POPULAR WIRELESS, November 27th, 1926. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THE STATION MASTER—By PERCY W. HARRIS

Popular Wireless

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Special Features In This Issue

WHEN X's ARE USEFUL — THE IMPORTANCE OF LAYOUT — SOME COMMON FAULTS

HOW TO MAKE FIXED RESISTORS — AN H.F. INTERVALVE COUPLING UNIT

SPECIAL EIGHT-PAGE SUPPLEMENT FOR THE CONSTRUCTOR

Edited by Percy W. Harris

Our cover photograph this week shows the transmitting plant of W R N Y which is owned and operated by the "Radio News" of America.

For Dull Emitter Valves

NOW that the Dull Emitter Valve has finally ousted the extravagant bright emitter from the market it has been necessary to evolve a new type of Accumulator suitable for two and three-valve Sets. The present day demand is for an accumulator small in size, light in weight, low in price, which will hold its charge for weeks and even several months without attention. The ordinary Accumulator was good enough for bright emitter valves consuming ·75 ampere each. Its plates never had a chance to become sulphated. No sooner was the accumulator charged up than the Set began to drain away its energy. After a week or so a further charge was necessary. But to put an ordinary accumulator to serve a 2-valve Set equipped with Dull Emitters is a waste of money. The plates are almost certain to sulphate if the accumulator is not given a regular charge—whether it is exhausted or not.

The unusual construction of the new Oldham O.V.D. (patent applied for) makes it the ideal Accumulator for small Receiving Sets. Its low initial price, coupled with the few pence only required for recharging, will enable every user to lower his maintenance costs immediately.

Where else can you find these seven features?

Type O.V.D.

2 volts—for use with Dull Emitter Valves. Fitted with the new Laminode Plate. Dimensions 6 ins. by 3 ins. by 2½ ins. 10 amp. hours.

5/6

Charged ready for use
Add acid only

Other Oldham Accumulators

Your Dealer can show you a wide range of other Oldham Accumulators — all made under the Special Activation Process. Ask to see particularly the Oldham H.T. Accumulator, which is made under expanding bookcase principles. With its handsome lid and base, it is the finest H.T. Accumulator on the market. Price 10d. per volt. Catalogues free—write to-day.

1 Charged ready for use

Every O.V.D. is charged ready for immediate use at the factory. It is only necessary to add acid and wait half an hour or so for the cell to be ready for use. No tedious and annoying delay while the cell is put on charge.

2 Laminated buckle-proof plates

The plates are laminated for extra strength and to permit the free circulation of the electrolyte. Standard plates are used which cannot shed their active material. No separators are required.

3 No leaking away of charge when not in use

In the ordinary accumulator the positive and negative plates are closely interleaved together. Some local action therefore is inevitable when the accumulator is standing idle. In the O.V.D. the plates are welded together in sets of three with a generous space between the positive and the negative groups. This eliminates interaction and enables the plates to hold their charge even for months without attention.

4 Large coloured terminals

Even the external appearance of the O.V.D. is distinctive and workmanlike. Note its generous coloured moulded terminals, indicating correct polarity at a glance. A man's size terminal which will grip any wire quickly and securely.

5 Quick charging and slow discharging

Never before has it been possible to combine these two requirements in an accumulator. The usual way to ensure a slow discharge has been to use a thick plate. But thick plates need a prolonged charge. Compare a thick plate, if you like, to a thick mass of absorbent material plunged into a liquid. It will take a long time for moisture to penetrate to its inmost recesses. But cut the material into strips and they absorb moisture at once. This, in non-technical language, is the principle of the Laminode Plate. It is the equivalent of a thick plate, but the electrolyte can flow through it immediately and get to work upon its several surfaces without hindrance. Any O.V.D. Accumulator can be recharged within 8 hours—speedy charging won't harm its plates.

Quick charging and slow discharging *(continued)*

6 Stout glass cell

The glass cell used in the O.V.D. offers further evidence—if such were needed—of the care and forethought put into its manufacture. Crystal clear and robust, it has ample mud space at the bottom to trap all the sludge.

7 Plates made under the Special Activation Process

The secret of the popularity of Oldham Accumulators among wireless enthusiasts lies in the efficiency of the plates made under the Special Activation Process. This process, because it produces a plate active right through, not merely on its surfaces only, gives that smooth unfluctuating current flow that is so essential for good broadcast reproduction. And at the same time it ensures a length of service which is truly remarkable.

Special Activation Process Batteries

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"WELL FOUND"

When the tall Clippers in all their pride raced for the wool and tea markets of the world, they had to be well found and seaworthy.

And being well found didn't end with having good "sticks, rigging, and running gear," it implied a tip top condition from the varnish on the truck down to a clean bottom.

It was attention to details more often than not which decided the issue of these stern chases—the details which, as far as one could see, "didn't matter."

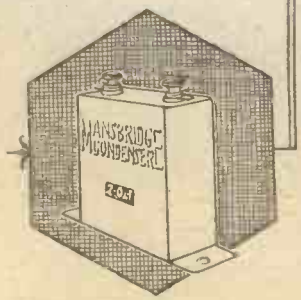
It is, perhaps, a far cry from Clippers to Condensers, but it is certainly a fact that many people regard Condensers as being a detail that "doesn't matter."

And still more numerous are the people who say that cheap condensers seem to give just as good results as expensive ones.

The fact is that cheap condensers do *not* give as good results as expensive ones. If they did, we should not be interested from any point of view in making the more expensive variety.

And the second fact—namely that the Dubilier Condensers sold number more than all other makes put together—points to the fact that the great majority of people value a well-found wireless set and insist on seeing that it is equipped with Dubilier Condensers.

Do you?



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E.P.S. 245

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Now Grannie *can* listen!

"THAT Wireless" Grannie used to say, "was no good—she never *could* hear what 'the man was saying!" That was before the **Brown** Crystal Amplifier came. Now she sits and listens to the Loud Speaker working from the little Crystal Set. For hours and hours! Now she appreciates the boon broadcasting can be. Mostly everyone, now, can work a Loud Speaker from a Crystal Set without the use of a single valve. If you live within fifteen miles of a B.B.C. Station (or eighty miles from Daventry) the **Brown** Crystal Amplifier will enable you to obtain pure, faithful Loud Speaker reproduction from your Crystal Receiver. No Valves. No accumulators. Just the Crystal Amplifier connected to your Set and the Loud Speaker. The only accessory needed is a 4½ volt dry battery. What more ideal way of enjoying the broadcast? You get the results of your friend the valve-user without any of the worry, trouble and expense his accumulators cost him.

Brown

—for faithful Radio interpretation.

See your Dealer about the Crystal Amplifier to-day. Get him to demonstrate it on one of the nine **Brown** Loud Speakers. You'll be sure to want one for yourself.

The H.Q.
20 inches high
2000 or 4000 ohms.
£6 0 0

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120 ohms. £5 5 0
2000 ohms. £5 8 0
4000 ohms. £5 10 0

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An economy which is no economy

FROM hedge to hedge the ploughman slowly cuts the furrow. Yard by yard the gleaming steel turns over the rich brown earth. In one working day Hodge and his two companions may be able to plough a whole acre. Over the horizon is to be found quite a different scene. A fussy little tractor, cutting several furrows at one time, is noisily eating up the ground at an amazing pace. In fifty minutes this machine will do as much work as a man with two horses can do in a whole day.

The tractor works under a big handicap—its initial cost is many times greater than the cost of a pair of horses. But in spite of this, mechanical ploughing is rapidly driving the horse from the land. Sensible farmers no longer look at first cost—they seek results. The extra expense of the tractor is amply justifed by the big reduction it can make in the cost of ploughing and by its superior work.

There are still tens of thousands of wireless enthusiasts who could take this lesson to heart. They are still using bright emitters or foreign dull emitters—like the two horse plough—they are low in first cost. But although they may be cheap to buy, they are not economical to use. They are extravagant in current and last only a comparatively short time.

Compare, on the other hand, the wonderful new Cossor Point One taking only one-tenth of an ampere. An accumulator which would last a 2-Valve Set fitted with Bright Emitters for ten hours would last more than 200 hours if Cossor Point One Valves were substituted. *190 hours of free Broadcasting every time your accumulator is charged.* Think of the money you will save in charging costs alone.

But economy is not the only advantage you get with Cossor Point One Valves. They are fitted with a kalenised filament which throws off a terrific stream of electrons without visible glow. The destructive effect of heat has been eliminated. Most valves—even dull emitters—come to an untimely end because their filaments have become brittle through excessive heat and are readily fractured. The Cossor kalenised filament, on the other hand, retains its lifelong pliability, is abnormally tough and is capable of resisting hard knocks with ease. *No valve will outlast a Cossor.*

See your Dealer about these remarkable Valves—he has them in stock in three types.

The new Cossor Point One
No. 210D. With Black Band. An ideal super-sensitive Detector. Consumption 1 amp. at 1·8 volts - - 14/-

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The new Cossor Stentor Two
No. 215P. With Green Band. For Power Valve use—ideal for Super Sets. Consumption ·15 amp. at 1·8 volts 18/6

Cossor Point One

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Popular Wireless

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RADIO NOTES AND NEWS.

The Royal Charter—"P.W." Radio in Rhodesia—More Curious Atmospherics—Marconi and Mussolini—Remarkable Daylight Reception—"The Ranger."

The Royal Charter.

THE draft of the Royal Charter, settling the lines upon which broadcasting will be conducted after December 31st, 1926, has now been issued. It has aroused much comment, but all I am going to say about it is this. We read that the Chairman is to get £3,000 per annum; the vice-chairman, £1,000; and each other governor is going to get £700. But *what is John Listener going to get out of it?* That is the acid test.

Free Wireless for the Blind.

THE House of Commons was dramatically stirred by the first reading of the Bill to provide free wireless licences for the blind. Captain Ian Fraser, the sightless M.P., walked up the floor of the House and handed in the Bill, and in a brief speech he asked for the support of all parties, in the hope that the Bill would become law by Christmas. By tense silence during the ceremonial, and by warm cheers at the end, the House marked its approval of the measure—and of the man.

Remarkable Daylight Reception.

MY recent remarks upon how well KDKA was coming over in daylight, brought me numbers of letters from readers who have been getting this station. One Leeds business man picked him up in an hotel, where the aerial was just an odd length of insulated wire hung from an upper window, using a portable 2-valver (Reinartz and L.F.).

It was this reader, too, who, getting loud-speaker results one night, left the dials set, and next day (Sunday) could distinctly hear KDKA at 3.15 p.m. Not at enjoyable strength, of course, but still, it was KDKA's telephony, on two valves, in the middle of the afternoon!

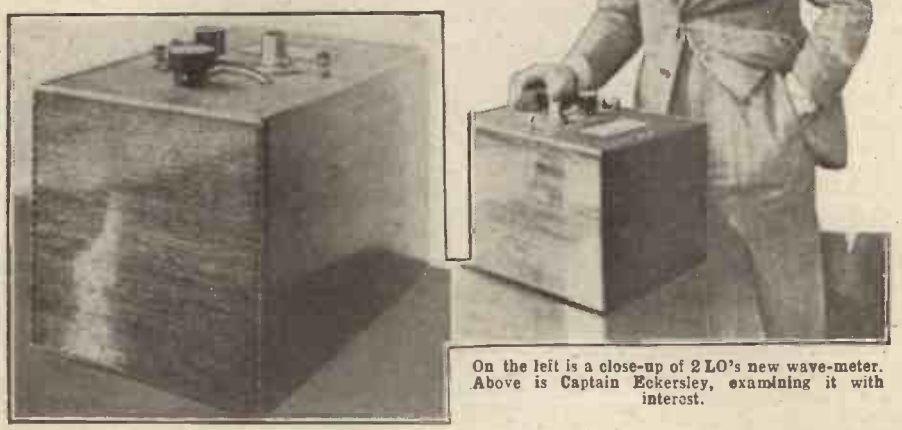
More Curious Atmospherics.

YOU remember that queer instance of the "atmospherics" in the 'phones, caused by cat-stroking, that I related two weeks ago. Well, I've had so many letters about similar cases, that I'm beginning to believe that these fish-eating, fur-licking pussy-cats that ornament our hearthrugs, are nothing more or less than generating stations! Apparently, when programmes are dull, dozens of listeners draw a spark from Fluffy, or Tiddlums, or Satan (or whatever the name is), listen to it in the 'phones, and think nothing of it!

Clicks from a Dog.

ONE Lambeth reader noticed the same effect when "someone standing near-by happened to draw a comb through their hair." This was repeated several times, the set being a 2-valver, Det. and L.F.

But one Heaton Moor reader carried out a little test one night that must have been really funny. He says: "I was listening in on a crystal set, when I touched our dog's nose, and was surprised to hear a loud click in the 'phones! This was repeated many times for experiment that day, but I have never been able to do it since."



On the left is a close-up of 2 LO's new wave-meter. Above is Captain Eckersley, examining it with interest.

"The Ranger."

"NUMBERS of British and foreign stations on the 'phones, and the local excellent on the loud speaker," seems to be the general experience with the "P.W." Ranger, described in October 23rd issue.

One Birmingham reader says, "Best two-valve's-worth I've ever struck." And, after all, how many of the multi-valvers get much more than can be tuned in with this two-valve straight circuit?

Helping the Hospitals.

"I'VE only got one kick coming against 'P.W.'" writes a London reader, "and that is that now it's so splendidly enlarged for threepence, it takes up too much room to keep all back numbers. Do the hospitals want them?"

Just to make sure I called up St. Thomas's and one or two others—any I could think of. They all said the same: "If readers will kindly send them along, we shall be only too delighted to have them."

More "Beam" Tests.

I HEAR that tests with South Africa from the new "beam" wireless station at Bodmin, have been a great success. Communication to and from the corresponding stations near Cape Town was carried out over long periods, and it is expected that this link in the Imperial Wireless Chain will soon be ready for public service.

"P.W." Radio in Rhodesia.

A RHODESIAN reader who built the short-wave set described in "P.W." by G2OD (Mr. E. J. Simmonds, of Gerrard's Cross), recently picked up signals sent from this well-known British amateur

(*Continued on next page.*)

NOTES AND NEWS.

(*Continued from previous page.*)

station. On a QSL card to G 2 O D, he says: "Receiver used: Your own 'P.W.' (Det. and L.F.")
Remarks: "Suits me fine!"

This is not the first time that Mr. Simmonds's signals have been picked up thousands of miles away, on a set that was built from the artic'e which he wrote for "P.W."

Sir Oliver Lodge.

SAY what you will about talks in general, the fact remains that sometimes a talk can be the most stimulating and enjoyable feature in the programme.

The wonderful one-ness of atoms and solar systems, expounded in the friendly, grave voice of Sir Oliver Lodge, for instance, may not have appealed to *every* listener. But I have been astounded to learn how keen and universal is the intellectual enjoyment of listening to a great man, dealing with a great subject. Sir Oliver is not only *doyen* of English scientists, but he certainly has the *flair* for broadcasting, the incomparable power of personality.

Transmitting Without a Licence.

RECEIVING wireless programmes without a licence is asking for trouble. But *transmitting* without one is not merely asking for it, but getting it! A Cheshire man who had tried this on was fined £10, and £5 expenses, and the magistrates ordered the apparatus to be forfeited. Moral: "The licence must be taken before the ether is shaken!"

A Loud Speaker 300 Years Old.

THE Dear Old Dad of all loud speakers is claimed by Vienna. Three hundred years ago this ancient megaphone was used to shout orders for the defence of the city against the invading Turks. Now it is installed near the top of the cathedral, and is used by the Fire Brigade to signal an outbreak of fire. Recently one of the firemen rigged up a wireless set to while away the night watch, and he used this Venerable Vox for his loud speaker. The three-centuries-old veteran pushed out the programmes in perfect style!

Dominion Premiers Lost.

YOU wouldn't think that motor-coach-fuls of Dominion Premiers could fail to find the Rugby wireless station, with its 800-feet masts, would you? Yet so it was! Hopelessly lost, the coaches drove up to a Warwickshire shepherd.

One of the party got out and explained: "I am the Postmaster-General."

The shepherd promptly replied: "Oh, yes! And I'm the Prince of Wales!"

So, after this question of identity had been satisfactorily cleared up, the shepherd took the Premiers in tow, and finally brought them to the Rugby station, all safe and sound. A few moments later the Premiers were exchanging messages with the Antipodes, whilst the shepherd was chuckling over his experiences with rulers of Empire.

Professor Fleming's Portrait.

TO commemorate the 42 years of Professor Fleming's service in the Chair of Electrical Engineering at University College—during which period he hitched up the first valve to a wireless set—his portrait is to be painted by Sir William Orpen.

The committee of the Portrait Fund will welcome any gift, however small, for it is felt that doubtless many listeners would like to associate themselves with this recognition of the Professor's pioneer wireless work. Subscriptions should be sent to Professor W. C. Clinton, University College, London, W.C.1.

New Wave-lengths.

THE B.B.C. announce that the Union Internationale de Radiophonie notify six revisions of the decisions previously made with regard to the wave-lengths of Continental stations. They are as follows:

	New wave-length.	Fixed previously at
Frankfort	428.6	394.7
Hamburg	394.7	428.6
Leipzig	357.1	322.6
Breslau	322.6	357.1
Königsberg	303	241.9
Münster	241.9	303

Marconi and Mussolini.

MUSSOLINI, who is quite unmoved if they try to stab, shoot, or bomb him, is not unmoved at the latest success of his countryman, Senatore Marconi. In a telegram of congratulation upon the opening of the "Beam" service, he says: "Permit me to express to you . . . my own feelings of profound and affectionate admiration." And so say all of us.

SHORT WAVES.

Truly, many are the uses of radio. Failure to answer an S O S message broadcast throughout the United States resulted in a man being declared officially dead, and a divorce was granted to his wife or widow.—"News of the World."

This must *not* be taken as a precedent.

* * *

Wireless has this advantage over the schoolmaster: What it says never comes in at one ear and goes out at the other. Not when you use headphones.—"Daily Herald."

* * *

We understand that a man who had been deaf for over twenty-five years recently heard a jazz band on the wireless. We hope this will be a warning to him.

* * *

"Wireless howlers a nuisance in London." The B.B.C. 2 L O cate them.—"The Star."

* * *

By the use of headphones and a specially constructed microphone an experimenter has listened to the sounds made by grubs while devouring apples. It is understood that the noise they made when spitting out the pips came through at loud-speaker strength.—"Electrician."

* * *

A special programme was broadcast recently under the title of "The Inns of Old London."
A case of Listen Inn.

* * *

"But when the Canon says the wireless is a way of the spirit I do not quite know what he means."—Extract from letter in newspaper.
Perhaps some of our readers who listen in at their clubs could enlighten us on this point.

* * *

The Popular Radio Weekly says: "3 L O is enterprising, too. The London Station, 2 L O, broadcast noises of several animals from the Zoo. So far we have only had comedy musicians."

* * *

"Do they really pay you to be funny, dad?" asked the young son of a comedian, after hearing his father on the wireless.
"Yes, my boy," replied the great man.
"Well, why aren't you?"

Heard at the B.B.C. Concert.

Phyl: "See that fellah with the stick? He's the conductor!"

Bill: "You don't suppose I should take him for the *insulator*, do you?"

The Latest.

I SAW a funny thing in one of the motoring papers the other week. An "expert," was writing about wireless, and about the disgraceful way the technical radio papers kept their readers in ignorance of the latest advances, and as an instance he gave the new American system of push-pull amplification!

Those who remember this old stunt (it was useful before power valves came in), will realise that somebody has been push-pulling the expert's leg!

"P.W." Presents Silver Cups.

"POPULAR WIRELESS" is giving the first prize—a silver cup—in both sections of the Constructor's Competition, to be held in connection with the Hull Wireless Exhibition. Full details are being announced locally, and a list of successful competitors will be given in the Hull and district newspapers on Dec. 10th. The Exhibition opens on December 4th.

TECHNICAL TERMS ILLUSTRATED.

The Earth.

A HARD-LOOKING young woman of Perth,
Had never been kissed from her birth;
Till she came into some money,
Then—wasn't it funny?—
Men said, "You're the best girl on [illustration]"

To-night's National Concert.

THE fourth of the B.B.C. National Concerts will be held in the Albert Hall to-night (Thursday).

Sir Edward Elgar himself is conducting the Orchestra and the programme will consist entirely of selections from Sir Edward's own works.

A Gentle Reminder.

I SAY—just one word before I close down to-day. About this Christmas business. [illegible] number of "P.W." is not only the Christmas Number, but it's the biggest number, the best number, and altogether the most dinky, astonishy, and bargainy number that ever graced a bookstall.

Worth Extra!

IF they want to charge you extra for the Christmas Number, repudiate them with scorn. It certainly would be worth the extra, but 3d. is the price, so don't go and pay more! But be sure and have your three circular metal discs all ready, and go to the shop good and early. For if your copy of "P.W." is sold—well, you'll feel that way, too!

ARIEL.

WHEN "X's" ARE USEFUL

By J. F. CORRIGAN, M.Sc., A.I.C.
(Staff Consultant.)

HOW many readers are vitally aware of the fact that their receiving sets possess the inherent power of affording weather forecasts which very often prove to be really amazingly accurate? By this, of course, I do not mean to imply that some genius has discovered a method of connecting up the set to an ordinary barometer, and of reading off the state of the weather as one reads the intensity of the valve current from an ammeter dial. Such a means of weather prediction is rather too easy to be true.

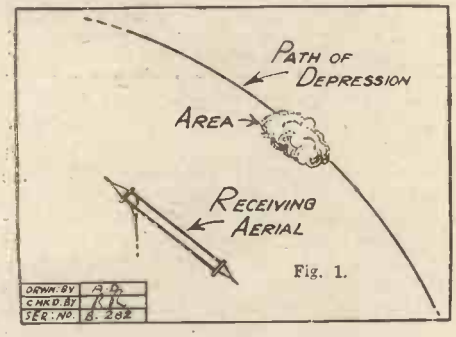


Fig. 1.

But, nevertheless, it is a feat quite possible of achievement to read the forthcoming state of the weather by carefully observing the behaviour of the set under various atmospheric conditions. All radio set owners, and especially users of multi-valve receivers, know only too well of the existence of various types of atmospheric disturbances which are fundamentally electrical in nature, and which, for convenience, are usually referred to under the one class of "atmospherics," "statics," "strays," or "X's."

Atmospherics are the bugbear of the long-distance radio worker, amateur and professional alike, and it is very natural that one of the modern trends of radio research should be in the direction of the total elimination of these unwanted disturbances.

The Radio Barometer.

The annihilation of atmospherics is not yet an accomplished feat, despite the great amount of careful thought and experiment which has been given to the subject within recent years, and therefore the ordinary radio amateur has just got to sit tight and put up with the nuisance until more efficient and universal filter circuits and other devices for eliminating atmospheric disturbances have been discovered.

But everything, it is said, possesses some use or other, and even the atmospheric curse under which all radio receiving installations labour may often be applied usefully in an endeavour to obtain reliable information as to the forthcoming state of the weather.

The radio receiver, in short, can be made to undertake the functions of a barometer simply by observing the type of atmospheric disturbance to which it is subjected at any particular time. Atmospherics, as the reader will well know, may, for ordinary purposes be divided into two general classes with respect to their source of origin. First of all, there is the ordinary type of atmospheric disturbance which produces violent clicks and gratings in the headphones of the receiver, especially in hot thundery weather. This "close range" type of disturbance is due to various electrical leakages between the earth and the clouds.

Simple Weather "Rules."

There is another type of atmospherics, however, which is far more mysterious in its origin. It is the "high altitude disturbance," and atmospherics of this type are more prolonged in duration in the 'phones than the "close range," or "low altitude" variety. Apart from the fact that the high altitude atmospherics are due to some type of continual electric disturbance in the upper regions of the earth's atmosphere, very little is known about them.

