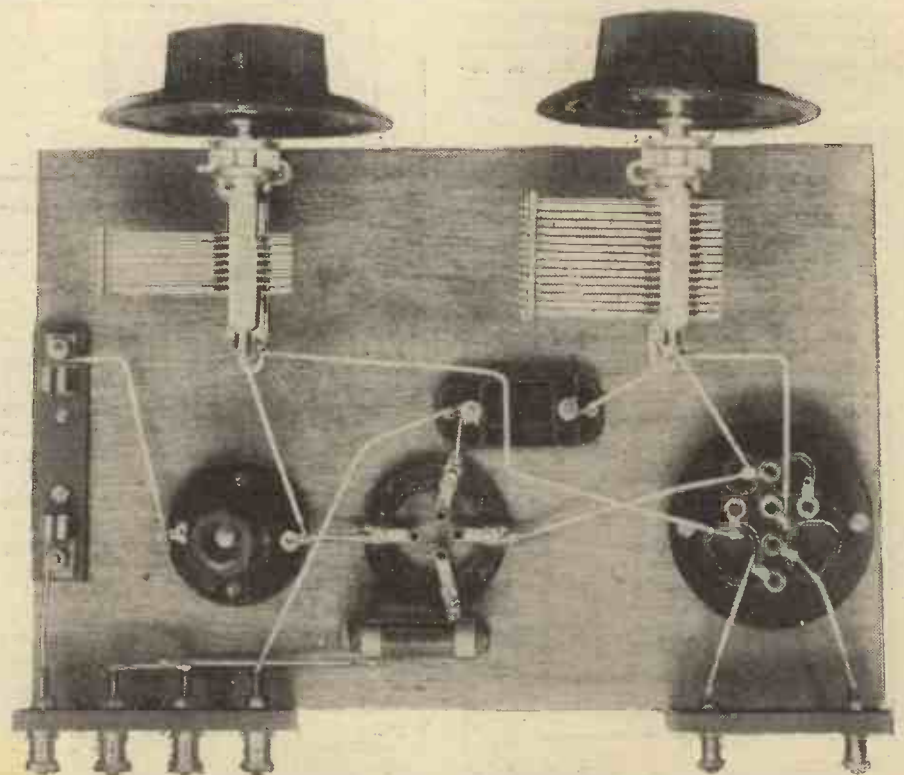

Only fourteen pieces of wire are needed for wiring up this set. Could you have anything more simple to build? And yet it is capable of giving surprisingly good results.

THE "FREE-GRID" ONE.

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would say, for the benefit of those who may wish to add an amplifier on to this single-valve receiver, that any form of

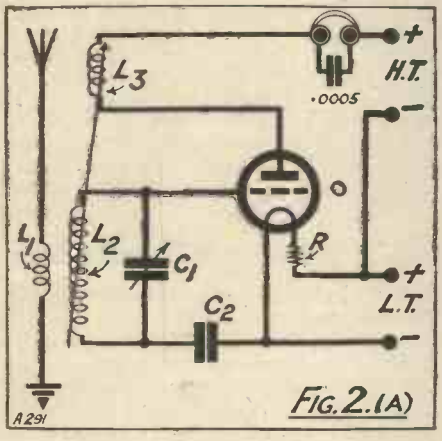


FIG. 2. (A)

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

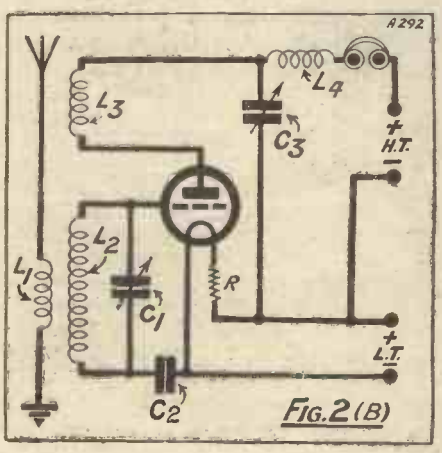


FIG. 2 (B)

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.

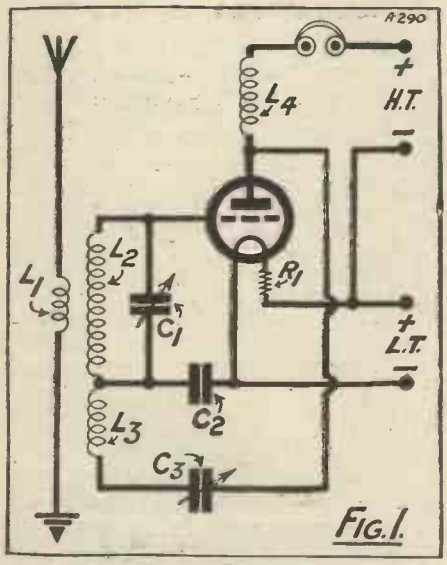


FIG. 1.

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.

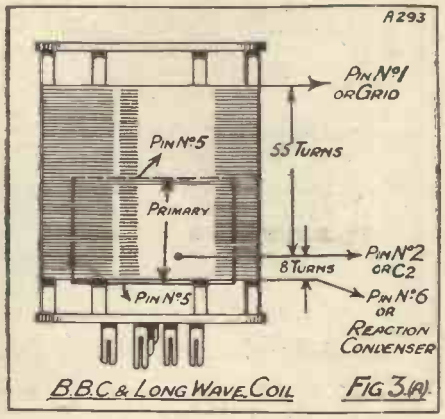


FIG. 3 (A)

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.)