The enthusiast who wishes to read the forthcoming state of the weather in the cacophonous symphony of atmospheric disturbances which pass into the receiver may easily do so after a little observation and the application of a few simple rules. Needless to say, such "rules" are quite general ones, but nevertheless they are very useful to memorise when one embarks upon a day by day study of the weather's effect on atmospheric generation.

Rule No. 1.—If atmospheric disturbances suddenly arise in the 'phones, or if those already audible suddenly increase in number and intensity (especially intensity) it may be inferred generally that the state of the weather is about to change for the worse.

Rule No. 2.—If the opposite phenomena to the above occur (that is to say, if the disturbances suddenly cease, or even fairly rapidly decrease in number and intensity) an immediate favourable change in the weather may be expected.

Rule No. 3.—If, however, atmospheric disturbances picked up by the receiver appear to remain fairly constant over a period of one or two days, the weather conditions may be expected to remain unchanged.

Meteorological Depressions.

With regard to the last "rule," during settled summer weather it is a fairly frequent experience to have a continual slight display of atmospherics in the 'phones over a period of many days. Such audible disturbances, of course, signify the occurrence of disturbed weather conditions somewhere or other within the set's "atmospheric range," but the meteorological "depression," if we may employ that term, which is responsible for the creation of the atmospherics will, under the above conditions, be moving along a curved path, all the various points of which are approximately the same distance from the receiving aerial.

Consider the diagram, Fig. 1, however. The area enclosed by the dotted lines

The barometer should be carefully watched and compared with the observations taken during listening periods.

represents the immediate area of the meteorological depression. Its path is represented by the curved line. Now, if we imagine the area within the dotted lines to be an area responsible for the generation of atmospherics, it is easy to see that, provided the depression travels along its

(Continued on next page).

WHEN "X's" ARE USEFUL.

(Continued from previous page.)

appointed path, it will not come materially nearer the receiving aerial. Thus the frequency of atmospheric disturbances picked up by the receiving aerial, and their intensity, will remain fairly constant.

If, however, as in Rule 1, the depression area considered as an atmospheric generator moves directly towards the receiving aerial, the result will be that the number and intensity of the atmospheric disturbances will increase, thus foretelling the coming unfavourable weather change.

Predicting Thunder.

And, of course, as in Rule 2, if the opposite state of affairs takes place, and the depression moves away from the receiving aerial, the atmospheric disturbances picked up by the set will decrease in number and intensity.

Sudden thunderstorms which arise quite locally during hot weather are predicted by violent atmospheric crashings in the 'phones of the receiver. And it is not difficult to understand the reason for this effect. The presence of highly charged thunder clouds in the immediate neighbourhood gives rise to electrostatic discharges or electrical leakages. A proportion of such invisible or silent leakages collects upon the aerial and is discharged to earth, causing crashing noises in the 'phones of the set.

Now as to the various general types of atmospheric disturbances which may be distinguished with the aid of any ordinary receiver. Violent crashings, as we have just seen, signify thundery weather almost immediately. On the other hand, atmospheric noises of the "grinding" variety point to an approaching, but not immediate, change for the worse in the weather conditions.

"Sizzling" Noises.

"Sizzling" noises in the 'phones which are due to atmospheric disturbances, provided they are not too frequent, nor of great intensity, may be taken to predict no weather change. Such atmospherics as these are frequently due to the passage of a distant meteorological depression area at right angles to an imaginary line drawn from the receiving aerial in a horizontal direction.

Sizzling noises which are of frequent occurrence, however, very often predict rain, unaccompanied by thunder. Sometimes, however, these peculiar sizzling noises occur in cold weather when frost is about, and they are more prominent in industrial districts. Their exact cause is obscure. One explanation is that they are due to the deposition of minute particles of dirt-contaminated moisture, each of which has received an electrical charge from the atmosphere, and which gives that charge up on reaching the receiving aerial. Sudden frosts and imminent falls of snow are preceded by this atmospheric change, and therefore there is very probably a large amount of truth in the above supposition. Often, during winter-time, the sizzling noises take upon themselves a peculiar rhythmic character, especially at those times at which the weather is about to become colder.

Quite a fascinating study may be made by noting the influence of the weather upon the types of atmospheric disturbance received, and, indeed, a good deal of very valuable data may be compiled by the amateur who has the necessary patience to take up the matter systematically. Any ordinary valve set suffices, in most cases, for the work, and even a crystal set will often record the more prominent atmospherics. But it must be remembered that many crystal rectifiers have the property of filtering out all but the very strong atmospheric disturbances to quite an appreciable extent, and therefore for the work mentioned above a crystal receiver is by no means an ideal instrument.

Needless to say, the aerial must be an out-of-doors one, and it should be situated as high as possible. The length of the aerial does not matter particularly; nor does the actual type of aerial employed. It is a well-known fact that most atmospheric disturbances are generated on all wavelengths (within certain limits), and therefore in taking up the study of weather forecasting by means of the radio set, there is no need to trouble about any particular mode of tuning the receiver. Manipulate the tuning controls so that the set brings in the local station satisfactorily, and any atmospherics present will soon show themselves.

In many cases, however, and particularly in those where the receiver is situated near to the local station, searchers after atmospheric indications will have to "stretch out." In this case, the best thing to do is to concentrate on receiving a fairly distant station. And without a doubt, if there are any atmospherics within range you will soon hear them!

Effect of Wave-trap.

A well-constructed wave-trap, besides cutting out the local station, will quite frequently minimise a good deal of the atmospheric disturbances received by the set. Hence it is necessary when searching for atmospheric indications with a set fitted with a wave-trap for the purpose of eliminating the local station, to detune the wave-trap so that it works inefficiently and allows the local broadcast to be heard faintly. Under such circumstances, the trap will have no appreciable eliminating influence on atmospherics, and although the set will not produce its most efficient broadcast reception, it will be in a sensitive state for the reception of the desired disturbances.

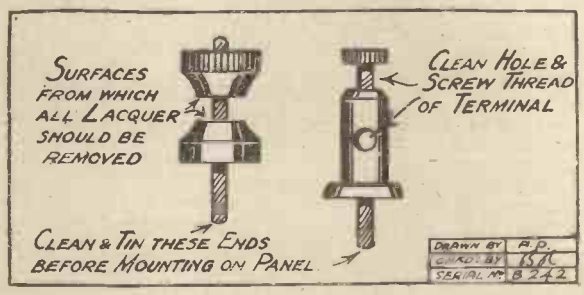
HINTS ON TERMINALS.

By J. F. C.

IT is difficult to imagine a more hardly used radio article than the average terminal. Such vitally indispensable articles of radio practice suffer a good deal in general arrangement and management, and yet they very seldom complain, or give rise to well-defined trouble.

A terminal is a simple thing. But, like every other simple device, there is a right way and a wrong one of using it.

In the first place, many constructors find a difficulty in making neat soldered connections to the ends of the terminal shafts when they are mounted in position on the panel. This is chiefly due to faulty tinning. It should be remembered that most terminals are turned out on to the market in a heavily lacquered condition. Rub the end of each terminal vigorously along a rough file until the end is perfectly bright and clean. Also, tin the end before the terminal is assembled. By these means subsequent soldering operations will be rendered much easier.



Screw down terminals, and terminals of the push-through type, require the lacquer to be removed from their business surfaces. Many reception troubles have been caused through the imperfect removal of this insulating lacquer coating.

Many, for some mysterious reason or other, will persist in placing the terminals in H.F. circuits very close together. This is bad practice. Place all H.F. terminals as far apart as is conveniently possible. You will thus minimise the chance of any stray leakages taking place across the panel.

Another trouble with some sets is that their terminals are placed too near to the edge of the panel. Under these conditions, the terminal shafts projecting downwards underneath the panel may possibly touch the woodwork of the cabinet, thus resulting in electrical leakage, and an improper fit of the panel into the cabinet.

The Best Type.

Another disadvantage of placing the terminals too near to the edge of the panel is that when drilling the necessary holes the ebonite is often very liable to break away at the edges.

Large, solidly made terminals are, as a general rule, more reliable in action than are their smaller brethren, and on this account their use is preferable whenever feasible.

And finally, nickel-plated terminals look well on a set, but nevertheless, if the receiver is to be used in city atmospheres, there is nothing like a good honest lacquered brass terminal for keeping its bright appearance.

An H.F. Intervalve Coupling Panel

By C. E. FIELD, B.Sc.
(*Staff Consultant.*)

THERE are three methods in general use for coupling an H.F. amplifying valve to a detector, or to a second H.F. amplifier, and there are conditions under which each method in turn is to be preferred to either of the other two.

The first of these utilises what is known as *resistance* or *resistance-capacity* coupling.

Fluctuations in the current flowing out from the first valve set up voltage variations across a resistance, which should have a value of from 50,000 to 100,000 ohms, connected in the anode circuit, giving rise to voltage impulses on the grid of the second valve. The corresponding amplified variations in the plate current of this valve are handed on in a similar manner to the grid of the detector, or the next H.F. stage.

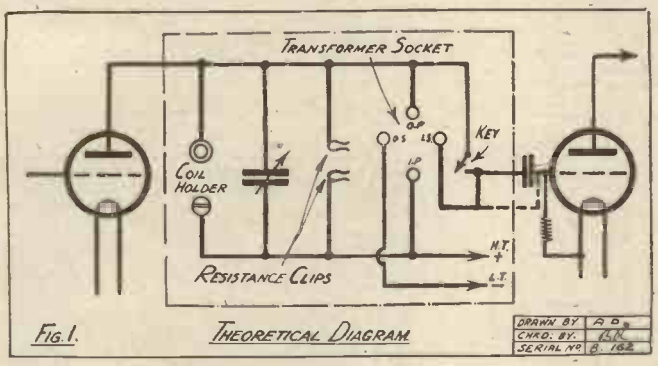


FIG. 1. THEORETICAL DIAGRAM.

Tuned Anode Coupling.

A blocking condenser is necessary between each pair of H.F. valves in order to prevent the positive voltage of the H.T. battery from getting on to the valve grids, and a grid leak must be employed to prevent the grids from accumulating a charge of negative electrons.

Before the detector valve, the blocking condenser also serves the purpose of rectifying grid condenser.

The second method of coupling H.F. valves is known as *tuned-anode* coupling, and is perhaps the most popular for the reception of short-wave broadcasting. The circuit in this case is exactly similar to that employing resistance coupling, except that each anode resistance is now replaced by a tuned circuit, consisting usually of a plug-in coil shunted by a variable condenser.

The third method makes use of an H.F. transformer, the primary winding of which is connected in the plate circuit of the first valve, the secondary being joined to the following grid and filament. In this case a blocking condenser and grid leak are required only before the detector.

It is obviously a great convenience to be able to change quickly from one type of coupling to another without having to alter the wiring of the receiver, or to introduce complicated switching arrangements.

Simple Method.

One method of carrying this out consists in connecting up a valve socket in the ordinary way for the reception of plug-in H.F. transformers, and making a special adaptor by means of which an anode resistance or a series of tuned coils can be inserted in the same socket. This, however, calls for a series of special coil plugs, or a somewhat complicated adaptor, the construction of which is probably beyond the scope of the average amateur.

The intervalve coupling panel described here makes use of the simple expedient of permanently connecting in parallel sockets for the reception of standard types of plug-in coil, transformer, and anode resistance. The only switching introduced is a simple break-key to disconnect the plate of the first valve from the following grid or grid condenser when transformer coupling is employed, the key being operated by the insertion of the transformer.

A diagram of connections is shown in Fig. 1.

The Shorting Key.

Assuming the use of conventional types of plug-in coils and transformers, and cartridge anode resistances of the Dubilier type, the components may conveniently be mounted on an ebonite panel measuring 7 in. by 6½ in. This should be drilled as indicated in Fig. 2, the method of mounting the components being clearly shown in the photograph of the front of the panel.

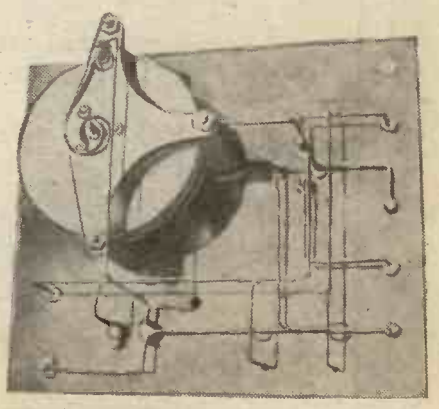
If a Dubilier anode resistance is employed, special clips should be made, as shown in the photograph, out of spring brass or copper strip, and mounted 1½ in. apart, connections being taken from the ends of the fixing screws at the back of the panel. This arrangement occupies less space than do the clips and terminals supplied with the resistance.

For the construction of the key previously referred to, two strips of spring brass or copper $\frac{5}{16}$ in. wide, and 2¾ in. and 2 in. long respectively, are required. These should be bent and drilled as shown in Fig. 3, and screwed on to a piece of hardwood, well dried and soaked in wax, measuring 1¾ in. long by 1 in. wide.

In this connection it should be remembered that when waxed wood is employed for any purpose, it should be waxed before being finally cut to size, for the waxing causes the wood to shrink considerably.

Automatic Action.

The longer strip, when secured in position, must be given a slight upward set, so that it is normally pressing upwards against the other, which is slit with a saw-cut for about half its length in order to provide two contact points, and thus ensure a good connection.



The single nature of the panel wiring can be seen by the above photograph.

(*Continued on next page.*)

AN H.F. INTERVALVE COUPLING PANEL.

(Continued from previous page.)

In order to ascertain the height of the mounting block, a transformer should be pressed home into the socket, and the block then made to the same height as the underside of the transformer spool above the panel. When the key is in position and the transformer inserted, the bottom key spring will then be deflected by about ¼ in., due to the bent-up portion at the end.

Connection may be made to these strips either by securing the wire under the head of one of the fixing screws, or by soldering it directly on to a clamped portion of the strip.

Wiring Up.

Five terminals are provided on the panel. Numbering from left to right, these are connected respectively to the H.T. positive, L.T. negative, plate of first valve, grid condenser of second valve, and grid of second valve (i.e. to the other terminal of the grid condenser).

The simplicity of the wiring will be evident from the photograph of the underside of the panel and the wiring diagram in Fig. 4; point-to-point connection being as follows.

Terminal 1 (H.T. +) is joined to one plug-in coil terminal, one anode resistance clip, inner primary transformer winding, and moving plates of variable condenser.

Terminal 2 (L.T. −) to outer secondary transformer winding.

Low Loss.

Terminal 3 (first valve plate) to the other plug-in coil terminal and anode resistance clip, outer primary transformer winding, fixed plates of variable condenser, and one key spring.

Terminal 4 (second valve grid condenser) to the other key spring, and the inner secondary transformer winding.

Terminal 5 is only made use of when transformer coupling is employed *between two H.F. stages.* It must then be strapped to terminal 4, thus short-circuiting the grid condenser, and connecting the secondary winding of the transformer directly to the second valve grid.

It will be obvious that in a circuit of this kind there is a risk of introducing considerable unwanted capacity, giving rise to instability and loss of efficiency. The following points, therefore, cannot be too strongly emphasised.

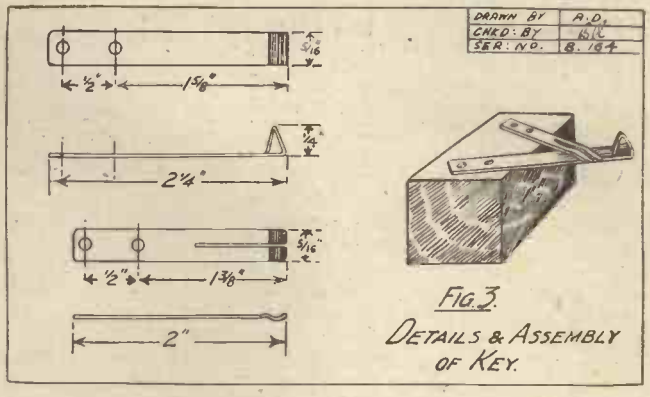


FIG. 3. DETAILS & ASSEMBLY OF KEY.

The coil holder should consist of a separate brass pin and socket, or should be of the low-capacity type, as made, for instance, by Lissen Ltd.

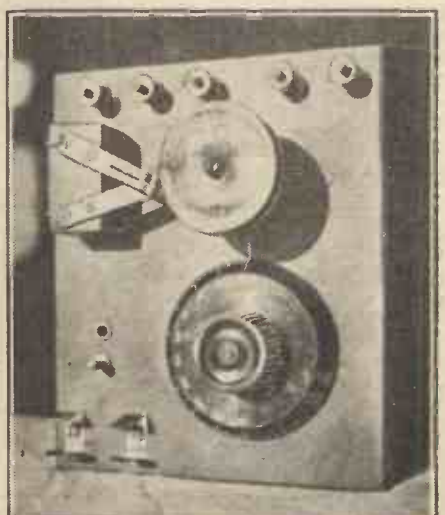
Separate valve pins, and not an ebonite valve holder, should be employed for the plug-in transformer.

A condenser should be chosen having a very low minimum capacity. This will be the case if, when in the all-out position, there is a clear space between the edges of the fixed and moving plates. The maximum capacity should be ·00025 mfd.

An Important Point.

The condenser is then suitable for tuning the primary transformer winding, and will be no detriment if the latter is required to be aperiodic.

When using the panel, it is necessary simply to insert the resistance, transformer, or coil, according to which type of coupling



The coupling unit forms a neat and compact item in the experimenter's workshop.

is desired, the condenser being kept all-out unless it is required to tune the anode coil or transformer winding.

A word of warning must be given here, however.

When the transformer is plugged-in, unless the key opens before the four legs have made contact with the sockets, it is possible for the two windings to be connected in series with the valve filaments, across the high-tension battery.

The high-tension should therefore be

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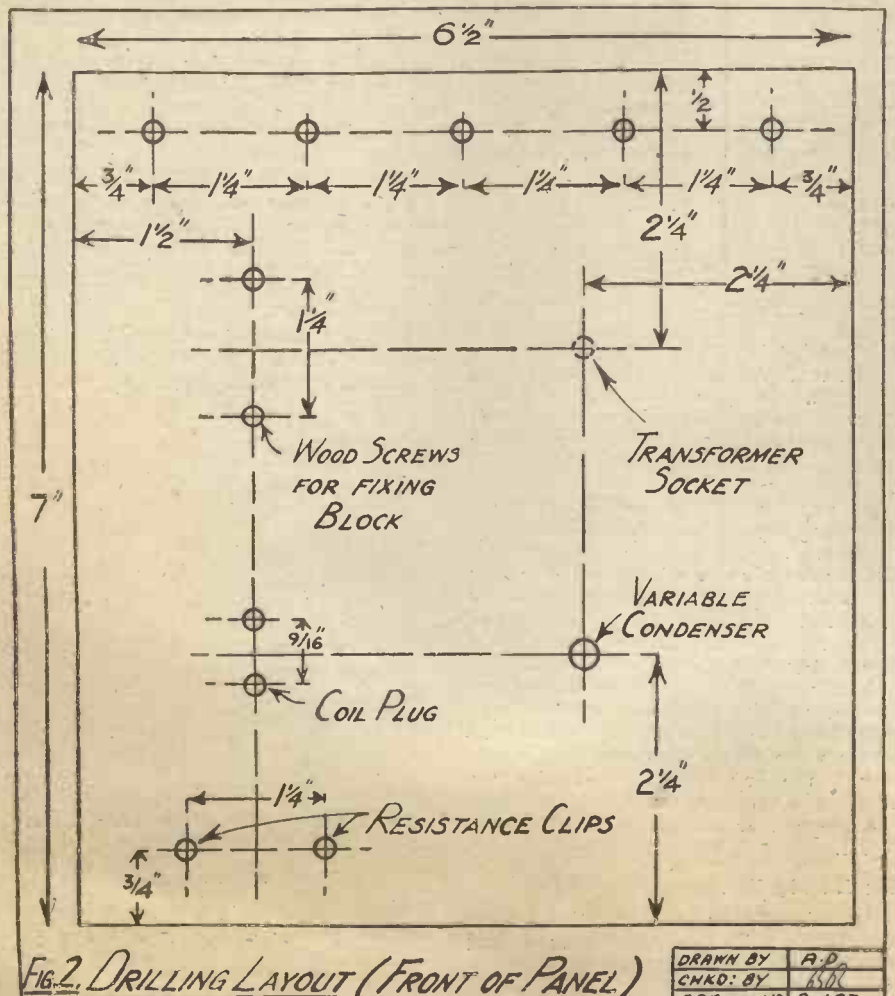


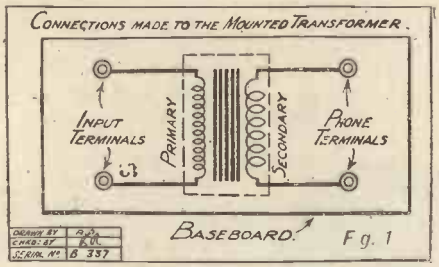
FIG. 2. DRILLING LAYOUT (FRONT OF PANEL)

THE TELEPHONE TRANSFORMER

By J. F. C.

TELEPHONE transformers are instruments of a bygone age. At least, so far as the average crystal set owner is concerned, they are. But nowadays one sees whole consignments of these articles on the market at very low prices, and it is certainly worth while for the keenly interested enthusiast in crystal and valve reception to procure one of these articles, and to conduct a few experiments with its use.

Transformers of this type, which are obtained from one or other of the various suppliers of surplus War Office goods, are generally articles which have been taken from old pattern Government receivers.



Fg. 1

Usually they are in good order, and can be relied upon to give a long period of useful service.

Preliminary Preparations.

Having obtained a telephone transformer of this description, the article should be mounted. The most convenient method of effecting this end is to utilise some old discarded wooden base for the purpose. A pair of terminals should be placed at each end of the wooden base (the transformer itself being mounted in the middle), and connections from the primary and secondary windings of the transformer led to each pair of terminals respectively.

A transformer mounted in this manner will be seen at Fig. 1 showing diagrammatically the mode of making the necessary connections from the primary and secondary windings of the transformer to the baseboard terminals.

The average resistance of the primary winding of a telephone transformer is of the order of 4,000 ohms. This winding is connected directly to the set. The telephones are included in the secondary circuit of the transformer (Fig. 2), the secondary transformer winding having a resistance of approximately 120 ohms.

L.R. 'Phones.

Of course, when a 4,000-ohm pair of headphones is used with the receiving set, there is no advantage to be gained by the use of a telephone transformer. It is only in those cases in which the experimenter has at his disposal one or more pairs of low-resistance (120 ohm) 'phones that a transformer of this type comes into real service. Most low-resistance 'phones in the possession of amateurs are little used nowadays. A telephone transformer, however, will immediately place these discarded 'phones on an equal level with the high-resistance ones.

Some experimenters in crystal reception claim that the use of low-resistance 'phones in conjunction with a telephone transformer results in a better clarity being given to the signals, and a complete freedom from local interference, such as generator hum. It is doubtful, however, as a general rule, whether these claims can be substantiated.

However, be this as it may, there are many useful purposes which a telephone transformer will serve in crystal and valve reception, whether by headphone or loud speaker, and as these articles are to be readily obtained nowadays at a fraction

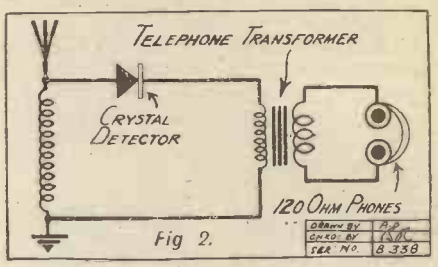


Fig 2.

of their original cost, it is certainly well worth while investing a "bob" or two on one of them, if only for the purpose of making a closer acquaintance with the properties of this useful type of radio component.


A good example of the trend of radio design in America. The model illustrated is a multi-valve Grebe receiver.

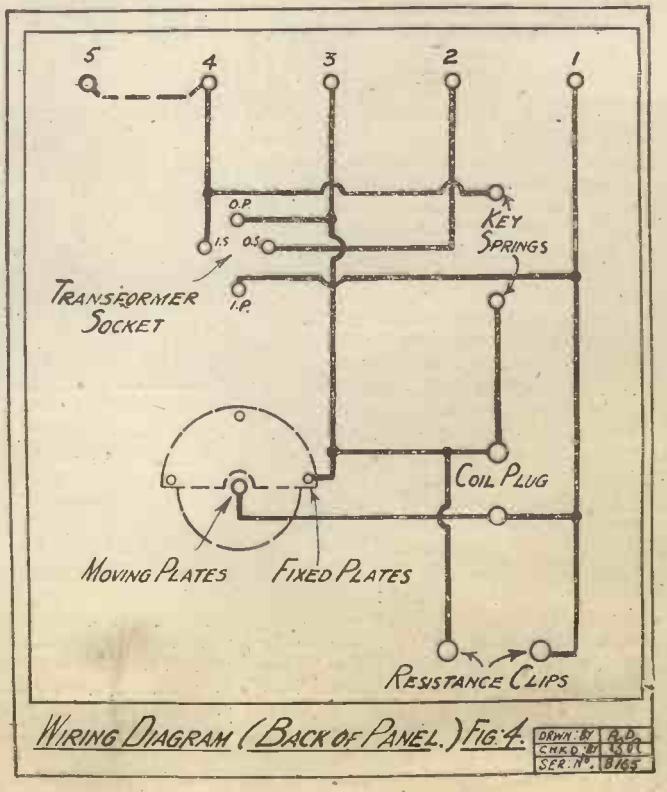
AN H.F. INTERVALVE COUPLING PANEL.

(Continued from previous page.)

switched off before inserting the transformer.

As an additional safeguard, one transformer leg may be cut short, so that it does not enter its socket until the key has broken circuit.

It will be realised, of course, that similar arrangements could be incorporated in the permanent wiring of a receiver without the necessity for introducing a separate panel.



WIRING DIAGRAM (BACK OF PANEL.) Fig 4.

TECHNICAL NOTES.

A Weekly Feature Conducted by

Dr. J. H. T. ROBERTS, F.Inst.P.
(Staff Consultant.)

A NEW type of aerial was submitted to me recently which, although I have not yet had time to test it myself, is claimed to have great advantages in regard to its property of picking up electro-magnetic waves. This aerial may be described briefly as being of the spiral-spring type, but with the convolutions of the spiral metallically connected together. For example, suppose a spiral spring be taken and a bare copper wire passed down the centre, the copper wire then being stretched across a room and acting as a support for the spiral spring which is threaded upon it. So long as the copper wire and the spiral spring are both clean, there will be a reasonable chance of the convolutions—or, at any rate, many of them—making electrical contact with the copper wire. But after a little time it is certain that, owing to dirt and corrosion, the contacts will become very bad, and, in effect, the aerial will be equivalent to the more or less familiar type consisting of a spiral metal spring strung upon an insulating cord.

A Novel Aerial.

In the new aerial, however, the convolutions are separately and individually soldered or spot-welded to the main longitudinal conductor, the whole resembling somewhat closely the grid of a valve, except that the longitudinal conductor is within the spiral instead of being external to it, as it usually is in the valve grid.

It will be seen that the result is the same as though a large number of metal wire rings were separately soldered to a straight conductor, except that by utilising a spiral spring in the manner indicated above the labour of producing the product is infinitely reduced.

For electrical purposes, the aerial must be regarded, however, as a straight conductor with a large number of metal rings electrically attached to it at small and regular intervals. I understand that this arrangement is patented, but there would appear to be no reason why experimenters should not try similar arrangements for themselves.

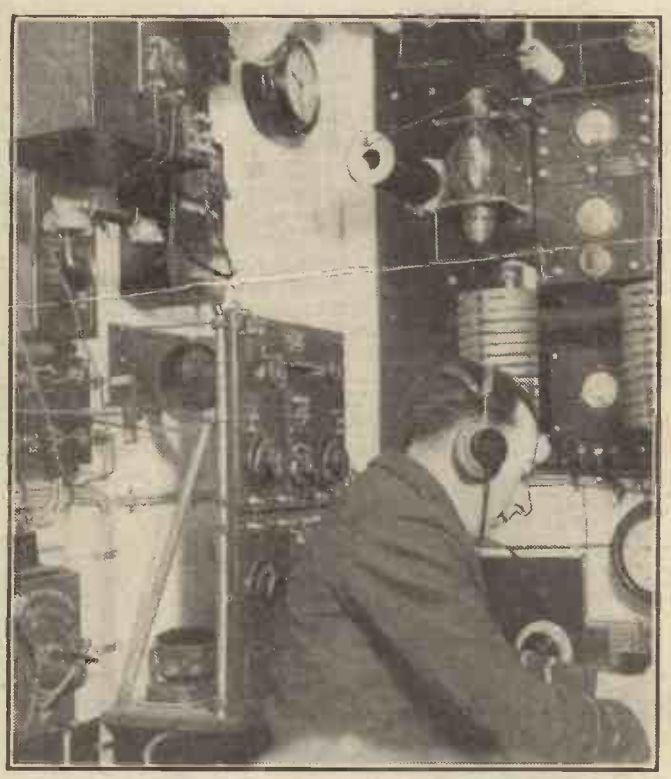
Avoiding Interaction.

The lay-out of a set is a matter of much more importance than is commonly appreciated by the amateur constructor, especially the beginner. It is often stated in articles describing the construction of particular types of receivers that the components should be arranged in such and such relation to one another, and it is, perhaps, not unnatural that the beginner should regard these instructions as being capable of a fairly liberal interpretation. If he happens to have a panel of a somewhat different size or shape from that described in the instructions, he sets to work to rearrange the layout so as to suit the panel.

It is true that in many cases a perfectly good result can be obtained with an arrangement quite different from that used by the author of the article in question; but, at the same time, it should be borne carefully in mind that there are some rearrangements which may make little difference, whilst there are others which may make all the difference to the efficient functioning of the set.

So far as possible, the components should be arranged in a regular sequence from the H.F. to the L.F. end, and conductors carrying H.F. currents should not be brought into proximity with conductors carrying L.F. currents. Similarly, of course, H.F. conductors should be kept away from earthed conductors. Long leads should be avoided as far as possible, and the parallelling of leads is particularly objectionable. I have already mentioned in some recent notes the importance of avoiding interaction in the case of L.F. transformers, and the same applies in the case of H.F. transformers.

In order to emphasise the importance of a correct lay-out (that is to say, an arrangement based upon a careful consideration of the foregoing principles), it should be sufficient to mention that a set which is found to be operating badly, or to break into howling on the slightest pretext, may frequently be corrected and put into perfect condition by removing the components from the panel, or baseboard, rearranging them in the proper way, and rewiring. So if you are using a lay-out which is different from that in the book, and you are not getting the results which you were led to expect, it is always a question worth considering as to whether the set should not be dismantled and components and wiring rearranged.



The wireless cabin of ss. "Jervis Bay" which kept in daily touch with Sydney (Australia) on its recent voyage to Plymouth.

New Type of Loud Speaker.

I recently mentioned an invention in connection with loud speakers which I believe is novel, although on that point I am not quite certain. However, beyond describing the idea for the information of readers of this journal, and examining some experimental models, the invention, although patented, was shelved owing to the pressure of other work.

The idea, in brief, was to employ a double-sided electro-magnetic system for a loud-speaker unit employing the same or similar coils and a similar magnetic system, except that the latter was provided with pole-pieces at the two opposite sides of the unit. The unit is then fitted with two diaphragms facing the two pole-pieces respectively.

It can be shown, theoretically, that with proper arrangements the addition of the second diaphragm does not seriously detract from the power available for functioning the first, and it evidently gives a considerable additional means of communicating sound energy to the air.

I notice that in the United States a new type of loud speaker has been placed on the market using a double-cone loud speaker, the unit being at the centre of the two cones, fitted on opposite sides. Whether it employs the system mentioned above, or not, I cannot say.

In Phase.

It is interesting and important to note that with the double-diaphragm arrangement mentioned above the two diaphragms are in phase; that is to say, they both move inwards together and outwards together, so that when a wave of compression is being generated at the one a wave of compression is also being generated at the other, and similarly with the waves of rarefaction. In the case of a single-cone loud speaker it might be argued that the sound proceeds from both sides of the cone; but here it should be observed that when a wave of compression is being generated at one surface of the cone, a wave of rarefaction is being generated at the opposite surface which may to some extent neutralise the effect of the first-mentioned.

If there is anything in "P.W." that you do not like, please tell us about it when writing.

How to make Fixed Resistors

By OSWALD J. RANKIN.

IF the filament potential of a modern dull-emitter valve is permanently set at the makers' specified figure, no further adjustments are necessary, for the valve will function efficiently at all times providing the accumulator is kept up to the mark. This means, of course, that we can use a very simple and compact form of fixed resistance or "resistor," in place of the usual variable resistance, or "rheostat," and the result is a great saving of space on the panel or baseboard of the set, and *fewer control knobs*. Moreover, a number of fixed resistors may be easily made up at home at a trifling cost.

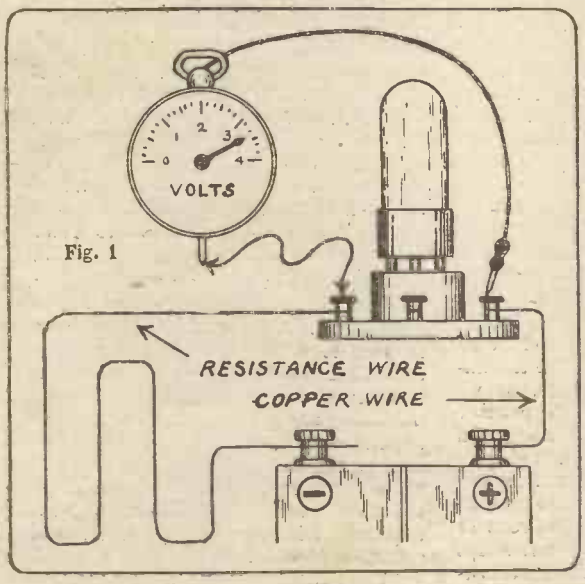


Fig. 1

The Wire to Use.

To find the approximate length and correct gauge of resistance wire to use it is only necessary to study the figures on the valve, glance at the table given below, and observe the simple rule: resistance equals the voltage to be dropped divided by the filament current.

EUREKA RESISTANCE WIRE.

Size S.W.G.	Ohmic Resistance per yard.	Current Capacity
18	·37	4·0
20	·66	3·0
22	1·10	2·0
24	1·77	1·5
26	2·65	1·0
28	4·0	0·75
30	5·58	0·5
32	7·35	0·50

Thus, assuming a 4-volt accumulator and a valve requiring, say, ·1 ampere at 3·5 volts, the voltage to be dropped, or "resisted," is ·5, and if this is divided by the current consumption of the valve, which is ·1 ampere, we get ·5 ÷ ·1 = 5 ohms.

Now for the length and gauge of resistance wire. From the table it will be seen that No. 28 gauge is a likely proposition, this giving a resistance of 4 ohms per yard; thus, for a resistance of 5 ohms we shall require 1¼ yards. But the smaller the gauge of wire the greater the resistance per yard, and since our aim is compactness, it would seem better to use a shorter length of finer wire, such as No. 30 gauge, which gives a resistance of 5·58 ohms per yard.

In this case we can use *less* than a yard, but what of the current carrying capacities of these finer wires? Will the resistance become overloaded, and heat up when in use? This may be quickly ascertained by glancing at the third column in the table, where it will be seen that the safe load capacity of No. 30 gauge wire is ·5 ampere. Our valve takes only ·1 ampere, so there is, of course, a large margin of safety.

Having now decided upon the gauge and approximate amount of wire, we will pass out of the "office" into the workshop, and find the *exact* amount by carrying out a practical test with the voltmeter. It is assumed, of course, that one cuts off a length of wire several inches in excess of the amount indicated in the table, for it is always better to cut off too much than too little.

A Similar Test.

There are two methods of carrying out this simple test, one is indicated in Fig. 1, where the correct *length* of wire is found, carefully noted for reference, and then wound on a suitable former. The other method is shown at A B in Fig. 2; here the whole length of wire is first wound on a former of the same diameter as the former ultimately used, the coil then being tapped until the best position is found, when the number of *turns* in circuit are then carefully noted and rewound on a former of suitable length.

To proceed with the first-mentioned test (Fig. 1), place the valve in a spare holder, connect one filament terminal to one side of the accumulator with a length of copper wire, and the other filament terminal to the other side of the accumulator with the selected length of resistance wire, which, assuming No. 30 S.W.G. Eureka wire and a dull-emitter requiring a resistance of 4 or 5 ohms, should be about 30 or 36 inches in length. Arrange this wire so that it lies flat on the bench, in worm fashion, connect the voltmeter across the two filament

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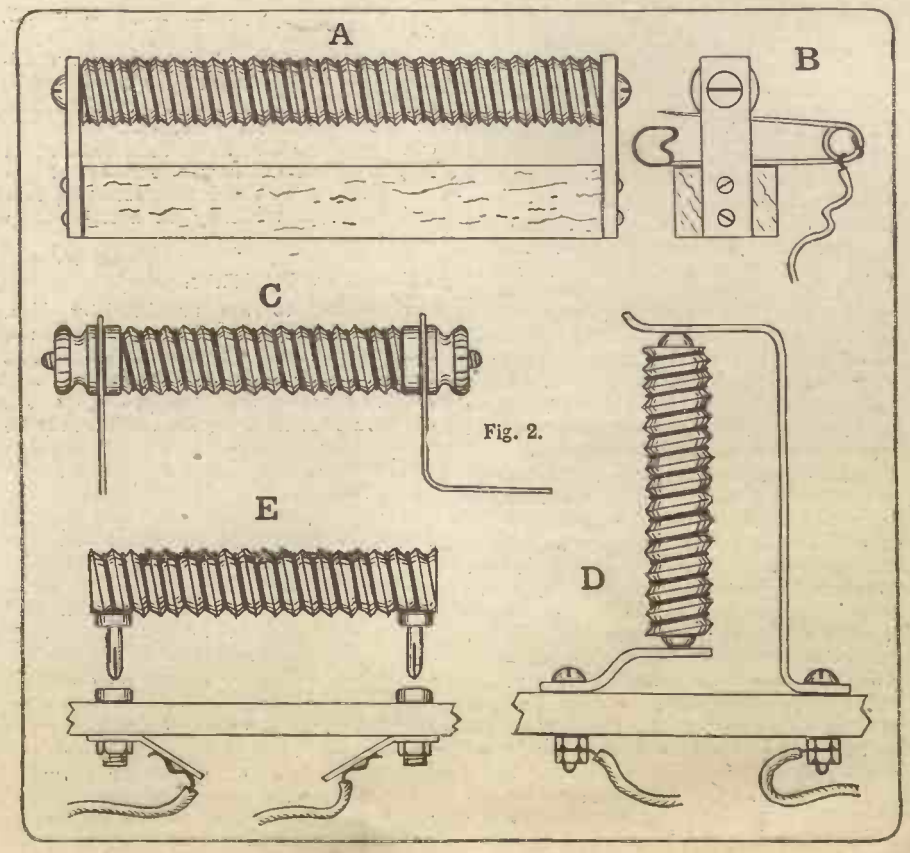


Fig. 2.

HOW TO MAKE FIXED RESISTORS.

(Continued from previous page.)

terminals, and gradually decrease the length of the wire until the voltmeter accurately registers the voltage specified by the makers of the valve. If now the exact length of wire is carefully measured, and noted, it is a simple matter to cut off similar lengths and make up any number of resistors for use in conjunction with valves of the same type.

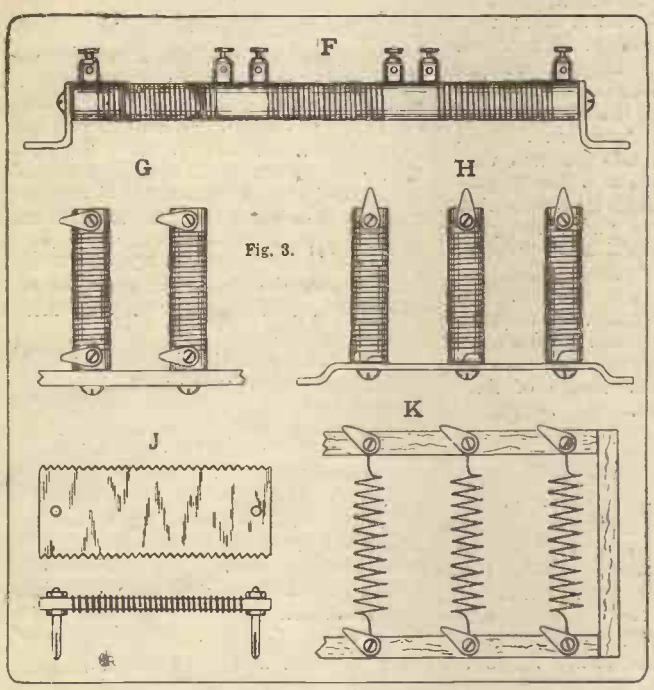


Fig. 3.

Mounting the Resistor.

Before passing on to the winding and mounting of the resistor, we will consider the second method of finding the correct amount of wire (A B, Fig. 2). Here the former receives first consideration. This is made from a 2½-in. length of ⅜-in. ebonite rod, which is screwed ⅜ in. Whitworth. Each end of the rod is previously drilled and tapped to take 8 B.A. screws, small brass links then being fitted as shown. The windings lie in the threads cut on the rod, the ends being secured under the links or screwheads. The lower ends of the links are then screwed to the ends of a rough wooden base, and a connection is taken from one of the links to one filament terminal on the valve holder. One accumulator terminal is connected, via a flexible lead, to a small safety-pin which is inserted between the wooden base and the under side of the winding in the manner shown at B (Fig. 2), so that the moving limb will make contact with any turn of the winding. The other side of the accumulator, and the voltmeter, are connected as shown in Fig. 1, the pin then being moved about until the desired voltage is obtained. The number of turns between the valve filament terminal and the pin are then counted; it is then only necessary to prepare another former having a corresponding number of threads, and fill the threads with the same gauge of wire.

Diagrams C to E (Fig. 2) show three simple methods of mounting resistors arranged on the latter principle; at C the ends of the rod are fitted with small terminals, which, of course, are connected to the ends of the winding, so that if fairly stiff wire is used for wiring up the set, the resistor needs no other support than the actual connecting wires. Round-headed screws may be fitted in place of the terminals, the device then being placed between two spring brass clips, in grid-leak fashion, or mounted vertically, as shown at D. The resistors may also be arranged on the plug-in principle as indicated at E, so that when removed from the sockets they act as switches for cutting off the filament current.

When the correct length of resistance wire is found by the Fig. 1 method, the design and general arrangement of the former is of little importance, since, as we have seen, the number of turns are not taken into account, and providing the turns are well spaced the wire may be wound on plain rods or tubes, or on flat strips of any suitable insulating material. If insulated wire is used the turns may, of course, lie close together.

Diagram F (Fig. 3) shows how a multi-resistor may be wound on a single length of rod or tube, the windings being connected to small terminals which also form the contact points for circuit connections, and diagram G shows how a number of resistors might be fitted with soldering tags and mounted vertically on a small strip of ebonite.

Multi-Resistor Possibilities.

Returning to the multi-resistor idea, there is no reason why we should not connect one side of each winding to a common lead, or busbar, for in most sets the resistances are "tapped" off the common L.T. negative lead. This may be effected by mounting the resistors on a strip of sheet brass in the manner shown at H, and connecting the lower ends of the windings to same. The strip may then be screwed down to the baseboard and connected to the L.T. lead at any convenient point. Such a method will only apply in cases where the resistors are all connected to the same L.T. lead. Different types of valves may be used providing the resistors are wound to conform with their requirements, and the upper end of each resistor correctly joined to its respective valve socket.

Diagram J depicts a simple flat type of resistor former which consists of an odd piece of hardwood, fibre, or ebonite, having its edges notched in order to separate the turns of the winding. If good, dry hardwood is used, the most suitable method of notching the edges is to procure a long ⅜ in. Whitworth bolt (screwed up to the head), place this in the fire until it becomes red hot, and then press the edges of the former lengthwise on the thread. The impression left by the heated thread forms the necessary spacing notches, which may be deepened, if necessary, with a small three-cornered file or a hacksaw. Such a resistor may be mounted in many different ways. The plug and socket system will be found most effective, since, as pointed out above, the component then serves a double purpose.

Converting Existing Rheostats.

The possibilities of the open coil resistor may interest some readers. Such a device, in multiple form, is shown at K, where the wire is first wound over a pencil and then stretched out in spring fashion and attached to the sides of a simple frame built up from strips of hardwood. The coils might be enclosed in small insulated tubes provided with metal end-caps so as to resemble ordinary grid leaks.

The problem of converting existing rheostats into fixed resistors is also worth considering. One simple method is shown in Fig. 4, where an ordinary rheostat is connected up in place of the length of resistance wire in Fig. 1, and carefully adjusted until the required voltage is registered. The position of the arm will, of course, depend upon the type of rheostat to be converted. Assuming one-third of the entire winding sufficient to give the required resistance, we then obtain three separate resistors by simply dismantling the rheostat and cutting the ring into three equal sections. Each section might then be flattened out, again tested, and finally screwed down to the baseboard of the set and connected to the valve.

Scope for Experiment.

The compressed carbon type of filament rheostat does not lend itself so readily to the purpose. At its best it is never so reliable as the wirewound resistance, and

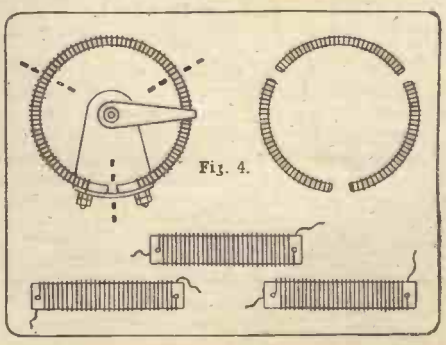


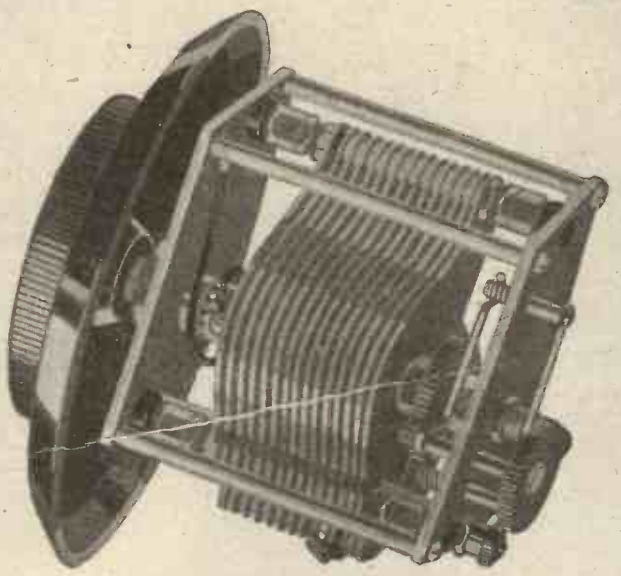
Fig. 4.

if it cannot hold its own as a variable resistance it would indeed stand a poor chance as a fixed resistor. Readers are therefore advised to adhere to the more reliable method of using *wire*, even at the expense of a little inconvenience and loss of space. The wirewound fixed resistor has come to stay, and experimenters will do well to devote a little effort towards improving present designs.