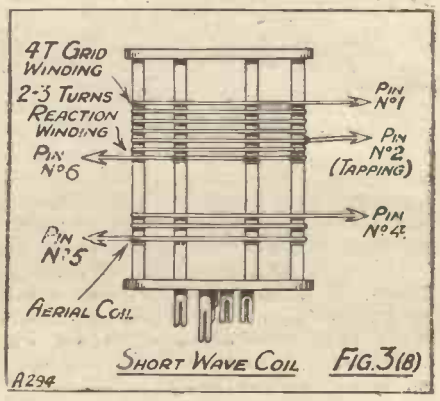


FIG. 3 (B)

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.

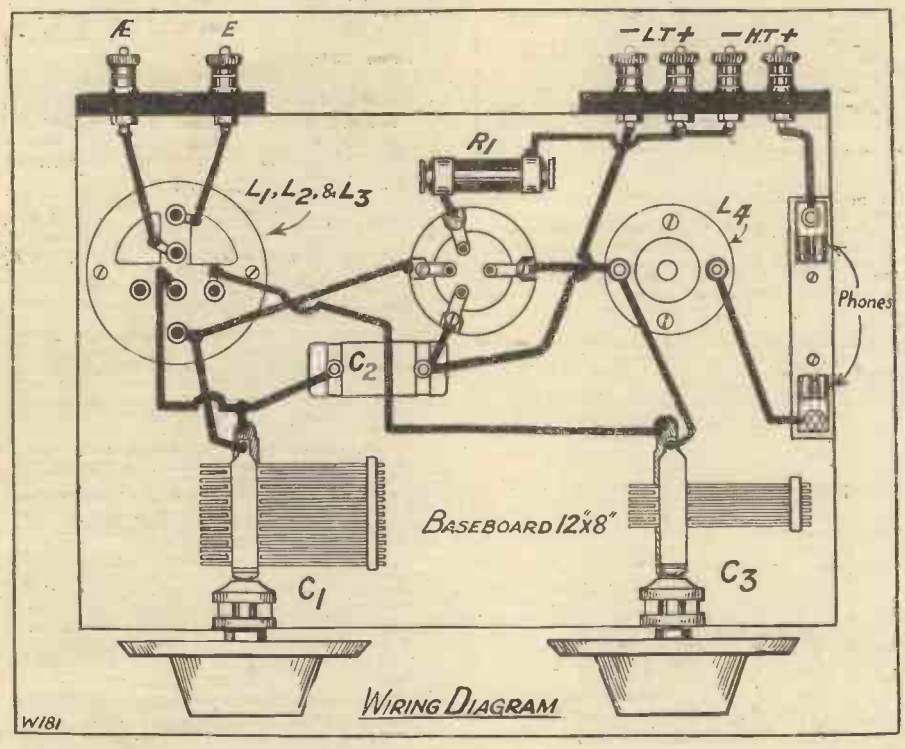
Sketches giving details of the coil are given in Fig. 3, and if you don't want to have the coil interchangeable, you can carry out the winding on an ebonite tube or former, 3 in. in diameter, using the same number of turns. The primary will be wound on a slightly smaller tube, which will just slip inside 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.



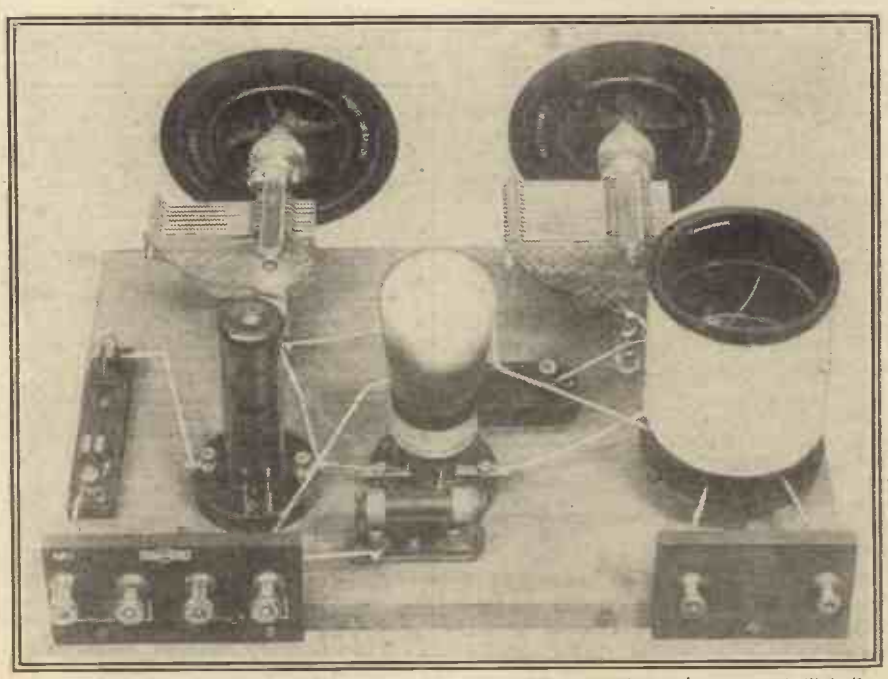
Short-Wave Coils.

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.

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.

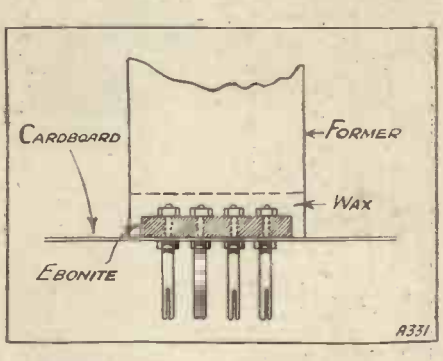
A SHORT-WAVE COIL.

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.

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.

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.

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 '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

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RADIOTORIAL QUESTIONS AND ANSWERS

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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.

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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.

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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.

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