NOW A Brandes CONDENSER

STRAIGHT LINE FREQUENCY SLOW MOTION LOW LOSS

It will be obvious from the table of new B.B.C. wave lengths given below that a condenser in which the dial reading varies directly as the frequency will give a more uniform separation of stations than one in which the dial reading varies directly as the wave length. This is particularly apparent in the lower wave lengths.



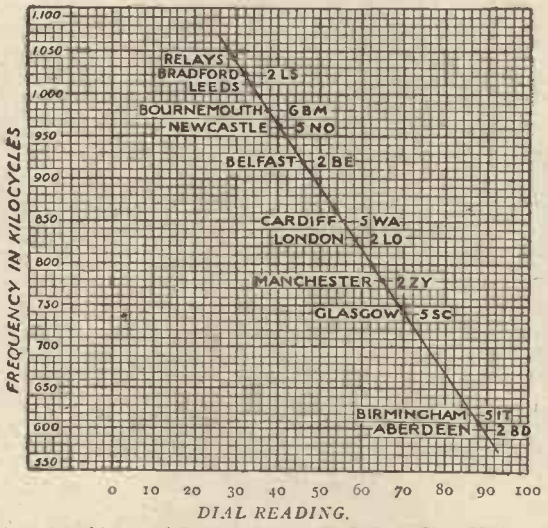
Brandes Straight Line Frequency Slow Motion Low Loss Condenser has been specially designed to provide a straight Line Frequency tuning characteristic and to bring in the B.B.C. Stations well spaced out over the major portion of the dial, whilst **at the same time maintaining the compact form which is so very essential in the back-of-panel instrument.**

A typical tuning curve is shown below :—

With this condenser a positive movement for approximate setting is obtained by turning the 4" diameter dial which is provided with finger grips for this purpose. The final critical setting is obtained by turning the 2½" knob which actuates the slow motion mechanism.

Low dielectric losses and the complete absence of backlash are ensured.

Price ·0005 - - **18/6**
·0003 - **18/-**



Actual curve of Brandes ·0005 mfd. S. L. F. Slow Motion Condenser used with a loose-coupled circuit comprising No. 35 untuned aerial coil and No. 50 tuned secondary coil.

The following table shows the new wave lengths of the B.B.C. stations with their corresponding frequencies :—

Call Sign	*Station*	*Wave Length*	*Frequency.*
2 BD	Aberdeen	491.8 metres	610 k.c.
5 IT	Birmingham		
5 SC	Glasgow	405.4 ,,	740 ,,
2 ZY	Manchester	384.6 ,,	780 ,,
2 LO	London	361.4 ,,	830 ,,
5 WA	Cardiff	353 ,,	850 ,,
2 BE	Belfast	326.1 ,,	920 ,,
5 NO	Newcastle	312.5 ,,	960 ,,
6 BM	Bournem'th	306.1 ,,	980 ,,
2 LS	Leeds ..	297 ,,	1,010 ,,
	Bradford	294.1 ,,	1,020 ,,
Other	Relays	288.5 ,,	1,040 ,,

Numerous Advantages :—

1. A handsome 4" dial engraved with clearly marked divisions and provided with finger grips for the approximate setting of the condenser.
2. The large knurled knob 2½" diameter operates the patent vernier mechanism for fine or critical tuning.
3. A minimum quantity of highest quality ebonite ensures low dielectric losses.
4. The single hole fixing bush has a knurled face to ensure a firm grip on the panel.
5. Ball bearings fitted into cone shaped races prevent shake and backlash.
6. A pigtail flexible connection ensures perfect contact between the frame and the moving vane system.
7. Brass vanes and spacing collars chemically cleaned ensure perfect contact.
8. Conical bearings at base prevent shake and backlash.
9. The Slow Motion is transmitted to the moving vanes through a carefully designed friction clutch by means of a train of wheels having a finely knurled surface which ensures a very smooth reduction movement without jump or slip.
10. Specially designed spring bearings keep the train of wheels in intimate contact and by exerting a gentle pressure on all the moving parts entirely eliminate backlash.

This Condenser will provide a Straight-Line-Frequency tuning characteristic with the stations within the B.B.C frequency range well spaced over the dial. The shape of the moving vane is designed to provide a small compact condenser having a straight-line-frequency tuning characteristic without taking up a large back-of-panel space. Most other S.L.F. Condensers have a long narrow vane with a very wide swing, taking up a lot of valuable space at the back of the panel.

BRANDES LTD., 296, REGENT STREET, W.1. WORKS : SLOUGH, BUCKS

The IMPORTANCE of LAYOUT

An example of well-spaced coils. They have been so mounted that their magnetic fields will not interact.

By K. D. ROGERS.
(*Assistant Technical Editor.*)

THE term "layout" is such an often-used one that probably not one of my readers is unfamiliar with it, but I wonder how many fully realise what it is intended to convey. "Oh," you say, "it merely means the position of the various components in a receiver." Yes, it means that, but not merely that, for it also embraces each lead and connection made between those various components.

Let me explain. Most are familiar with the circuit employed in a one-valve set with one H.F. stage, and most of you, probably, realise that there can be all kinds of designs, flat panel, American type, and so on, incorporating that circuit. With those designs all sorts of layouts are possible, *but* you will find in ninety-nine cases out of a hundred that the layout decided upon by any one experienced constructor will be very similar to that employed by any other constructor who knows what he is doing. In short, the components are so arranged that the stages come in their proper sequence and the wiring is simplified as much as possible.

No one in his senses would put—in the case of an American baseboard design—the variable condenser on the right, the aerial on the left and the coil holder up near the aerial terminal. This would leave long tuning leads between the condenser and the rest of the circuit and would be asking for inefficiency.

That is an obvious case, but where more complicated receivers are concerned, or where ultra-sensitivity and efficiency have to be considered, layout plays an extremely important part. And here, when I say layout, I also include *panel* layout, or the relative position of the controls.

Arranging the Controls.

Where easy control is to be obtained, the various tuning dials, rheostat knobs, etc., must be placed ready to hand so as to simplify the handling of the set as far as possible, but, unfortunately, a compromise between extreme operating efficiency and appearance has to be made in a great many cases, or the set would look very strange and unorthodox. However, as far as possible, the operation side of the question should be considered before that of mere appearance, because, to a large extent, the success or failure of the set, however well made the components may be and however good the *circuit*, will depend upon the ease with which the set can be handled, quite apart from the efficient arrangement of the interior of the receiver.

So the first thing to do when you decide to build a wireless set and have chosen the circuit and type of panel (either upright or flat), is to think carefully over the layout from all points of view.

Take your components and place the control dials on the panel in the positions you would *like* them to occupy—the positions that appeal to you most from the point of view of handling the set. Then re-arrange them until the *appearance* and efficiency point of view are merged and you have the best compromise between the two, bias always being given towards the efficiency part.

Then place the interior components in position, as you think they will fit in best with the layout of the panel, and you will probably have a shock. Maybe the coil holder won't clear the variable condenser or the L.F. transformer, and so on, and you will have to rearrange things again.

Well-Spaced Components.

All this takes a long time to describe, but it can be carried out quite rapidly in practice and is not nearly so tedious as it sounds.

This time arrange things so that they have ample space between them—keeping to the original panel layout as far as possible. This part of the business must be done much more carefully, for you should visualise the various connections as you move the components about and should avoid long plate and grid leads like the plague. From a sheer efficiency point of view I like to layout most of my components in the exact order in which they occur.

In other words, imagine you are a wireless signal and follow its path, dropping the components into position as you go along and keeping all "live" wires (H.F. and L.F.) as short as possible. It is not an easy task to get things *exactly* as you would like them and still to make the set look nice, but by carrying out the operation as described you will make a much better job of it than by studying appearance alone or by merely laying out the components *equally* so that the baseboard and panel are evenly covered.

Short Leads Essential.

When the components have been placed in their final positions, the wiring up can be commenced, and here it is best that the filaments, all L.T. wiring in fact, be done first. This is because in the majority of sets these connections can be tucked away anywhere and arranged so that maximum space is left for the other wiring. The L.T. wiring is at earth potential so can be carried along all round the set if desired, without causing any trouble.

Not so the grid and plate leads, which should be as short as possible and well separated—grid and plate leads *never* being allowed to run parallel to each other unless they are a considerable distance apart. In this respect, the word "never" should be your maxim if possible, but if "sometimes" has to be employed, it should be very seldom.

I recently had a case of the most annoying kind, which shows how careful one must be even when hooking up an apparently "harmless" receiver. I had occasion

(*Continued on next page.*)

Members of the Tottenham Wireless Society demonstrating coil winding during the recent radio exhibition held by that Society.

THE IMPORTANCE OF LAYOUT.

(*Continued from previous page.*)

to try out a circuit which employed three valves, all resistance-capacity coupled and using no reaction whatever. There it was, one valve, the detector, acting on the anode bend principle, resistance-coupled to another and this latter resistance-coupled to a third. That was all there was to it—*apparently.*

On the face of it it looked as if a nice compact receiver could be built, and as no reaction was employed and the plate circuits of the valves were quite aperiodic, I did not expect any trouble. Furthermore, no components capable of giving out a magnetic field (except the wire itself) were employed.

I built the set, beautifully compact but not crowded, and ideal from an operating point of view. On test I received about 30 per cent. *more* amplification than I expected, *but*—and a very big but it was—the results were anything but pure. What was happening? The set was resistance coupled, had matched valves and impedances and all that sort of thing, and yet, although amplification was good, results were not at all satisfactory.

An Unexpected Effect.

The tuning of the set gave me the clue. Instead of being flat on the local station—two miles away—as I had expected, it was dead sharp, almost like a super-het. and with two degrees on the .0005 aerial condenser (the only one) *all trace of the station was lost.* Connections throughout the set were perfect, so only one thing could be causing that sharpness—the set was all but *oscillating,* at H.F.

What had happened was that the first valve plate lead ran alongside the aerial lead (the set was loose-coupled with aperiodic aerial coil of 50 turns) for about 1½ in., and this, together with the self-capacity of the valve and the fact that a negative bias was employed on it in order to use the anode bend principle, was sufficient to cause an H.F. feed-back.

In other words, reaction was taking place and the set was not far from oscillation. Consequently, tuning was sharp and the H.F. component in the plate of the detector got mixed up with the L.F. and so caused serious distortion. The build-up of amplification was remarkable and on spark the set would have been ideal. But it was no good for telephony.

Watch the Wiring

More careful spacing cured the trouble and now the set, with the same components and valves, is operating perfectly. Purity of reception is obtained and the tuning is as it should be—flat. This is, of course, a detail, for the set is solely intended for local loud-speaker work, and for such has finally completely justified its existence.

That, I think, is a very unusual example of the effect of thoughtless layout. The circuit appeared so harmless that I was taken off my guard, and although no obvious errors in spacing were committed the wiring was not laid out as carefully as it would have been if I had more carefully considered the matter.

So, in building *any* set, no matter what it may be, you cannot be too careful about that all-important feature—the layout. It is no good having super-efficient components and expensive valves if a bad or careless layout is going to ruin the whole affair. Watch those H.F. leads and then—watch the L.F. Suspect every wire of possible interaction and you won't go far wrong. It may not always be necessary, but if you neglect it you will come up against a snag some time or other, and it may take a long time and much searching before the cause of the trouble is ascertained.

Sets designed and described in these pages can be relied upon as regards layout, but where deviation from design and where home-made sets are made up independently of published details, then every constructor should carefully consider his layout and act accordingly.

Where multi-valve sets are concerned it is sometimes advisable to sacrifice a little of the appearance of the wiring and use direct leads of round tinned copper wire rather than employ square wire and those beautiful right angled bends that add so much to the internal appearance.

A portion of the crowd assembled at the Memorial Hall, Dayton, Ohio, to listen to the broadcast of the Dempsey-Tunney fight.

SOLDERING TAGS.

By HUMPHREY PURCELL.

SOLDERING tags are fashionable. They "came in" with square wire, but even though one may prefer to wire up with the easier, and equally efficient, No. 18 S.W.G. round wire, there is a definite advantage in using them.

The alternatives to the use of soldering tags are either to screw down the looped wire under a nut and washer, or to solder direct on to the shank of the terminal or component with which contact is desired.

The screw-down method might, at first sight, seem at least as efficient as the use of soldering tags, because in the one case there is only one joint with a simple mechanical contact, as compared with a double joint consisting of the mechanical contact between the tag and the fixing nuts, and the additional soldered contact between the wire and the tag. But there is a difference between the value of a screw-down contact on to a loop of wire and a screw-down contact on to a tag. When screwing down a loop of wire it is seldom possible to use great pressure, because to do so may either splay out the loop or twist the wire out of the direction in which it is desired that it should run. When a tag is used, to which the wire is to be soldered later, there is no restriction as to the force that may be used in screwing down, and the nuts will bite into the tag, thus giving a greater area of contact than is possible with a loop of wire.

Direct Soldering

Soldering direct on to the end of a terminal does of course give a very satisfactory contact when it is properly done, but the practice introduces several complications:

1. A poor connection is easily made, due to faulty adhesion of the solder to the terminal, and if this should occur, the chance of its escaping detection is greater than when the joint is made by means of a tag.

2. The application of heat to the terminal may loosen its hold on the panel.

3. If the terminal should work loose in course of time, there is danger that the wire may break away, with disastrous results.

4. The joint is mechanically weaker than when a tag is used, and a joint of this kind cannot be relied on to hold components (such as fixed condensers) in position.

5. If the set is not intended to last for ever, the task of dismantling will be more troublesome.

Simplifying the Wiring

Soldering tags have, therefore, the advantages that they simplify the task of wiring up, and add strength to the structure of the set if they are used properly. Suitable tags of plain brass, or tinned brass, should be used; they should be provided with a small hole at the end, into which it is possible to insert the connecting wire, if a right-angle bend is made in this about ⅛ in. from the end. It is remarkably easy to get a good blob of solder to cover this contact, so that the wire and the tag are for all practical purposes one piece of metal. Needless to say, the tag should always be held between two nuts, and should not be used between one nut and the panel.

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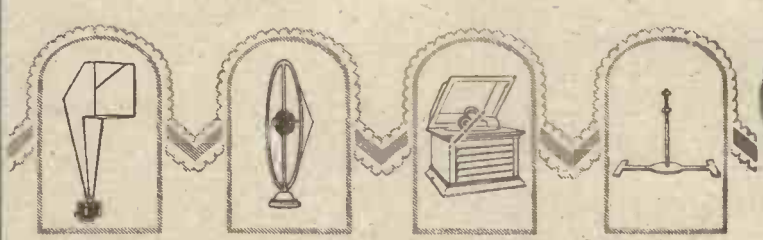

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L. 122.

SOME COMMON FAULTS.

FROM A CORRESPONDENT.

THE following is a brief account of some of the faults which commonly occur in receiving sets and the best means of repairing them. The partial or total failure of a receiver may be due to some very small cause which could easily be put right if the owner only knew the proper way of going about the business.

A fall in signal strength is a very common mishap. Unfortunately it may be due to one of many causes, and it is therefore advisable to run over these points to see whether everything is in order. First examine the batteries; the H.T. battery especially is a frequent source of trouble. Test the battery with the aid of a flash-lamp which is placed across each 3-volt tapping at a time. Faulty cells should be short-circuited with a piece of wire.

Causes of Fading.

The accumulator should be tested under actual working conditions. Otherwise the voltmeter gives a misleading indication of its true state, because when the accumulator is switched off the set its voltage rises rapidly.

Then examine the earth connection. In dry weather the soil around the earth plate loses its conductivity and sets up a high resistance in the oscillatory circuit. The result is a mysterious falling off in signal strength. The remedy is to prepare a solution composed of a quarter of a pound of common salt to three gallons of water, and to pour this solution over the soil in the neighbourhood of the earth plate.

The peculiar phenomenon known as fading may be due to several causes. When it occurs during the reception of a distant station it may be due to atmospheric or geographical conditions, unfortunately beyond human control. If it occurs when the local station is being received it is probably due to a faulty grid leak or possibly the swaying of the aerial. Try the effect of a grid leak with a lower resistance and tighten the aerial.

Eliminating Distortion.

Scratchy sounds are apt to be very troublesome, and the source of the trouble is often difficult to trace. Scrape the valve pins free of oxide with a penknife, clean the switches with a soft rag. If the vanes of the variable condenser are bent at all, carefully adjust them so that they do not cause a "short." Make sure that the H.T. battery is not run down: dry batteries when in an exhausted condition are apt to produce annoying buzzing and crackling. Examine the leads to the headphones. When the flex is frayed partial short-circuits often occur.

Distortion is a very serious fault and is generally due to too much reaction or a fault in the L.F. amplifier. On no account use more reaction than is absolutely necessary, and when receiving the local station it is better to do without it altogether.

The standard broadcast receiver at the South Kensington Science Museum which is demonstrated regularly for the benefit of the public.

Make sure that the transformer in use is a reliable one. If not it must be scrapped, and the owner would be well advised to exercise great care in the choice of its successor. The chief point to remember is that the L.F. valve must always be kept working on the straight portion of its characteristic curve; therefore use a high anode voltage of 100 volts or so with about 4 volts on the grid as negative bias.

Occasionally distorted signals are due to a neighbour's carelessness or ignorance in allowing his set to oscillate. In such cases a tactful note, together with helpful advice on the subject of reaction, will generally put matters right.

IS EBONITE WORTH WHILE?

By HUMPHREY PURCELL.

THE present fashion is to mount as few components and terminals as possible on the panel itself, and at the same time to space things out more and more. The 3-valve or 4-valve set of to-day frequently measures 24 or 30 inches in length, and, as everyone knows, ebonite is sold by the inch. To buy a really good ebonite panel for an up-to-date set may cost fifteen or twenty shillings, and it may then carry merely a couple of variables, a rheostat, and a jack or two.

What is the advantage of an ebonite panel? It looks pretty when it is new; but the colour fades, and it shows up dust badly. It is fairly strong; but the panel is no longer required to bear any great weight. It is "safe" electrically; but no severe electrical strain is applied to it. *All the parts that touch the panel nowadays are at earth potential.* Some of them may be connected to L.T. minus and others to H.T. plus, but it is not necessary to use ebonite to guard against a leakage of direct current. Dry wood is quite satisfactory.

Points at "Earth Potential."

Let us consider the points of a set that require careful insulation. The aerial terminal: there is no need for this to be on the panel; it may be on a small piece of ebonite at the back of the set, or it may be provided on the coil itself if auto-coupling is employed in the aerial circuit. Valve holders, coil mounts, neutrodyne condensers, grid condensers, grid leaks: these are all arranged to mount on the baseboard, and are adequately insulated. Variable condensers: the later types are constructed so that the fixed plates do not come in contact with the panel, and the moving plates are usually connected to earth (or to one of the batteries, which are, of course, at earth potential). Rheostats: many are suitable for baseboard mounting, but in any case they are at earth potential, as are telephone jacks or terminals.

There is really nothing that requires a big sheet of ebonite. A terminal strip, or even two, will be necessary, but for the rest, a piece of ¼ in. mahogany or oak, nicely figured and polished, will be just as efficient as the most expensive black stuff, and if well selected and fitted, will probably improve the appearance of the set.

BROADCAST NOTES.

FROM OUR BROADCASTING CORRESPONDENTS.

The Dead Hand—Xmas Programmes—A Question of Cash—Broadcast News Service—Opera News.

The Dead Hand.

AS prophesied in this page, the new Constitution of British Broadcasting has departed radically from the recommendations of the Crawford Committee. The point which the latter placed pre-eminently in the foreground was freedom from Post Office interference on the programme side. The new Licence devotes several clauses to making sure that no such freedom is attained. The censorship of the Post Office officials is to be much more intrusive and absolute than it has been under the regime of the company.

The assurances of the P.M.G. in the House of Commons have not quieted misgivings. It is notorious that the inner junta of officials at the Post Office were determined to make Broadcasting a permanent subsection of their Department. So far at least as the written constitution is concerned they have succeeded in flouting both Parliament and public opinion. But the Corporation would be well advised to exploit the collateral assurances of the P.M.G. to the utmost.

The only really satisfactory feature of the new documents is the inclusion of Mr. Reith as first Director-General. Even this is qualified by the obvious blunder of not putting Mr. Reith on the Board of Governors. The real reason for this, of course, is that the Post Office officials are terrified of Mr. Reith, and they feel the need of placing him under a constitutional handicap. Where they have miscalculated, however, is in failing to recognise that handicaps of this kind only spur him to greater effort, and a more relentless policy.

Christmas Programmes.

Among the programmes already arranged for the Christmas period are the following: Humperdinck's Opera, "Hansel and Gretel," for Tuesday, December 21st; a special Radio Pantomime for Boxing Day; Bach's Christmas Oratorio, Sunday, December 26th.

On New Year's Eve there will be a special transmission reminiscent of the many and varied phases of Broadcasting during the four years of the B.B. Company.

Variety Events of Interest.

National Wireless Week programmes did succeed in proving one thing conclusively, and that was that the real trouble in connection with B.B.C. variety and vaudeville is lack of money. The variety shows of the special week were all first class. They were organised and gathered by the normal staff. The only difference was that a reasonable amount of money was available.

On Wednesday, December 1st, there will be a special performance of Felgate King's Revels of 1926, a concert party including the following artistes: Elsie Mayfair, Gladys Holliday, Anna Clive, Henry Hearty, Charles Baines, and Felgate King. Holt's Saxophone Octet will make their microphone début on Thursday, December 2nd. Marie Dainton, of music-hall fame, will be heard on Tuesday, December 7th.

A Question of Cash.

Exposures in POPULAR WIRELESS were largely instrumental in arousing such a volume of public opinion against the original plans of the Treasury that at the last minute the Government yielded, and the financial arrangements of the new Broadcasting Authority are much more satisfactory than there was any reason to anticipate. There is established, of course, the dangerous principle of the "right to raid" before the service is developed. But in practice the Corporation should not be unduly hampered, especially as it can

A good example of a camouflaged American radio receiver: the Bosch "Ambaroda".

borrow up to £500,000. The money available for current expenditure during 1927 will be of the order of £800,000. There should, therefore, be no further delay in at least some of the ambitious programme projects the B.B.C. has been impatiently nursing for months past.

Broadcast News Service.

According to its constitution the new Corporation can collect and distribute its own news. It is understood, however, that the policy of the Broadcasting Company in this respect will be closely pursued. There is no present intention to set up in opposition to the press or the news agencies. Negotiations are actually in progress for another agreement similar to that which has enabled the company to provide its attenuated news service during the past four years. It is hoped that the new agreement will allow a considerable extension of present facilities. For instance, it is almost certain that at the next Derby a narrative account from the course will be broadcast. Other similar occasions will be the subject of descriptive broadcasts, if impending discussions are successful. If they are not successful, then the Corporation may have to fall back on its own resources and enter into a cut-throat competition with the press. This is regarded as a most unlikely eventuality.

The Prime Minister's Son.

On Saturday, December 4th, Mr. Oliver Baldwin, the Prime Minister's son, will broadcast through all stations from Birmingham one of his own short stories. He is reported to have an excellent microphone voice and manner.

The German at Dundee.

A sign of stiffening Post Office surveillance is contained in the announcement that at the last minute a talk on the League of Nations by a German professor at Dundee was cancelled by the Post Office after acceptance by the B.B.C.

Clamour About Cackle.

The wise B.B.C. decision to eliminate a large proportion of the public dinners from programmes has led to protests from interested quarters. Some parliamentary pressure is now threatened. It is to be hoped that interference of this kind through parliament will not be successful. If it is, there will be a new and grave menace to the entertainment value of the programmes.

Chief Obah Mehewhe.

London will provide an absolute novelty programme on Wednesday, December 8th, when Chief Obah Mehewhe and a group of his Yoruba tribe of natives from Central Africa will put on a typical native show. There will be a call to morning prayer, a march of the tribe to battle, a return from victory; after which the chief will broadcast a special message to British listeners in his own tongue. This will be translated by another member of the tribe who has acquired some little knowledge of English.

Opera at Aberdeen.

The current revival of the quality of broadcasting from the Scottish stations is reflected in the announcement that on Saturday, December 4th, Aberdeen will give a repeat performance of the concert opera, "The Romance of Spain," written by Norman Ingram with music by Vincent Thomas. The chorus will be from the Lyric Opera Company, and the soloists will include Miss Alice Moxon, Miss Dorothy Forrest, and Mr. Stuart Robertson. The opera will be under the direction of Mr. Irvine S. Cooper.

New York Calls Britain.

THE surprise birthday greeting from America, which was relayed to listeners during the closing programme of the B.B.C.'s Birthday Week, was by common consent the best American relay we have had. Reception was exceptionally good, and as the speech was addressed to us over here, it was far more significant than just a chance-heard American programme. I hope the Keston receiving station will continue to look out for a chance to snap up these overseas programmes now and then.

PLANNED FOR POWER, PLANNED FOR PURITY

—it makes a whisper loud.

LISSEN has produced a transformer which has revolutionised all previous ideas about transformer performance and price.

It is not always the best transformer available that may be specified in any circuit. You are free to choose your own parts—we give you seven days to find out that you cannot get a better transformer than the new LISSEN.

Never again pay a high price for a transformer. No matter what may be specified always use a new LISSEN in place of it. You will save money and distinctly gain in tone, purity and power by using the new LISSEN. Compare this against any, no matter what price—you cannot beat it for tone, purity and power. It fully amplifies every tone, every note, every harmonic, every overtone—many expensive transformers will not do that—BUT THIS NEW LISSEN DOES IT.

That is why we have withdrawn all our own expensive transformers which have been on the market and largely sold for several years past.

SEVEN DAYS' TEST

If you don't prefer the new LISSEN against every other transformer you may test it against, take it back to your dealer or send it back to us.

8/6

AND GUARANTEED FOR 12 MONTHS.

TEST IT FOR 7 DAYS.

Turns ratio 3 to 1
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Use it for 1, 2 or 3 stages L.F.

It will suit every circuit and every valve you will want to use.

The unheard of low price for such a high grade master part is made possible by a huge production programme, special plant, a determination to place big powerful amplifiers within the reach of all who care to build them, and our new direct-to-dealer policy of distribution which cuts out all wholesale profits.

USE LISSEN FIXED CONDENSERS, TOO, Mica & Mansbridge Type

LISSEN Mica Type CONDENSERS

Small energy-conserving condensers—note the new case which enables the condenser to be used upright or flat. At present the new case is available only in the most used capacities, but will quickly become a LISSEN standard.

Capacities—
·0001 to ·001 1/- each (much reduced).
·002 to ·006 1/6 each (much reduced).

Accurate to 5%—they never leak—they never vary.

LISSEN Mansbridge Type CONDENSERS.

To a fine LISSEN quality condenser is added the specially moulded case—the condenser cannot short circuit on to its case. The new LISSEN case protects you if the condenser is used in any circuit connected straight on to the electric light mains. And due to our new policy of direct to dealer distribution this LISSEN Condenser costs no more than the ordinary type.

·01 to ·09	2/4
·1	2/6
·2	2/8
·25	3/-
·5	3/4
1·0	3/10
2·0	4/8

LISSEN FIXED GRID LEAKS

A case of these was left on our factory roof during the summer of 1925, soaked in rain, baked by sun and the resistance value of these leaks never altered.

All capacities, previously 1/8, **Now 1/-** each.

Improve every circuit by using LISSEN parts wherever you can—save money too—for now you get keen prices as well as fine quality.

LISSEN LTD., 8-16, FRIARS LANE, RICHMOND, SURREY.

Managing Director: THOMAS N. COLE.

Many are using LISSEN Transformers in "N" Circuits.

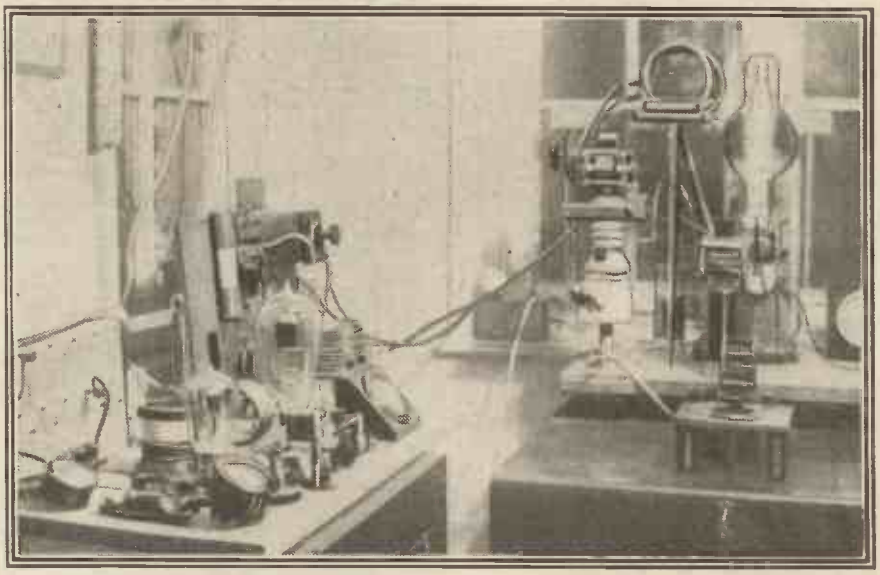
L. 121

A 32-METRE CRYSTAL CONTROLLED TRANSMITTER.

By E. J. SIMMONDS, M.I.R.E., F.R.S.A.
(Staff Consultant.)

THE following short description of the quartz crystal transmitter which has been in operation on 32·2 metres at Radio G 2 O D for some time now will be of especial interest to those readers who have so kindly forwarded reports on the transmissions.

The photograph here reproduced shows the lay-out of the apparatus, which consists of four stages of H.F. couplings progressing in input powers from 6 watts in the first stage to 100 watts in the final stage, which is inductively coupled to the aerial system. The first stage, which is seen on extreme left, consists of an L.S.5 valve with 300 volts on the anode, controlled by a quartz plate in the grid circuit in the usual way. The output from this stage is passed to the next valve, an Osram Det. 1. In this stage, by choosing suitable valves of negative grid potential and plate voltage, and the use of filter coils on the anode circuit, the frequency is doubled—that is, the wave-length of the first crystal controlled valve is halved. This arrangement allows the use of crystals of longer wave-length, and consequently greater mechanical strength.



Mr. Simmonds' latest short-wave receiver, some interesting details concerning which are given in the accompanying article.

The output of this frequency-doubling stage is passed to the third stage, which is a 250 Osram valve run at a relatively low input power; and finally the output of the third stage is passed to last stage, called the "power amplifier."

This valve is one of the special short-wave valves developed by the Osram Company for operation at high frequencies.

The last two stages of amplification are carefully neutralised and balanced in much the same way as the H.F. stages are neutrodyned in a broadcast receiver, although in view of the frequencies used in this transmitter, neutralising is not quite as straightforward as it would be at broadcast frequencies.

The aerial proper is an elevated horizontal half-wave oscillator-radiator, fed at the voltage node by two parallel radio-frequency lines, which are balanced so that the current readings in each feed wire are exactly equal. Numerous reports from all parts of the world have been received on these transmissions, and on Sunday last between 18.00 and 19.30 G.M.T. two-way communication was maintained with places as far apart as Singapore, Cape Town, and Australia. All reports received on these transmissions emphasise the extreme steadiness of the frequency and purity and quality of note, which qualities are the outstanding characteristics only possible where some form of crystal control is embodied in the transmitter.

THE RADIO WATER-DIVINER.

By A. J. BOYINGTON.

THIS possibility was suggested at the World Power Conference at Wembley, in 1924, by Mr. Oskar Taussig, of Vienna, that radio waves can be used to discover something about rock strata, ore deposits, or water channels deeply buried in the earth, without actually digging down to them.

As far back as 1910, another Austrian—Dr. Heinrich Loewy—discovered that when a radiating aerial or antenna is brought within reasonable distance from a conducting body, the presence of the latter in the field of the radiation will affect the shape and nature of the field and may affect the nature of the radiation itself.

Mr. Taussig proposed a practical application of Dr. Loewy's principle by equipping a small dirigible with radio transmitting apparatus and aerial, and surveying the world's great deserts from the air, with a view to determining the character of their mineral and water deposits. The surface soil of these areas, being dry, will not act as a conductor—consequently the working of the transmitter will be unaffected.

A Step Further.

But supposing that the airship crosses a location where there exists a considerable body of underground water. This water will form a conductor and its reaction on the transmitter will be to alter the wave-length of the aerial, or what amounts to the same thing, it will alter the capacity between aerial and earth. As this alteration can be detected and measured, Mr. Taussig believes it possible to locate those parts of any desert where drilling would be most likely to develop supplies of water.

The possibility may be carried a step further in the detection of metalliferous strata by transmitting waves downward into the earth and detecting the upward reflection of these same waves from underground conducting layers. The latter may be water-saturated strata, or they may be ore-bearing beds having a higher conductivity than is normal for barren rock.

German Inventor's Success.

The plan is undoubtedly interesting. A German inventor named Pastor has already developed a "mine-finder," which operates on the reflection principle and has succeeded in detecting the presence—from the surface—of metallic ores underground.

To carry out the same project from the air, however, involves difficulties which are not at first apparent. The mere surface of the ground may act either as an absorbing or reflecting layer, while rock strata—though similar in composition—may differ among themselves in conductivity. Much exhaustive experimental work must be carried out before the aerial water-diviner becomes a certainty, but there is more than a chance that radio will play no insignificant part in causing the desert to "blossom as a rose."

A two-valve set made by the Lorenz Co., of Germany.

The RADIO CONSTRUCTOR

Edited by PERCY W. HARRIS, M.I.R.E.

This valuable eight-page supplement, devoted to the interests of amateur wireless constructors, appears every week in POPULAR WIRELESS. Tell your friends about it, for it is only in "P.W." that they will find the radio articles by the leading constructor expert, Mr. Percy W. Harris.

FIRST of all this week I want to thank the almost innumerable correspondents who have written to me giving me the results they have obtained from the Hale circuit. A selection from these letters will be published next week, and many more would be printed but for the limitations of space.

That the Hale circuit will give thousands of readers just what they want for local reception I have not the slightest doubt, for the combination of purity with volume given by this receiver is unequalled by any other combination.

I notice, too, that readers are now recording results which, had I listed them in the first article, might have appeared as exaggerated claims. This gives me an opportunity of publishing a few opinions on the subject of test reports, and the policy of "The Radio Constructor" in regard to them.

Every home constructor, whether he writes for the Press or keeps his results for a limited circle of friends, must submit to a number of temptations when he builds a successful receiver. Human nature being what it is, we are all rather liable to exaggerate our results in the enthusiasm which comes from achieving that success.

Unfortunately radio conditions differ from day to day, hour by hour, and are rarely the same at a given time in two places separated twenty or thirty miles from one another.

Again, the immediate surroundings of the receiving installation, the size, shape and disposition of the aerial, the efficiency or otherwise of his earthing system, and the individual skill of the operator, all represent factors which make for a wide difference between results obtainable by Mr. Jones and those by Mr. Brown.

Wireless receivers can be reported upon in regard to sensitivity, selectivity, and quality. So far as sensitivity is concerned, in skilled hands and with the use of an accurately calibrated wave-meter, stations can be found and made clearly audible which otherwise would not be picked up at all. With some very sharp tuning sets, fitted with reaction control, no little skill is required to get the best results, both in regard to sensitivity and selectivity.

On the Loud Speaker.

Then there is the question of that much worn phrase "picked up on the loud speaker." I am afraid in very many test reports that have appeared in the past the picking up on the loud speaker, while being a true statement in so far as the operator preparing the test report did not use telephones throughout the experiment, has created the impression that the station so picked up has been of sufficient strength to provide entertainment in the average living-room by means of the loud speaker.

Frequently the results "on a loud speaker" have been so faint that, unless one were standing close up to the horn, they would not have been heard at all. Frequently, too, owing to the variations in natural conditions which occur from night to night and hour to hour, it has not been possible to repeat such tests on two successive evenings, and I have often known cases where on one evening really genuine loud-speaker strength, sufficient for any living-room, has been obtained on a foreign station, while on the following evening the best that could be obtained was a faint whisper from the horn on the same station.

Though, by taking readings over a number of evenings, it is possible with many receivers to compile a test report giving a very large number of stations as received at "loud-speaker strength" due to the conditions previously outlined, the impression given by such test reports is that once the receiver has been built by a constructor he can turn from degree to degree and obtain the list of stations at full loud-speaker strength.

For Average Conditions.

Many an excellent receiver has been prejudiced in the eyes of the public by test reports which have not been reproducible in the manner suggested on the first reading, and by awakening expectations which have not been fulfilled have done much more harm than good.

The test reports which have been appearing, and which will appear in connection with sets described in "The Radio Constructor," will endeavour to reflect their average conditions such as are likely to be met with by the majority of readers of these pages. Many will get far better results than I shall indicate, and such people are to be congratulated for their local conditions, and other factors which place them above the average.

Among the hundreds of letters received from readers giving their views on the subject of modernising existing receivers a very large number have asked for details of how to bring the "Four-Valve Family Receiver" up to date. Laboratory tests on this set have shown me that results comparable with those of some of the best of modern receivers can be obtained with relatively few changes, and in this week's issue a short article shows how grid bias can be fitted. In next week's issue a long article, fully illustrated with photographs and diagrams, will describe how semi-aperiodic aerial coupling, neutrodyning for the H.F. stage, grid bias, and separate H.T. for H.F., detector and two note magnifiers can be fitted, together with jack switching. These changes make for a much higher efficiency all round, and will ensure the user obtaining really modern results for the expenditure of less than thirty shillings.

Before closing this week's chat I must also thank the many readers who have given me expressions of their views on the subject of their ideal set. I hope shortly to collate many of these letters, and give you some kind of an analysis of their contents. Meanwhile I am delighted to find that my new receiver, "The King of the Air," to which I have already referred, fits in so well with what so many people ask for.

This is the time of the year to examine your aerial. Test all your guys and halyards for rot!

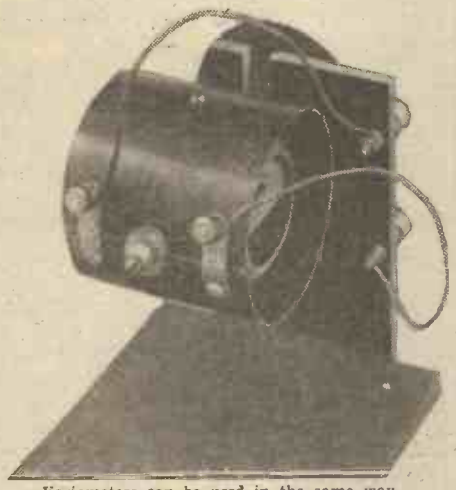
Percy W. Harris

A USEFUL STAND FOR TEST WORK

AND OTHER HINTS.

BY THE EDITOR.

WHEN new circuits appear the first desire of most experimenters is to "hook them up," and try them out as speedily as possible. If the circuit turns out to be a desirable one, then the work of building it into a finished receiver can be undertaken at leisure or by following the published design. Here are a few ideas which will help you in quickly rigging up the circuit for trial without robbing yourself of apparatus which you will subsequently need for the finished receiver.



Variometers can be used in the same way.

The Condenser Stand.

One of the most useful devices I possess is a stand made to hold any variable condenser temporarily in position. It consists, as you will see from the photographs reproduced herewith, of a simple baseboard cut from a board, an ebonite front panel (slotted), and a pair of terminals. A suitable baseboard can easily be found, while the ebonite is any scrap from an old set or from your "junk box." The slot is made $\frac{3}{8}$ in. wide, so that any of the "one-hole-fixing" condensers can be slipped in and the nut tightened in a moment. Flexible wires join the fixed and moving plates to the terminals.

Two or three of these stands will be found extremely useful when trying out a circuit, as whenever desired, the particular variable condenser can be removed and used for set building.

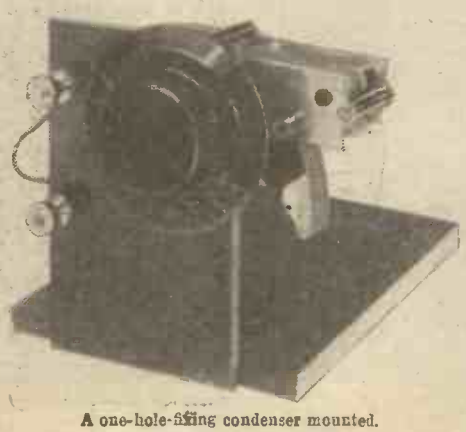
I make very good use of a length of board some 9 in. × 30 in. × 1 in. thick, planed and supported on six rubber feet. These feet serve the double purpose of preventing scratches on furniture, and of stopping any slip that might occur during operations. The wood being soft deal, components such as fixed condensers, grid-leak holders, L.F. transformers, and the like, can be screwed down in a moment and just as easily removed. So many components are now sold mounted upon their own insulating bases that circuits can be rigged up very quickly and with a minimum of trouble. The condenser stands, by the way, are often useful for holding other one-hole-fixing components, such as neutralising condensers, filament rheostats, variometers and many other devices.

Unless a considerable amount of experimental work is being done with a particular circuit, it is not usually necessary to solder connections or make neat wiring; unless, of course, you are dealing with some neutralised circuit where the actual disposition of every wire is important. In such cases the whole design must be worked out with great thoroughness, but such work is generally too tedious for the general experimenter.

Circuit Wiring.

The wiring up of the circuit with the components in place is often hindered by the absence of suitable lengths of wire, and indeed one can waste a great deal of material in this way. Home constructors do not generally realise the great utility of the small brass "pinch-on" tag, which gives a useful finish to a wire without soldering and with the minimum of effort. These tags can be purchased from most wireless dealers at about 2d. per dozen, and are an excellent investment.

The method of fitting is to bare the end of the insulated wire, lay it on the tag and pinch over the projecting fingers, with pliers. I keep a whole boxful of leads finished off in this way, and although the cutting and "tagging" of these leads originally occupied an hour or so, the initial investment of time has yielded a rich dividend in subsequent time-saving.



A one-hole-fixing condenser mounted.

A small baseboard, an odd piece of ebonite, and two terminals are all that is required.

The experimental board should have permanently mounted at one end and behind a terminal strip with an adequate supply of terminals fitted with nuts. You will generally require low-tension negative and positive, high-tension negative and, say, three high-tension positives, while provision should also be made for at least three pairs of grid-bias terminals, if you are doing experimental work with multi-valve circuits.

Semi-Permanency.

You will find, by experience, that quite a considerable amount of apparatus will be kept permanently mounted on the board. For example, the detector and two note-magnifying stages will stand for many circuit arrangements. I find it useful to keep such apparatus on the board but without transformers, arranging flexible leads with spade terminals so that any make of transformer can be connected in a moment or two, without cutting and fitting special wires. It is also convenient to keep a couple of resistance stages "alongside" ready for comparison purposes.

The STATION MASTER

By PERCY W. HARRIS, M.I.R.E.

Designed for headphone listening, this self-contained super-heterodyne brings all Europe to your ears. The complete cost with all valves, batteries, etc., is under £16.0.0.

ON a number of occasions recently, and again when answering readers' queries at a big London store, I have been asked for a design of receiver which would enable the user to sit quietly in a room and listen to a wide variety of stations without interference from the nearest, and without using a loud speaker for the purpose. In a phrase, what was needed was a long-distance "telephone" set, with real simplicity of control.

Of course, for high selectivity and simplicity of control a super-heterodyne has many good points, but the large number of valves generally necessary, the complicated make-up, together with the large demand made upon the H.T. battery, and not the least the expense involved, generally put the super-heterodyne out of the ordinary man's way.

Sitting down to think about the matter, it occurred to me that by cutting out the note-magnifying stages we should still get ample strength for telephone use, while the other advantages, simplicity of control and selectivity, would be retained. Furthermore, a five-valve set should be amply sufficient in this form, and a five-valve set is neither expensive to run nor particularly expensive to build, especially if, as in the set to be described, due precautions are taken to keep the costs down.

All in One.

Now, self-contained sets have great charm for me, and one of my first requirements in laying out the design was to find some way in which the receiver could be built in which both batteries were inside the cabinet without making it too bulky. Batteries themselves cannot be reduced in size, so the space would have to be saved elsewhere. In one direction a saving of weight and bulk could be effected by using a two-volt battery, particularly as good two-volt valves of all types are now available in a number of makes.

It so happens that one manufacturer is now producing a "super-heterodyne unit" containing many of the essential parts of this receiver in a very small compass. The simplified unit referred to is extremely compact, and contains the combined oscillator and detector unit, the intermediate frequency transformers, and the necessary fixed condensers and grid leaks with the valve holders mounted on the top.

Additionally there are required two variable condensers, the potentiometer, jack, on-and-off switch, and a Mansbridge condenser. On carefully laying out the parts I found it possible to get the five-valve super-heterodyne equipment into a space generally occupied by a three-valve set, and by obtaining a cabinet slightly deeper than usual, the batteries could be placed behind, while still making a very compact instrument.

There are several other points of interest in the design. For example, by adopting a fairly new type of cabinet with a special front, it is possible to use not only a slightly smaller ebonite panel than would otherwise be required for this size of cabinet, but any irregularities in cutting the panel—and many home constructors find trouble in obtaining a neat edge—is covered up by the overlapping woodwork. Furthermore, the "cut away" effect is very pleasing, and will be definitely preferred to the older type of panel presentation by most people.

How It Works.

Seeing that we are using a complete unit for the supersonic portion there is no need to go into details of the circuit, but for the benefit of those who have not previously handled a super-heterodyne, a few notes will be useful on the general principles of working.

Although the name "super-heterodyne" may seem formidable to the beginner and suggestive of technical mystery, this type of receiver is one of the easiest to operate, but it is not always the most easy to design and construct. To obtain long-distance results it is necessary that our signals should be magnified by H.F. amplifiers before being detected, and, indeed, most of the energies of designers during the last three years have been devoted to evolving new and more efficient means of H.F. amplification.

The valve itself is, of course, a magnifier, and it would seem easy to arrange a number of valves one after the other so that each should magnify signals passed on from the previous one. If, for example, we tune our aerial circuit to the wave-length we wish to receive, then the valve will magnify the small current set up and, if these currents induce further currents in the next stage, still greater magnification will be obtained.

It will be observed that to carry out this amplification each stage must be separately tuned to the wave-length we desire to receive, and this means that in most sensitive receiving sets there are several tuning controls—one for each stage of magnifica-

(Continued on next page.)

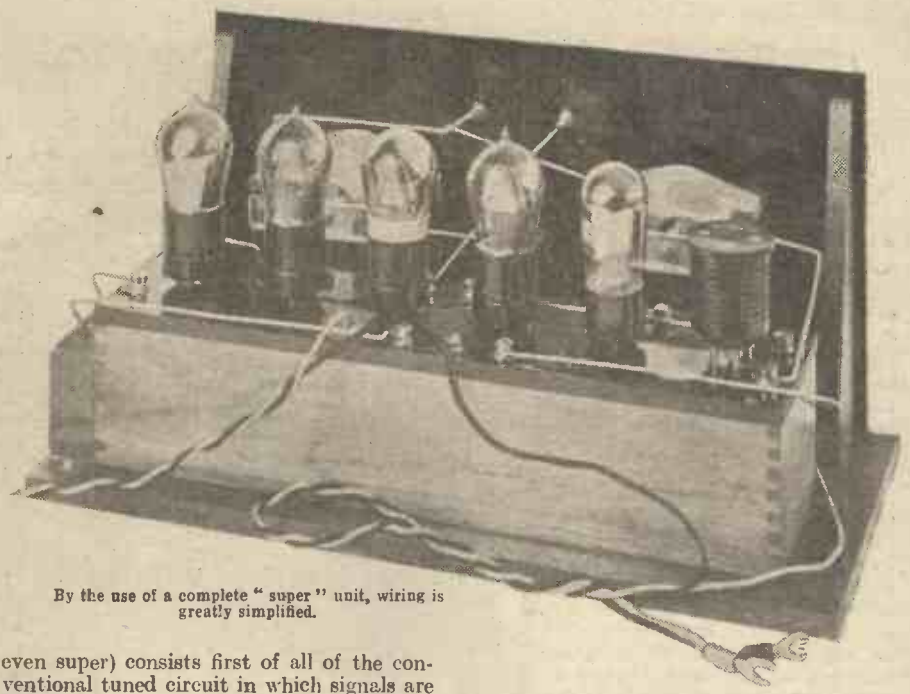
All components are of the best, including high-grade vernier dials. The appearance has been much admired.

THE STATION MASTER.

(*Continued from previous page.*)

tion. Within the last year or so attempts have been made to simplify the handling of such receivers by joining all the variable condensers to one shaft so that all can be rotated at the same time.

This method is known as the single control method, and if carefully matched condensers and equally matched coils are used, and if, furthermore, certain precautions are taken in the initial stages, it is possible to obtain a practical receiver using several stages of H.F. amplification with only one tuning control. However, such receivers are generally expensive, and completely dependent upon accuracy of matching, and personally I have never felt very enthusiastic about them. It is much easier and far less expensive to use two or three controls, and it is probable that many experimenters will still prefer this method until the technique is still further improved.



By the use of a complete "super" unit, wiring is greatly simplified.

Fixed Tuning.

Now, it will be obvious that if our receiver is designed to receive one wave-length only, then the various stages could be tuned to that particular wave-length and left so set. Such a receiver once tuned would always give us good signals from that particular station, but the simplicity so obtained would hardly be worth while seeing that we should be limited to one station only.

In the supersonic heterodyne receiver the real merits of a single frequency in amplification are taken advantage of, while the ability to tune to any desired wave is obtained by a very ingenious special device. For simplicity's sake we can say that a supersonic heterodyne receiver (generally abbreviated to super-het. or even super) consists first of all of the conventional tuned circuit in which signals are picked up.

This may take the form of a small frame aerial across which a tuning condenser is placed, or it may be the conventional tuned circuit such as we use in conjunction with an outdoor aerial. In view of the extreme sensitivity of a super-heterodyne receiver it is usually the former as, with the frame aerial a much higher degree of selectivity is obtained than with the outdoor type. Against this must be set off the reduction in general sensitivity which a frame aerial gives.

The Inventors.

The frequencies to which the first tuned circuit is adjusted range over all the wave-lengths that we commonly desire to receive, and therefore if we wish to obtain high-frequency amplification of an efficient type by ordinary methods, each stage of high frequency would have to be simultaneously tuned with the first tuned circuit. By a highly ingenious method, invented by Dr. Lucien Levy and Edwin H. Armstrong about the same time, the oscillations set up in the tuned circuit are combined with separately generated oscillations from a special valve so as to produce a still different frequency which is kept the same for all wave-lengths.

Thus, we may have oscillations on a 300-metre wave-length giving a frequency of

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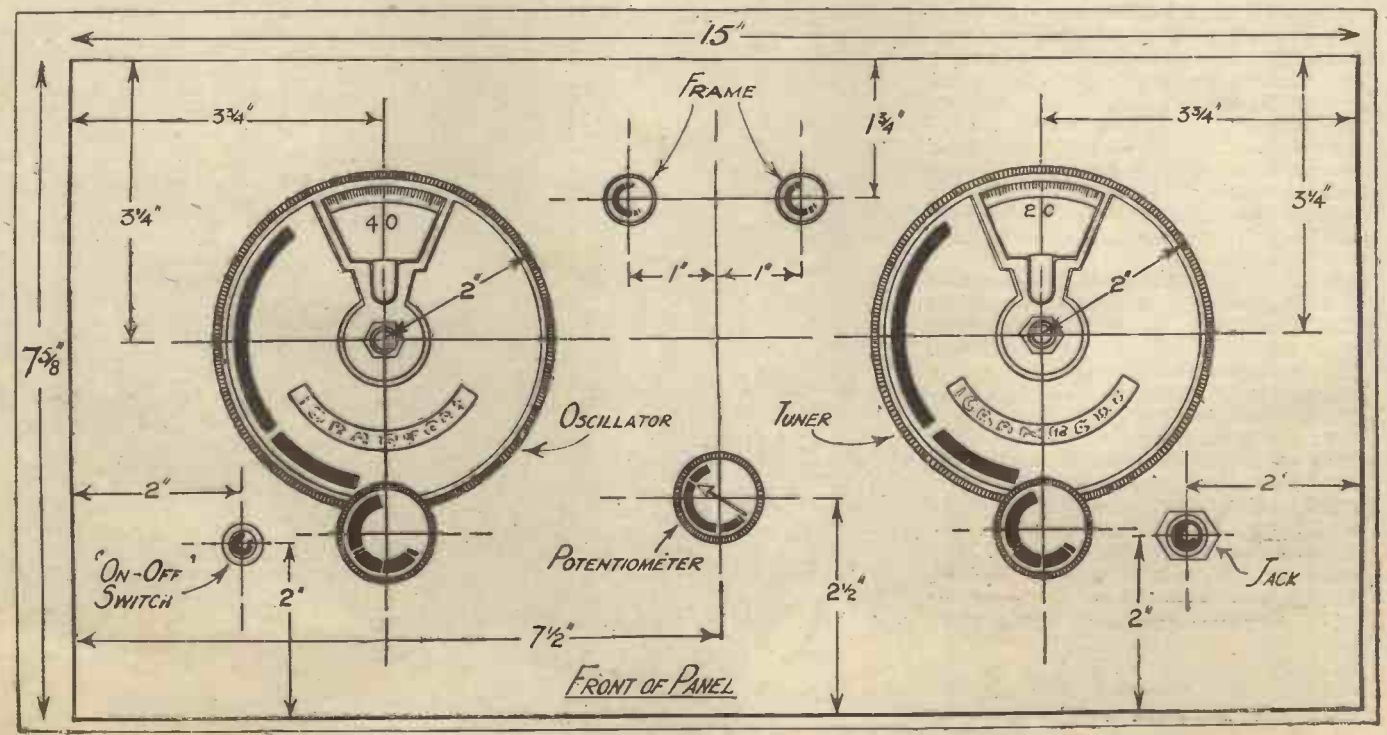


Although the actual panel shown is smaller, a standard 16" x 8" panel is equally suitable.

THE STATION MASTER

(*Continued from previous page.*)

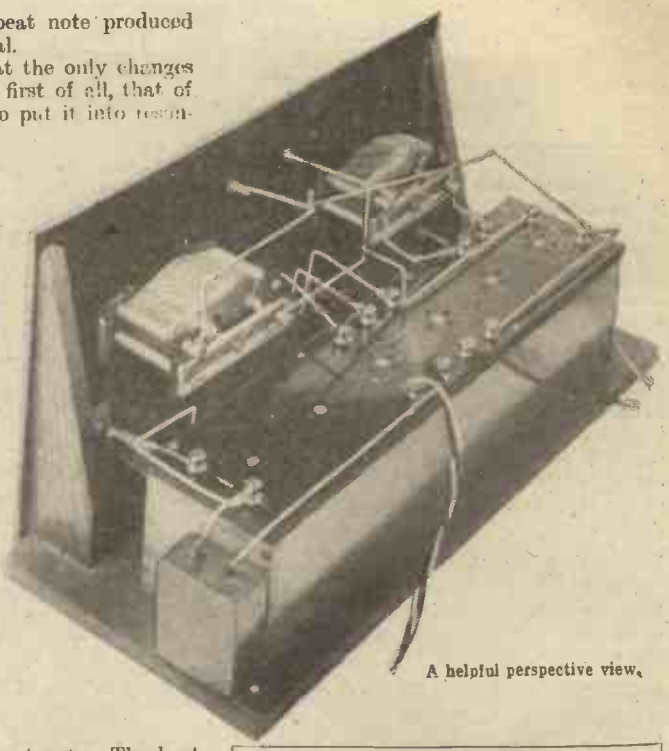
1,000,000, and by our oscillating valve we can produce simultaneously oscillations of a frequency of 1,100,000. The 1,100,000 frequency can be superimposed upon the 1,000,000 frequency, and there will be produced "beats" which can be rectified by a detector valve and will produce a frequency of only 100,000 cycles corresponding to a wave-length of 3,000 metres. This new "beat frequency" carries the modulation of the received signals, and if we put this through an amplifier designed to amplify at 3,000 metres and at no other frequency, we can utilise the method which does not require special tuning other than the initial tuning in the 3,000-metre wave-length.

The Oscillator.

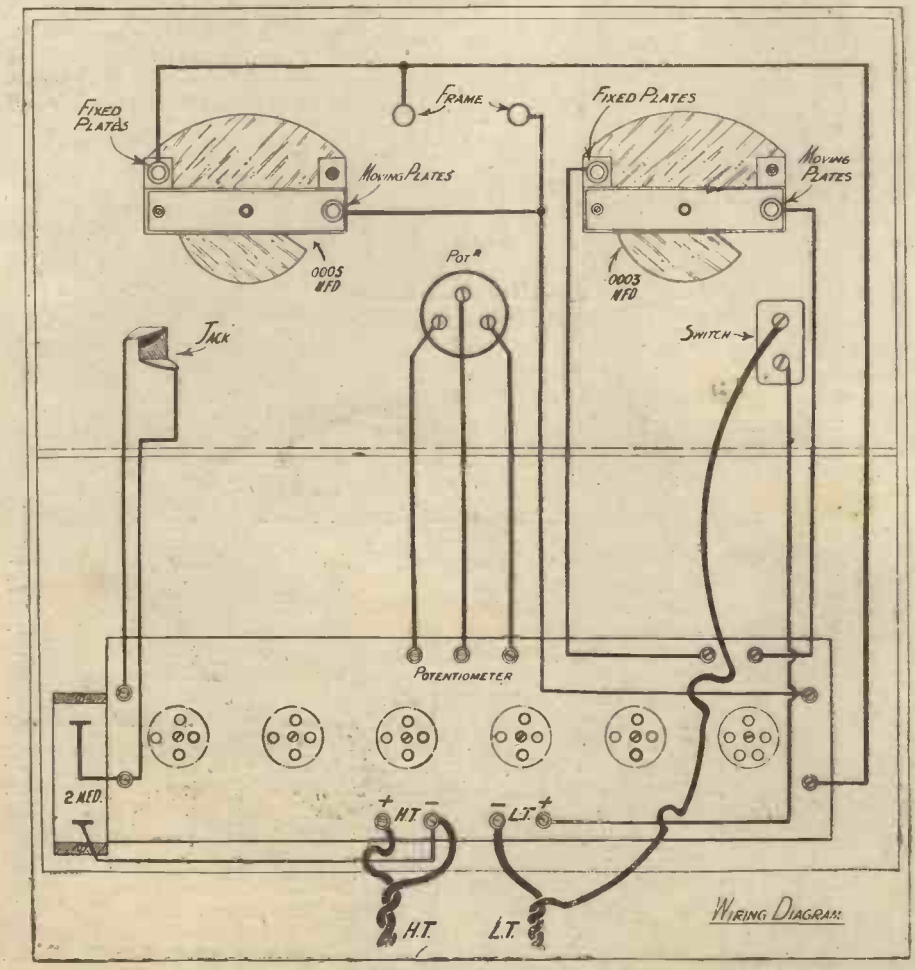
Now let us assume that we wish to tune to a wave-length of 600 metres, corresponding to a frequency of 500,000. When we change our tuning, at the same time we change the tuning of our oscillator to produce a frequency of 600,000, and again the beat note will be produced. This beat note will be the same as before, viz., 100,000, corresponding to a wave-length of 3,000 metres above referred to. In this way the amplifier which has been tuned once and for all to 3,000-metre signals can be used again to magnify the beat note produced *from* the 600-metre signal.

You will thus see that the only changes necessary in tuning are, first of all, that of the first tuned circuit to put it into resonance with the incoming signal, and secondly that of the oscillator to keep the difference of frequency between the two sets of oscillations always the same, namely, the 100,000 or 300 metres frequency. No matter what wave-length we wish to receive within the range of the instrument, we are only required to readjust the oscillator to keep the beat frequency the same.

You are now in a position to understand the general principles of a super-heterodyne receiver. It consists, then, of a tuned circuit into which are induced oscillations from a separate oscillator valve to produce the beat note. The beat note is then rectified, giving what is called the intermediate frequency signals, and these are magnified with a fixed amplifier to correspond with the frequency of the beat note.



A helpful perspective view.



Wiring is of the simplest character. Note that the conventional terminal strip is unnecessary.

PARTS REQUIRED.

One McMichael supersonic Unit. (L. McMichael, Ltd.)

One special cabinet to take a panel measuring 16 by 8 by ¼ in. The cabinet illustrated is made by the Unica Cabinet Company.

One ebonite panel 16 by 8 by ¼ or ⅜ in. Any good guaranteed ebonite.

Two variable condensers, one of ·0003 mfd. and one of ·0005 mfd. Those illustrated are the Bowyer-Lowe "Popular," but any good make of variable condenser of the value given will do, provided the securing nut of the one-hole-fixing method does not project too far from the front, so as to foul the vernier dials.

Two vernier dials. Those shown are the Igranic Indigraph, but any other suitable vernier dials can be chosen if the reader so desires.

One potentiometer; 300 or 400 ohms, any good make, will do here. That shown is a Yesley.

One on-and-off switch. Here again you have a wide variety of choice. That shown is an Igranic.

One single circuit open jack. Bowyer-Lowe, Igranic, Ashley, or any other well-known make will do.

Two terminals. I have used the Belling-Lee bakelite covered terminals, which give a smart appearance.

One plug to suit jack. As plugs and jacks are now standardised any good make will suit.

Suitable baseboard to fit in the cabinet. Most cabinet-makers supply these with the cabinet.

One 60-volt high-tension battery.

One 2-volt accumulator.

Five valves, 2-volt variety. (See notes next week.)

One suitable frame aerial.

One 2-mfd. Mansbridge condenser.

Two yards two colour twin flex.

Most of the components can be obtained in different makes, which will naturally vary a little in price, but if the parts used in this particular layout are adopted, the total cost will not exceed £16.

(*Continued on next page.*)

THE STATION MASTER.

(*Continued from previous page.*)

After they have been amplified at this intermediate frequency by two or three stages of high-frequency amplification, they are rectified in the usual way and passed out of the telephones direct or through the intermediary of audio-frequency amplifiers to our loud speaker.

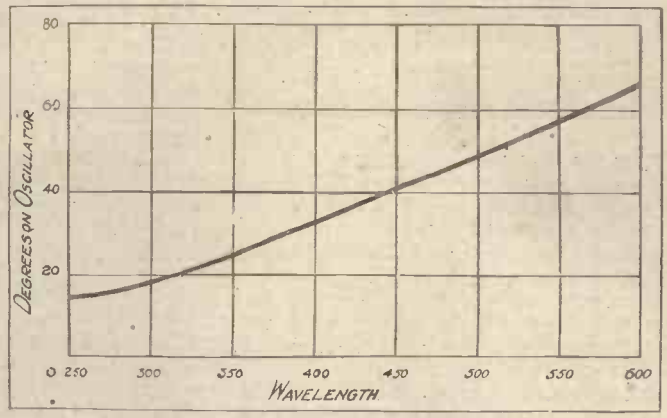
We can, of course, choose a wide variety of frequencies for the intermediate frequency amplifier, and indeed the commercial intermediate frequency transformers used in these amplifiers are designed for widely different wave-lengths. Some are tuned to a frequency corresponding to 10,000 metres, others to one corresponding to 2,500 or 3,000 metres.

Intermediate Frequencies.

There are advantages and disadvantages in the various frequencies, but so long as we are careful to choose one which does not happen to fall on one which is occupied by a loud signal, such as that from high power station which is liable to give interference, we have quite a large variety of efficient wave-bands to choose from.

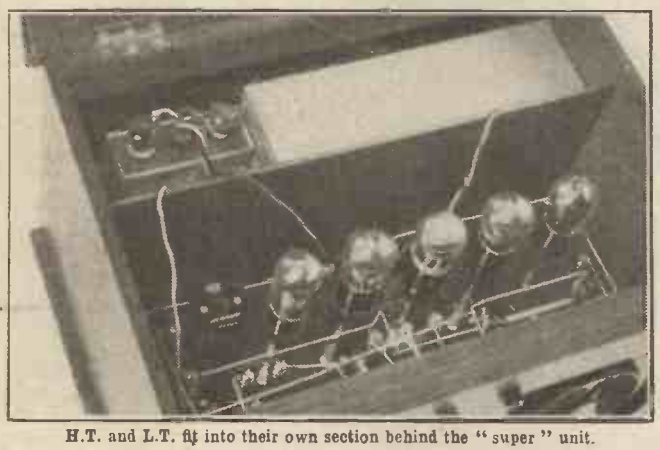
Many super-heterodyne receivers consist of a first detector, a separate oscillator valve for rectifying the beat note to produce the intermediate frequency, three intermediate frequency stages, a second detector and two stages of note magnification. By several ingenious adaptations it has been found possible to combine the functions of the first detector and oscillator in one valve, and sometimes only stage of audio-frequency magnification is used.

In the present receiver, which is designed purely for telephone work, economy of valves has been sought after. There are but five valves, the first acting as a combined oscillator and first detector, the second, third and fourth are intermediate frequency amplifiers, and the fifth as the second detector.



Approximate tuning guide for the oscillator dial.

In order to give the greatest simplicity of construction a special unit has been incorporated in the set. This unit contains within a small compass all the intermodiate transformer, condensers, oscillator coils, etc., going to make up the supersonic portion of the outfit, together with valve holders and terminals. This unit is made by Messrs. McMichael, Ltd., and greatly simplifies the construction of the set.



H.T. and L.T. fit into their own section behind the "super" unit.

Frame Aerials.

For the time being I may mention that you can buy from the London Electric Wire Co. 100 ft. of frame aerial wire, consisting of very flexible copper wire silk insulated and identical with that used on the most expensive frame aerials, for 3s. 6d. Next week I will show you how to make a good frame.

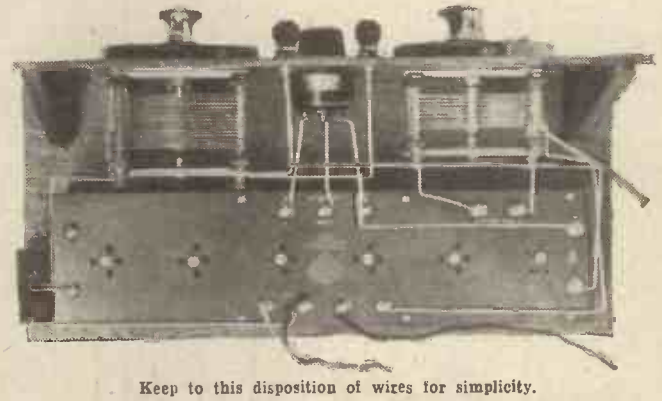
One hundred feet wound on a frame of about the size shown in the photograph, will give you a frame aerial to cover the ordinary broadcast range with a ·0005 mfd. condenser. Actually the instrument with such a frame should tune from about 260 to well over 600 metres.

Although the supersonic portions are contained in a very neat box, properly wired up and sealed by the manufacturers, it must not be imagined that the layout of the remainder of the wiring is unimportant. Although it may surprise many readers, it is a fact that this set had to be re-wired three times before it would give satisfactory working, for the length of the condenser leads and their relation to one another was found to be highly important. I would advise you, then, to follow very carefully the actual wiring of the set shown, as it is the result of very careful experiment and test.

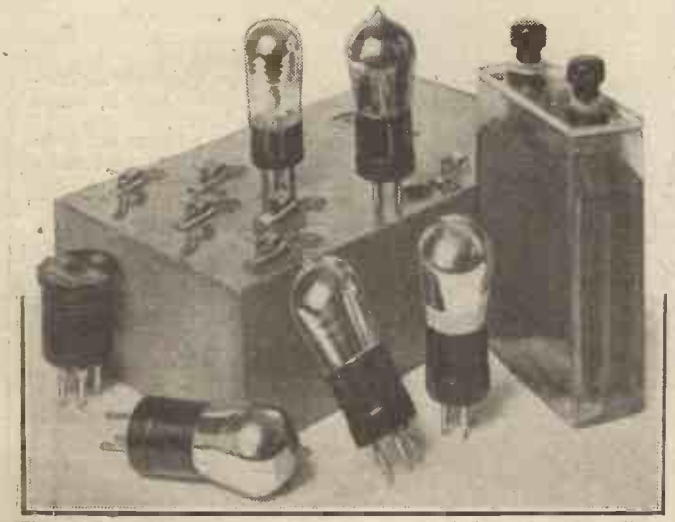
Constructional Hints.

Seeing that the drawings give you all dimensions, the drilling will present no difficulty, particularly as the components on the front panel are, as usual in most of my sets, of the one-hole-fixing variety. Condensers, which mount with three fixing screws, are equally suitable.

Some variable condensers of the one-hole-fixing variety have a very large nut in front which prevents the Indigraph dial being mounted in the proper way, but the Bowyer-Lowe "Popular" one-hole-fixing condenser will be found satisfactory in this regard, particularly if the last few threads of the centre bush, which project in some cases after the locking nut has been screwed on, are carefully removed with a file.



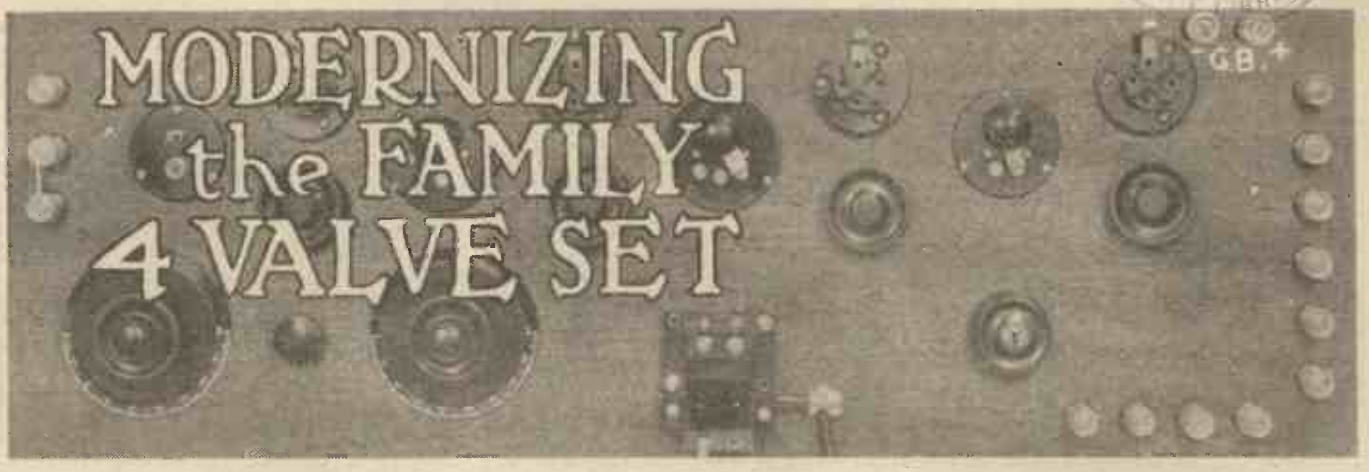
Keep to this disposition of wires for simplicity.



The only accessories needed. The plug-in unit is supplied with the "super" kit.

NEXT WEEK:

Further Details and Hints. Valve Notes. Test Report and Frame Aerial Construction.



MODERNIZING the FAMILY 4 VALVE SET

Simple Changes that Make for Efficiency.

By PERCY W. HARRIS, M.I.R.E.

I HAVE received, in response to my invitation in the first issue of "The Radio Constructor," many letters from readers regarding the modernising of their existing sets. A very large number have written me, asking what can be done to modernise the "Four-valve Family Receiver," which they very kindly say has given them excellent results, and in many ways gives all they require. They do not wish to scrap the set, but if there are any minor improvements which can be made, they are only too anxious to effect them.

The Original Set.

The "Four-valve Family Receiver" was designed several years ago, before the home constructor had such a wide choice of valves and before the selectivity problem became really acute. Improvement in the Four-valve Family can be effected in several ways and with very little expense, increasing both efficiency and quality. The first change which I would strongly recommend is that for introducing grid bias.

In the original receiver a slight bias is given to the grids of the note magnifying valve by a voltage drop in the filament resistance which is placed in the negative lead. For example, when the set was first produced practically everyone was using four-volt valves on six-volt accumulators. By placing the filament resistance in the negative lead and by joining the I.S. of the L.F. transformers to the negative low-tension lead, a drop of two volts for grid bias was obtainable in the filament resistance.

In the sets I now design I always place the filament resistance in the positive lead, and provide a separate grid bias battery, for there are so many varieties of valves in use, that one can no longer rely upon the use of a filament resistance to give sufficient grid bias. In any case with modern power valves much more grid bias is necessary than can be obtained by this means.

On this page you will find two photographs of the front and back of panel respectively of the original "Four-valve Family Receiver," as reproduced in the original description. On the photographs I have marked clearly the positions for the terminals for grid bias, and the changed connections behind the panel have also been indicated.

Other Improvements.

This is the simplest change that can be effected for making an improvement in the set, and is given at once so that readers who desire to obtain the benefit of modern valves and grid bias can do so. However, in the next issue, I will show a number of very important improvements in design, both in the high and low-frequency sides, which will enable readers to bring this set much more up to date with relatively small expenditure.

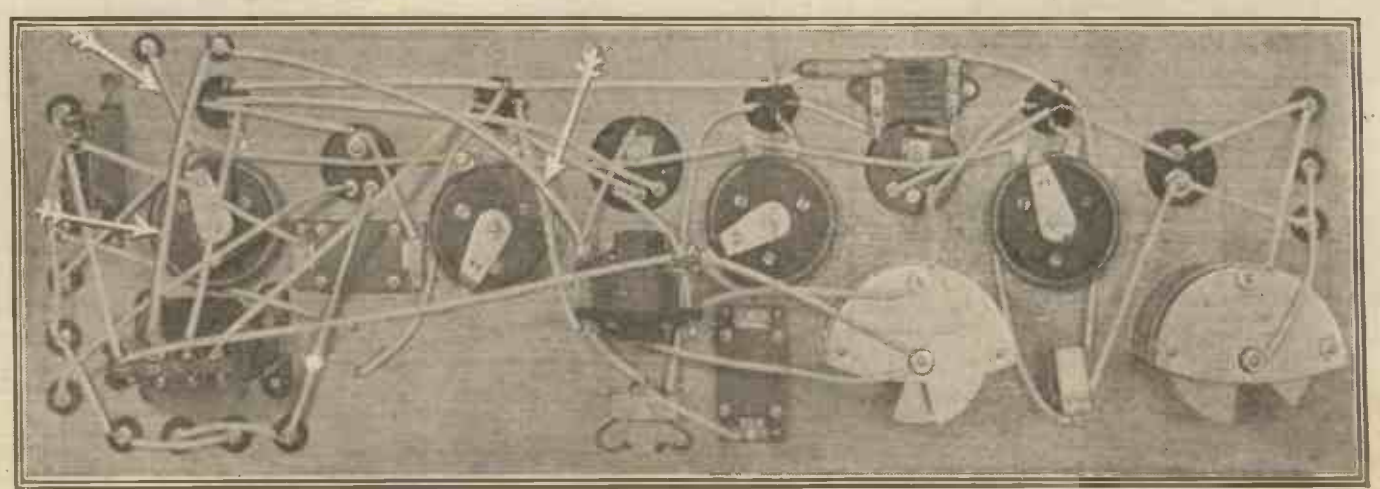
To indicate what these changes will be, and in order to give the more advanced reader an opportunity of making the changes himself at once, I may say that the H.F. side will be neutrodyned, still using plug-in coils and retaining the advantage of reaction, while plug and jack switching will be introduced so that different voltages can be used for the H.F., detector and note magnifying valves. This cannot be done with the present arrangement, which has a special method of switching precluding the use of separate H.T.

A Quality Hint.

Meanwhile readers who are not quite satisfied with the quality they are obtaining in the Four-valve Family set, due to transformers not being suited to one another, may try the scheme of connecting either a 100,000 ohm resistance or a quarter megohm grid leak (whichever they happen to have on hand) across the secondary windings (I.S. and O.S.) of the second L.F. transformer.

In many cases the inclusion of this resistance or grid leak makes a very considerable improvement in quality without much reduction in signal strength, or, if there is a reduction, the improvement in quality much more than compensates for the loss of strength.

In using the simple grid bias arrangement described in this article, the same grid bias is used on both magnifying valves, which may be of the small power type, the high tension being raised to about eighty or a hundred. Grid bias in this case can conveniently take the form of a 4½ volt flash-lamp battery.



A photograph of the original set, with arrows showing the changes necessary for applying grid bias to the note magnifying valves. Note the two additional terminals marked "G.B." in the heading photograph.

Note.—In this section Mr. Harris will discuss each week interesting points from the large correspondence he regularly receives. Readers are invited to write to him on matters of interest, and extracts from their letters, together with Mr. Harris' comments, will be published from time to time. It must be pointed out, however, that general and technical queries cannot be answered in this section, but should be addressed to the Technical Query Department, complying with the conditions laid down under the heading "Technical Queries" in each week's issue of POPULAR WIRELESS.

MY "Hale" letter bag is already very, very large, and naturally, as one would expect in the case of a receiver by a vast number all over the country, a certain number of difficulties have arisen.

For example, in their enthusiasm to "get started," many readers have made up the set without taking precautions to see that everything is correct. I have before me five or six letters from readers who report disappointing results, and in describing their "hook-up" either state in words or indicate in the diagram that they have not yet used grid bias.

Owing to the fact that in many receivers the addition of grid bias, as I have previously indicated in "The Radio Constructor," does not make any appreciable difference in signal strength, but merely makes a slight improvement in quality, and, what is very important, cuts down the consumption of high-tension current, they have rather looked upon its application in the Hale circuit as a kind of "finishing touch" which can be left till a later period.

Grid bias in the Hale circuit is essential for its successful working, and makes a tremendous difference to the reaction control, quality and general efficiency. For example, two or three readers have stated that they can hear quite good signals with the cat's-whisker removed from the crystal surface. Unless they are right underneath the shadow of the station this should not be so, save when the closest reaction is being used.

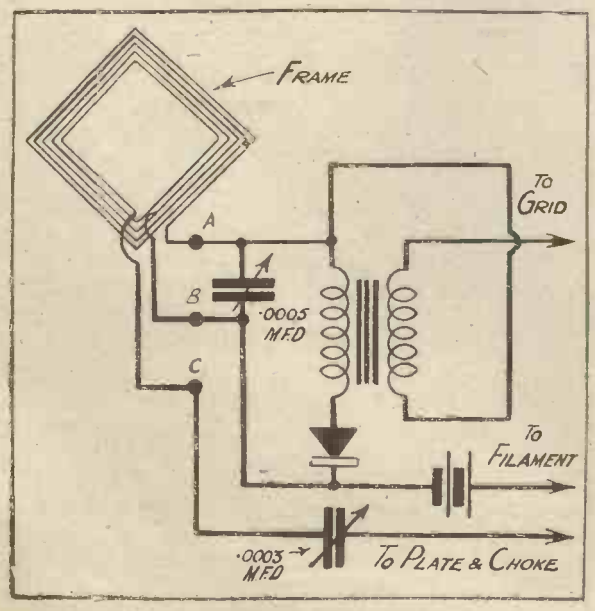
SPECIAL ARTICLES NEXT WEEK:

Neutrodyning the "Four-Valve Family" Set

(Fully Illustrated),

AND

How to Make a Four-Shilling Frame Aerial.



How to use the Hale circuit with a frame aerial.

It is one of the tests of satisfactory adjustment in the Hale circuit to see whether any signals can be heard when the cat's-whisker is lifted from the crystal surface, or in the case of a permanent detector, when the two crystals are separated. With proper grid bias nothing whatever should be heard in the way of signals, for the valve is used purely as an amplifier and not as a detector. Whatever valve you use, a few experiments with grid bias will be well worth while.

Some other queries indicate that the reaction coil has been connected the wrong way round. It is not generally known that even when the reaction coil is reversed oscillation can be produced when the two coils are tightly coupled, for a capacity reaction can then be set up, which is sufficient to produce oscillation.

If all is well with the Hale circuit, and the correct size of reaction coil is being used, one can bring the set gently into oscillation and out again with such delicacy that one hardly notices the point at which oscillation is reached. Before such a state of affairs is possible, however, the right size of the coil must be chosen, and the correct grid bias, for the particular high-tension value used.

In indicating the results obtained with the high voltage and a power valve I was, of course, dealing with the reception on a loud speaker. When the Hale is being used for telephone reception there is no need to use such high voltage, and 60 will be generally quite sufficient.

The "Hale" on a Frame.

Certain other queries relate to the use of frame aerials, indoor aerials and other substitutes for the long outdoor wire supported on a pole. One or two readers have written to say that they have very poor results when using a frame. The reason for this is that the average frame aerial connection does not provide for any reaction, which is one of the most important points in the Hale circuit. However, if the circuit is properly arranged wonderfully good results can be obtained on a frame, but the frame must be tapped, otherwise a reaction effect cannot be obtained.

For the benefit of those readers who wish to use a frame aerial with the Hale circuit I give on this page a diagram showing the connections which have to be changed when using a frame aerial with the form of circuit published on page 488 of the 30th October issue. From this diagram it will be seen that the tapped frame takes the place of both the tuning coil and the reaction coil in the Reinartz reaction circuit. The frame can be of any convenient type, but the tappings should be taken about a third of the way from one end.

The connections will then be as shown in the diagram—i.e. the end of the frame nearest the tapping to the reaction condenser, the tapping to moving plates of the condenser, grid bias battery and crystal, and the other end of the frame winding to the fixed plates of the condenser and the low-frequency transformer, etc. The best position for the tapping will probably be found by trial, but if you begin your experiments as suggested you will find it will be somewhere near the point suggested.

Indoor Aerials.

It should not be forgotten that in this connection only a portion of the frame (approximately two-thirds) is used for tuning purposes, so that the wave-length range with the particular variable condenser will not be so great as it was before. However, if it is a home-made frame, or if it is desired to construct one specially for the purpose, use about one-third more turns than normal.

So far as other aerials are concerned, such as the wire round the picture rail, a wire round the loft, and other forms of indoor aerials, they all work excellently and with much higher selectivity than with the outdoor type, but of course with a reduction of strength. It will generally be found that a much smaller reaction coil is needed with the indoor aerial, and a few experiments are recommended before final decision is taken.

CURRENT TOPICS.

BY THE EDITOR.

The Royal Charter—The P.M.G.'s Powers—More Money Available—The Listeners' Remedy.

THE Government have issued a White Paper containing the drafts of the Royal Charter for which the Postmaster-General proposes to apply for the incorporation of the British Broadcasting Corporation and of the licence and agreement, the terms of which have been mutually agreed upon between the Postmaster-General and the B.B.C.

It is stated in the Royal Charter that more than two million people have applied for and taken out wireless licences, and "in view of the widespread interest thereby shown in the broadcasting service and of the great value of the service as a means of education and entertainment, we deem it desirable that the service shall be developed and exploited to the best advantage and in the national interests."

Power is given to the new Corporation to acquire any undertaking, stations, plant, and assets which may be necessary, to erect and equip stations, to compile and prepare, print, publish, issue, circulate and distribute, whether gratis or otherwise, such papers, magazines, periodicals, books, circulars, and other literary matter as may seem conducive to any of the objects of the Corporation.

The new B.B.C. may collect news of and information relating to current events in any part of the world and in any manner that may be thought fit, and to establish and subscribe to new agencies. It can acquire by registration, purchase, or otherwise copyrights in any literary, musical, and artistic works, plays, songs, gramophone records, news, and other matter!

More Money Forthcoming.

The Corporation is going to be established for a period of ten years. The governors of the Corporation are eligible for office for five years, but may seek re-election at the end of that period, and the remuneration for their services is as follows:

Chairman	£3,000 per annum.
Vice-chairman	£1,000 „ „
Other governors ..	£700 „ „

With regard to finance, the Corporation is to pay to the Postmaster-General a royalty of £10 per annum in respect of each of the stations, while the Postmaster-General is to pay the Corporation:

1. In respect of the first million licences or fractional part thereof issued against payment in the year, 90 per cent.
2. In respect of the second million licences or fractional part thereof issued against payment in the year, 80 per cent.
3. In respect of the third million licences or fractional part thereof issued against payment in the year, 70 per cent.
4. In respect of all additional licences issued against payment in the year, 60 per cent.

A deduction of 12½ per cent on account of the cost of collection of licences will be made from the amount of all sums received by the Postmaster-General in respect of licences before the calculation of the percentage to be paid to the new B.B.C.

The agreement states that the Postmaster-General has agreed to pay the company £620,000, being as to £548,464 the agreed contribution or payment by the Postmaster-General to the revenue of the company in respect of the period from March 31st to December 31st, 1926, and as to £71,536 in respect of share capital to be repaid in full. These sums are in full satisfaction of all claims on the part of the company against the Postmaster-General.

Mrs. Philip Snowden, one of the governors of the new B.B.C.

A supplementary estimate of the Civil Service and Revenue Departments includes a vote for an additional sum of £295,000 for broadcasting!

A perusal of the White Paper shows that the Postmaster-General's authority over the new B.B.C. is to be supreme. His powers of control appear to be much greater on the whole than those contemplated in the report of Lord Crawford's Committee, whose recommendations have generally been followed.

A Bright Spot.

A tremendous amount depends upon the capabilities of the new governors. The "Times" has pointed out that it is not easy to understand why Lord Clarendon, who has been doing first-rate work and gaining invaluable experience at the Dominions Office, should suddenly have been removed to this entirely novel field. We admit it is very difficult to understand indeed!

And the same difficulty arises when we look at the names of the other governors. But the one bright spot is that the chief executive officer, who is to be called Director-General, will be Mr. J. C. W. Reith, who has the whole technique of broadcasting and the management of broadcasting at his finger-tips.

It appears that the governors of the new Corporation will be able to call upon the services of as many committees as they may think fit to appoint, and in turn the committees may themselves appoint sub-committees; and so on paper, at any rate, the new B.B.C. should be well supplied with sound advice and intelligence.

It would seem that the Corporation will receive more money than the B.B.C. has hitherto received from the Post Office, for, instead of the retention by the Post Office of half the amount of revenue derived from licences, there will be a new scale (which we have printed above), and this ought to leave the Corporation richer than the B.B.C.

P.M.G.'s Powers.

The Postmaster-General's powers over the new B.B.C. are, in our opinion, far too sweeping; for example, it is provided that the Postmaster-General may from time to time require the Corporation to refrain from broadcasting any particular matter. Now, this gives the Government a unique hold over the censorship of broadcast news. Supposing another General Strike breaks out, the B.B.C. can repress, at the command of the Postmaster-General, legitimate news which the public is entitled to receive, and it may even, for its own ends, colour that news and so give an entirely erroneous impression of current events.

Furthermore, the Postmaster-General can revoke the licence if, in his opinion, the Corporation does not adequately perform its duties. In other words, the Postmaster-General is in a position of being the master holding the big stick, and if the Corporation does not behave itself to the liking of the Postmaster-General then it can be turned out of office.

The B.B.C. Pie.

There are so many points in connection with this new Royal Charter which show that the Government have got their fingers well into the new B.B.C. pie and intend to keep them there, that it would take many pages of this journal to enumerate them. But there the matter is, and we can only hope that this new B.B.C. Corporation will prove half as successful as the old B.B.C., and that it will not, under this new band of governors, be turned into a highbrow, pedantic institution for feeding the public with what it considers should be "good" for the public.

Primarily it should remember that it is an entertainment industry, and its chief business is to provide its clients with entertainment. The only remedy listeners will have against the new service is to let their licences lapse and not take them out again. And next year if the new B.B.C. does not live up to the standard the present B.B.C. has maintained, there will undoubtedly be a very severe falling off in the number of licences taken out.

THE INTERPLEX.

PART III.

The Final Article on a Very Interesting Experimental System.

By J. ENGLISH.

THE main constructional work has now been described, but before the system is ready for operation there are one or two accessories to be constructed, the most important being the *Filament Control Panel.* This is a device by means of which any valve may be supplied with current at various voltages so that we can use at the same time an R valve (·70 amp. 4 v.), a D.E.R. (·35 amp. 1·8 v.), a D.E.3 (·06 amp. 2·8 v), and a D.E.5 (·25 amp. 6 v.). This flexibility of filament current supply is highly desirable in an experimental system, and one has but to experience the ease and certainty with which these various adjustments can be made in order to appreciate the great utility of the panel. As the various voltages are selected without the use of large series resistances, there is no great waste of current.

A Master Rheostat.

An additional control of current is provided by the master rheostat, which should have a resistance of about 30 ohms and be capable of carrying several amperes without overheating. Although current to the valves is cut off by pulling out the supply plugs, a further safeguard against short circuits is provided in the fusebox. The fuse should be adjusted to blow out when passing current of some predetermined value a little in excess of that required for all the valve filaments.

The ebonite panel, 9 by 5 inches, should be drilled as indicated in Fig. 12. The marking out of the four lines of five ¼-inch holes should be done carefully so that the supply plugs will fit properly in the sockets. The distance between the centres of the holes in each line of five must be exactly ½ inch.

A good method of making connection to the rear of the sockets is to drill four ¼-inch holes, ⅜ inch apart, in a 3-inch length of brass or copper strip not more than ⅜ inch wide. When this is placed over the shanks of the sockets underneath the panel and the nuts tightened up, a sound electrical connection is made to every socket. The panel is then wired up as shown in Fig. 12.

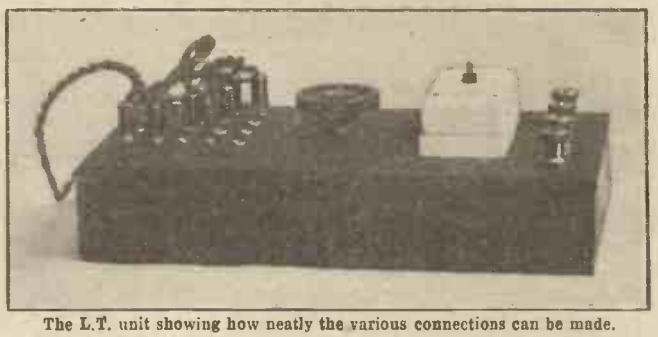
The completed panel is screwed to a wooden framework resembling a flat box without top or bottom. This is constructed from ⅜-inch wood and when finished measures 9 by 5 inches and 1½ inches deep. The filament control panel is screwed underneath the bottom board of the cabinet with the group of sockets to the front and the four terminals for connection to L.T. supply at the back.

As a complement to this panel we need four supply leads complete with plugs at each end. For these we require two 18-inch and two 24-inch lengths of heavy lighting flex, sixteen Eelex plugs in pairs of black and red, and sixteen separators.

The Interplex installed in the author's wireless "den."

From these materials plugs at the ends of each lead are built up as indicated in Fig. 13, and it will be observed from the photograph that the supply leads so formed are very neat and the method of current supply both safe and efficient.

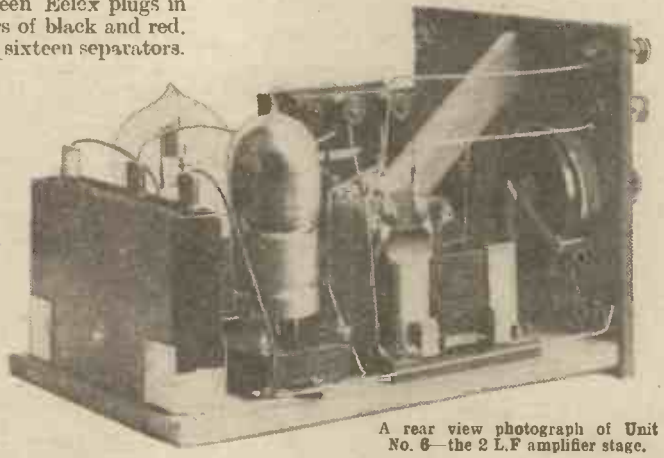
By using black and red discs behind the filament sockets on the valve panels corresponding with the black and red bodies of the plugs, it is easy to differentiate between positive and negative filament connections. Placing a supply plug in sockets A and B of any line of five gives 2 volts, in B and C, or C and D, 4 volts, and in D and E, 6 volts. Sockets B and D are positive and A, C and E negative, so that reversing a plug in any pair of sockets reverses the polarity of the filament connections, which reversal is often required and can be performed here in a moment.



The L.T. unit showing how neatly the various connections can be made.

Testing the Battery Circuits.

Four single leads are also required for anode current supply, and these should be long enough to reach the H.T. battery wherever it is situated. In my own installation, supply batteries, both H.T. and L.T., are placed beneath the operating table, where they are out of the way yet easily accessible. These four leads are furnished at each end with an Eelex plug with different coloured bodies corresponding to the coloured discs of the H.T. sockets on each valve panel, so that the various leads may be quickly identified when plugging into the H.T. battery.



A rear view photograph of Unit No. 6—the 2 L.F amplifier stage.

Except for a few sundries, the system is now complete and ready for operation. Before commencing any experiments, however, it would be well to test the current supply arrangements, all four filament circuits and H.T. positive leads.

The method of connecting the L.T. supply is shown in Fig. 12, while the

(*Continued on page* 767.)

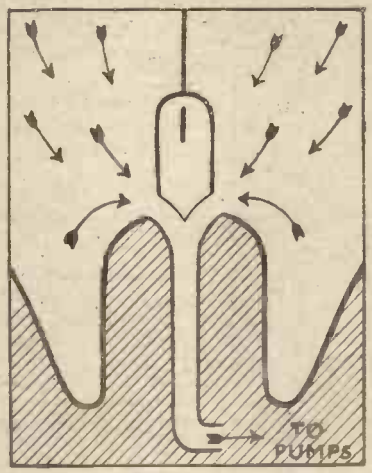
Features

RADIO ST VALVES

LIFE

THE most brilliant performance of a valve when first used in your set will not satisfy you unless those results are going to last. Some foreign motor-cars give excellent results to begin with, but they are practically useless after a couple of years. A Rolls Royce car, however, will give the same results after a few years as when new. The real cost of a valve is not the initial one, but the replacement and upkeep costs.

This fact was always in the mind of the designer of the S.T. valve, and all the causes of valve failure were scrutinised. He came to the conclusion that both mechanical and electrical causes were responsible. A valve fails because (a) the filament burns out, (b) the filament breaks, (c) the filament touches the grid, (d) the emission from the filament decreases, (e) the vacuum deteriorates. These troubles often occur together.



The filament, for example, burns out often because it becomes mechanically weak in one spot ; it may get very thin at one point and the wire may melt. This cannot happen with the torodium filament in the S.T. valve, which works at the lowest temperature of any filament used. Mechanical breakage is almost impossible because torodium retains its elasticity throughout its long life. The filament is not under tension, and there are no violent stresses set up by rapid heating and cooling when the valve is switched on or off. When you put an S.T. in its holder there is a just perceptible delay before signals reach full strength, which indicates that torodium heats up slowly, its very low specific heat protecting it from strain. Rapid switching on or off of a filament cannot possibly harm S.T. valves.

The risk of the filament touching the grid is very great in valves where the distances are very small, but the S.T. valve is designed so that there is adequate spacing, the desirable relatively low impedance being obtained in a different way, viz., by a very long filament and the use of "flat" electrodes of large surface area.

A very common fault of dull emitter valves is that the emission falls off, i.e., the filament does not burn out, but the valve ceases to function properly and signals go weaker or become distorted. This may be due to the material of which the filament is made changing in character. Most valves sold in this country have thoriated tungsten filaments, and evaporation of the thoria from the tungsten causes the valve to relapse to the state of a bright emitter. Torodium, however, works on an entirely different principle, and retains its emission month in and month out. Its coefficient of emission is, moreover, the highest of any known material.

Anode current may, however, fall off owing to a deterioration of vacuum. The slightest trace of oxygen, water vapour or other gases may cause the emission from an otherwise perfect filament to fall off. Practically all the gases in the valve bulb may be pumped out, but some may remain occluded (i.e., absorbed) in the metal electrodes and, after some weeks, may ooze out and spoil the vacuum. The S.T. valve, however, is exhausted by the Barguet process, which removes every trace of any gas, not only in the bulb, but in the electrodes themselves. In many cases it's the vacuum that's vital, and not only does this special process produce the highest vacuum known to science, but it never deteriorates. We see, then, that not only do S.T. valves give superlative performance, but they are :

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THE INTERPLEX.

(*Continued from page 763.*)

connection from H.T. negative to L.T. negative or positive may be made between the batteries themselves, preferably through a fuse or some current-limiting device, such as a high resistance shunted by a

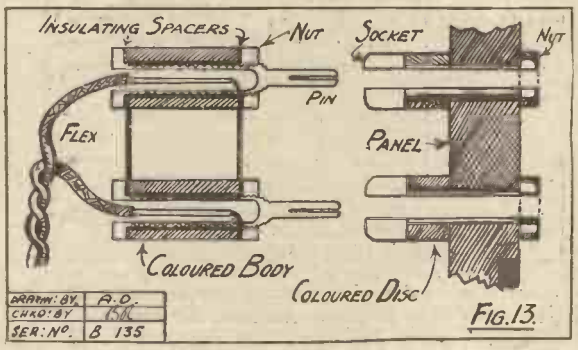
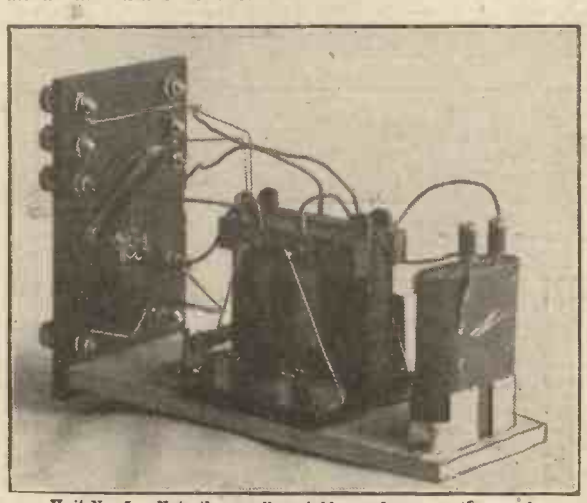


FIG. 13.

condenser. If the H.T. negative lead is brought up and plugged into a socket on the F.C. panel, it is easier to introduce components, where required, between the anode and filament batteries.



Unit No. 5. Note the small variable condenser on the panel.

As regards the use of fixed condensers across the anode taps, this will depend largely upon the nature of the experiment, but in the majority of cases such condensers will be required, and in my own installation a 2 mfd. fixed condenser is connected across each anode tap, these condensers being mounted in the box containing the H.T. batteries.

When all the supply arrangements have been tested and found correct, a preliminary test can be commenced. This will necessitate the addition of all the usual accessories such as valves, 'phones, coils, chokes, etc. Even if the experimenter has a deep pocket, it would not be wise to start off with a huge stock of such accessories, but to acquire them as he goes along. There *are* amateurs, however, who are not happy unless surrounded by as many odd pieces of apparatus as possible.

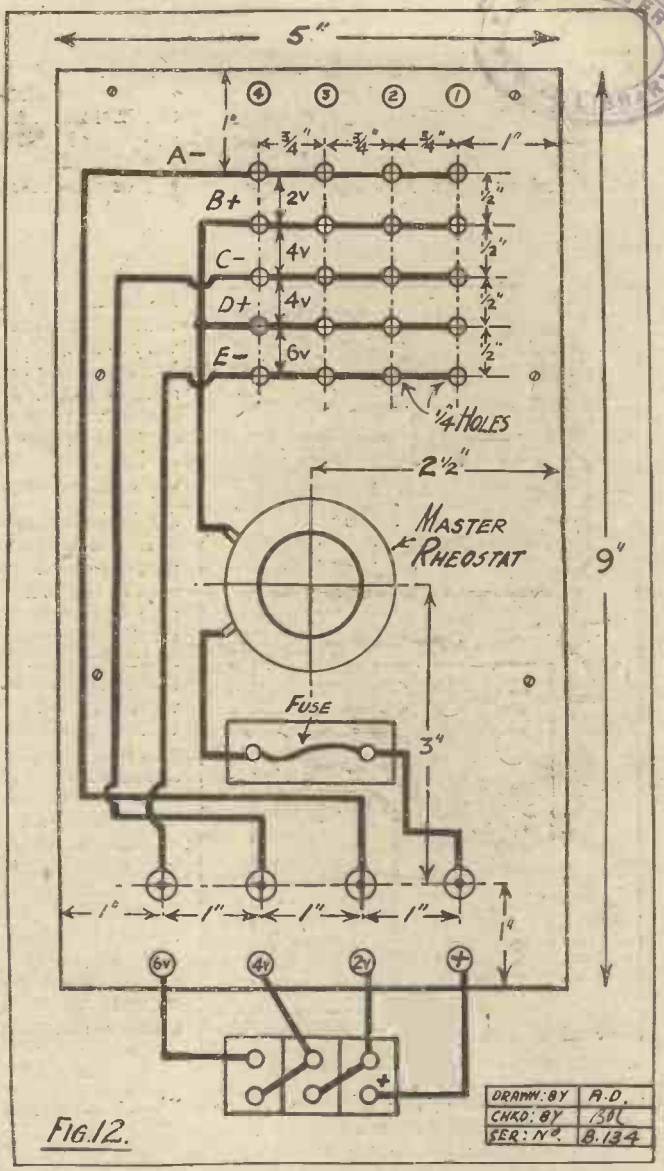
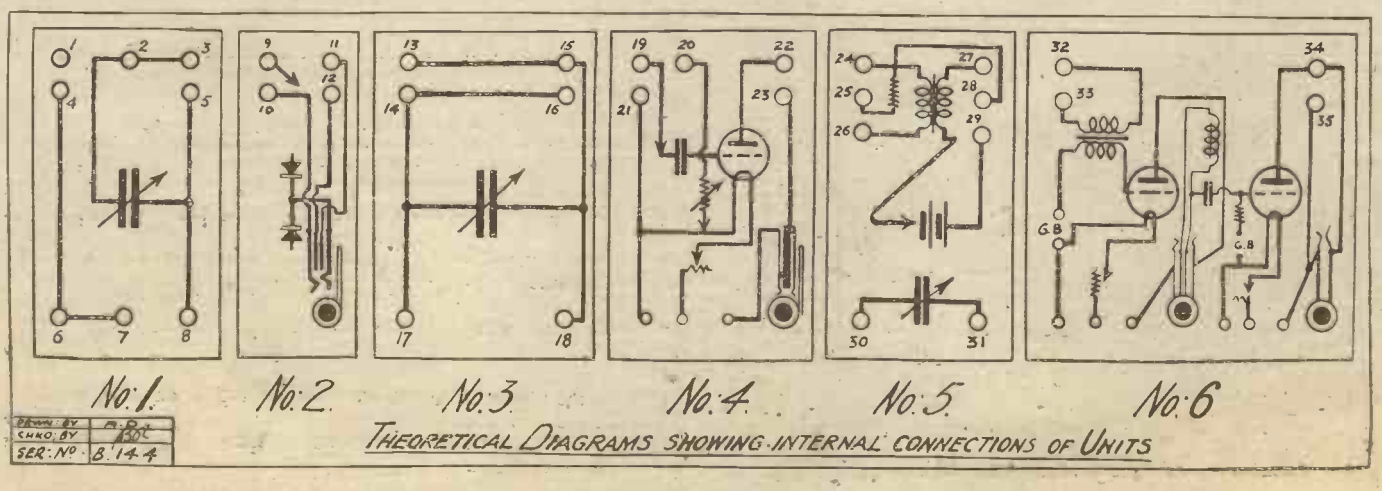


FIG. 12.

Returning to the subject of operation, it would be impossible to give here an example of every use of the Interplex system, but in order to convey some idea of how it is operated we will first consider briefly its use as a multi-circuit receiver. No doubt this function is of more general interest and is best illustrated by Figs. 14, 15 and 16, showing how units are connected up to form three well-known circuits. When joining up units short connections are made with lengths of square tinned wire, longer connections being made with ordinary insulated flexible wire terminating in spade terminals.

(*Continued on next page.*)



THEORETICAL DIAGRAMS SHOWING INTERNAL CONNECTIONS OF UNITS

THE INTERPLEX.

(Continued from previous page.)

The first example, Fig. 14, is a simple crystal receiver with series condenser tuning. The 'phone leads can be connected to terminals 11 and 12, but a better plan

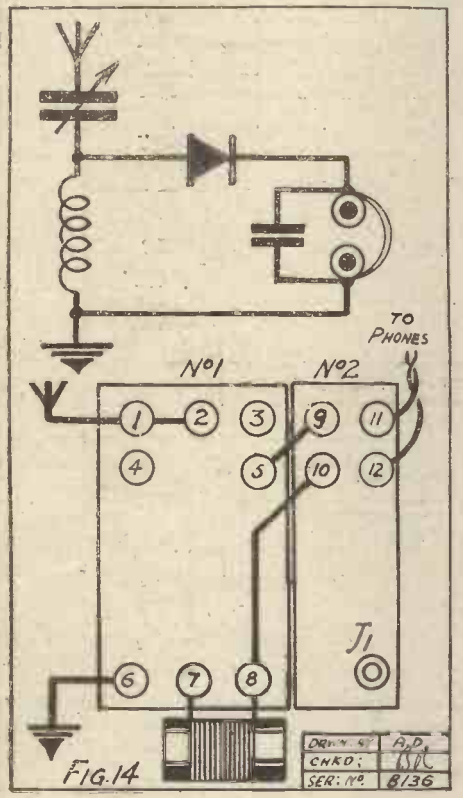


FIG. 14

is to use a length of flex having a 'phone plug at one end and connected at the other to a 'phone box containing the by-pass condenser and terminals for the 'phones or loud speaker. The 'phone plug can then be placed in any jack as desired. There is ample scope here for ideas for 'phone boxes incorporating switching arrangements, etc., and such a device is always of value.

Audio-frequency amplification can be added to the circuit of Fig. 14 by inserting the input plug of Unit No. 6 into the jack of Unit No. 2. This forms one of the best receivers for distortionless loud-speaker reception of the local station.

Fig. 15 (A and B) indicates the connection for a modified Reinartz one-valve receiver, with the addition of an acceptor wave-trap. Connections to batteries have been left out for sake of simplicity, and, as in diagrams to follow, only the terminals of the units are shown, as this is sufficient to indicate the methods employed.

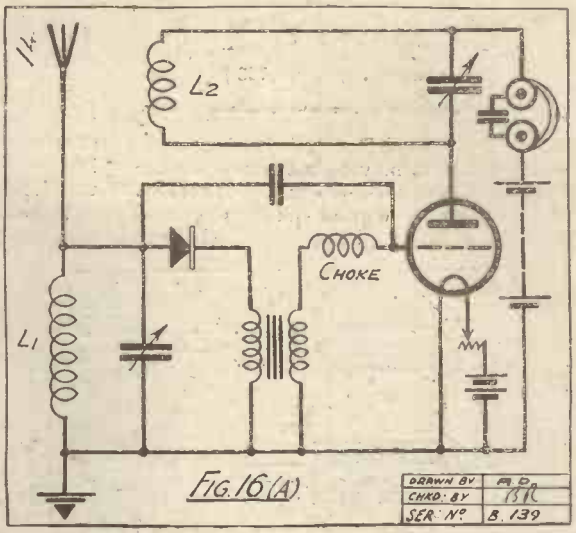


FIG. 16 (A)

An Adaptable System.

It will be noticed that the primary of the transformer in Unit No. 5 is used as the radio-frequency choke, the variable condenser of the same unit being the reaction control condenser. Also, Unit No. 3 forms the basis of the grid tuning circuit, the condenser of Unit No. 1 being the wave-trap condenser. The control of the valve is effected in Unit No. 4, the value of grid leak and grid condenser being adjusted as required.

The connections necessary to build up this circuit are few and simple, and there is ample scope for experiment with the receiver so constituted, which is admirably suited for DX work. Signals can be brought up to loud-speaker strength by the addition of Unit No. 6 as described above.

Fig. 16 (A and B) shows the connections for a one-valve Trinadyne receiver. Notice how Unit No. 3 is used to form a tuned anode reaction circuit.

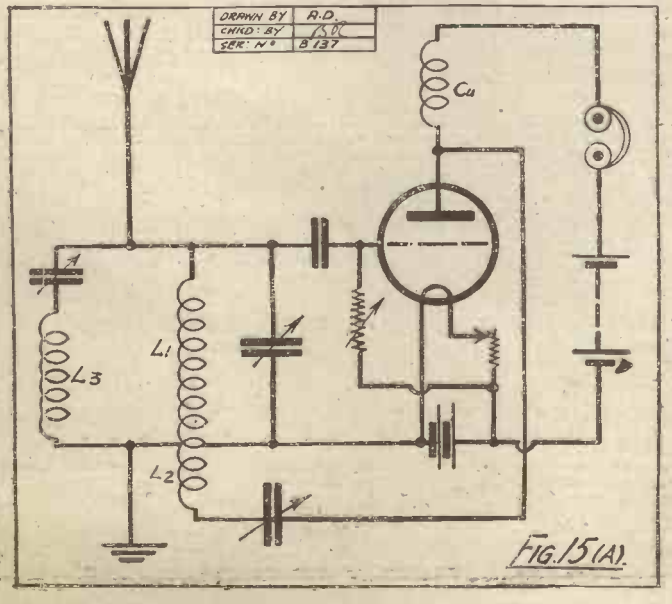


FIG. 15 (A)

The Interplex system is admirably suited for working out ideas for original circuits. New circuits are very rarely discovered by the haphazard connection of apparatus, and embryo inventors should work out their ideas on paper first, rejecting all that is obviously unsound. Then the final project can be tried out on this system, and in this way much time will be saved that would otherwise be wasted in pursuit of fruitless ideas. I might add that the

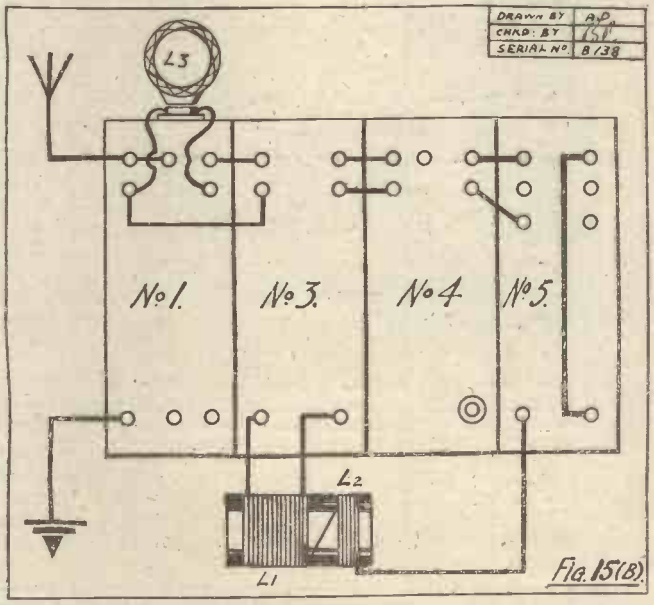


FIG. 15 (B)

Coils L_1 and L_2 can be mounted in a two-coil holder for convenience of coupling.

The three simple examples given above will, no doubt, be sufficient to give a general idea of how the system is used as a multi-circuit receiver. The rapidity and ease with which various circuits can be connected up should appeal to the man who likes to try out all the latest circuits and new forms of old ones. Trinadyne circuits, evolved on paper, were all tried out and worked into practical form on the original Interplex system.

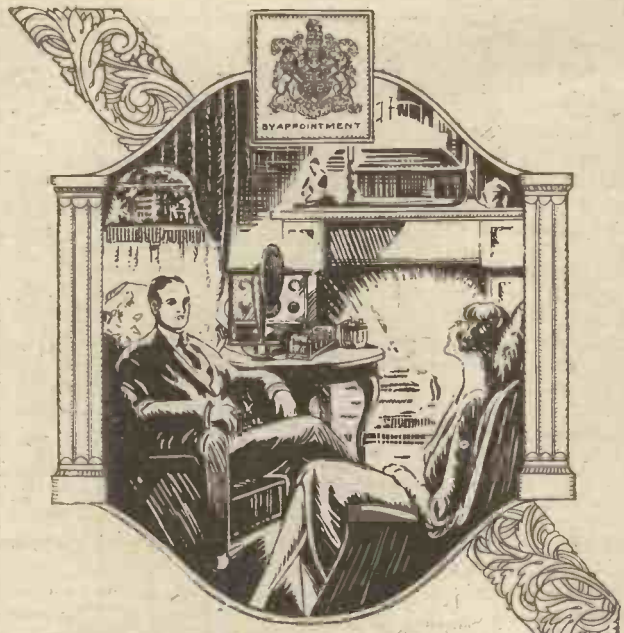
Anyone who designs and constructs much radio apparatus will find the system ideal for working out details of receivers, and it is possible to get a close approximation to the layout of the proposed instrument.

A Useful Device.

It will be noticed from the examples given above that Unit No. 1 is the foundation of all aerial tuning circuits, while Unit No. 3 forms the basis of other tuned circuits, such as tuned anode, grid, and coupled circuits.

An accessory that, in conjunction with

(Continued on page 770.)



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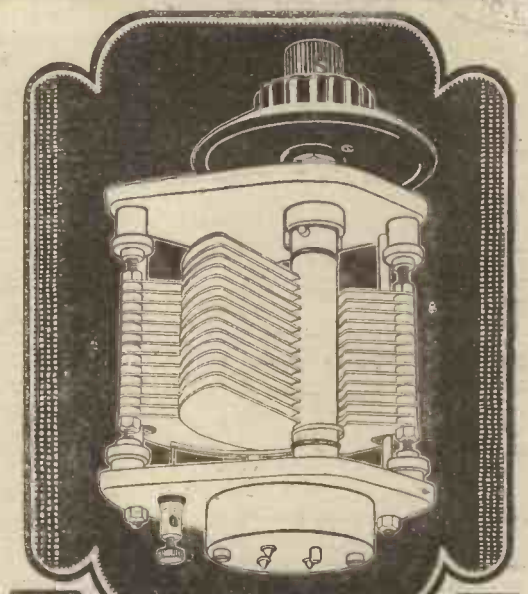

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Manufacturers of Scientific Instruments and Radio Apparatus

BRINGS RECEPTION PYE TO PERFECTION

THE INTERPLEX.

(Continued from page 768.)

Unit No. 3, constitutes the foundation of several forms of H.F. coupling is the device illustrated in Fig. 17. On a square of ebonite are mounted four valve pins, 1 in. apart, the four holes in the middle being drilled so that a plug-in type of transformer can be inserted. The pins of the transformer engage with spring clips behind, these contacts being connected to the valve pins shown in the figure, and contacts from H.T.C. valve holders are useful here.

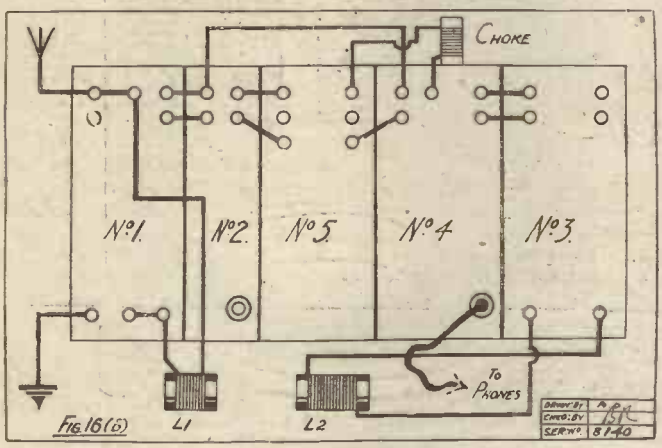


Fig. 16(6)

The H.F. Adapter.

If a Unit No. 3 is placed between two Units No. 4, this adapter can be connected to the terminals 22, 23, 13, 14, or 15, 16, 19, 21, giving respectively the circuits A and B of Fig. 18. When the second valve is a detector, terminals 19 and 20 are shorted.

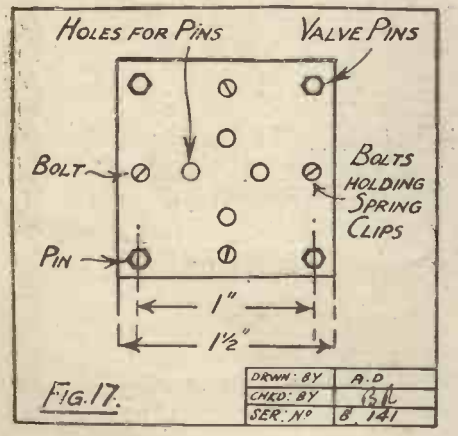


Fig. 17.

This adapter may be used to couple a crystal detector circuit to a radio-frequency valve, and if the primary or secondary windings of the transformer are tapped, then it is an easy matter to build up the couplings required for such circuits as the Neutrodyne, Rice, etc.

Apart from the pleasure and information that can be obtained from the use of the installation as an experimental receiver, it has other uses of great value to the experimenter interested in more serious work. For example, Unit No. 4 can be used for the determination of valve characteristics and other valuable data. Also, Units No. 3 and No. 4 can be used for the plotting of resonance curves, etc.

A Final Refinement.

A guide to the connections for using Unit No. 4 as a valve-testing panel is Fig. 19, which includes a potentiometer panel, another useful accessory used in my own installation.

Many uses can be found for the Universal Valve Unit, and there is no reason why a similar unit built on a larger scale should not be used for experimental transmission on low power.

In concluding, I hope that, even if the reader is not tempted to make up the entire system, he will have gleaned from this description of it some idea that will be useful in his own experimental set. On the other hand, I feel certain that anyone who builds an installation on the lines indicated above will be amply repaid for his trouble, and he will never go back to the untidy "hook-up."

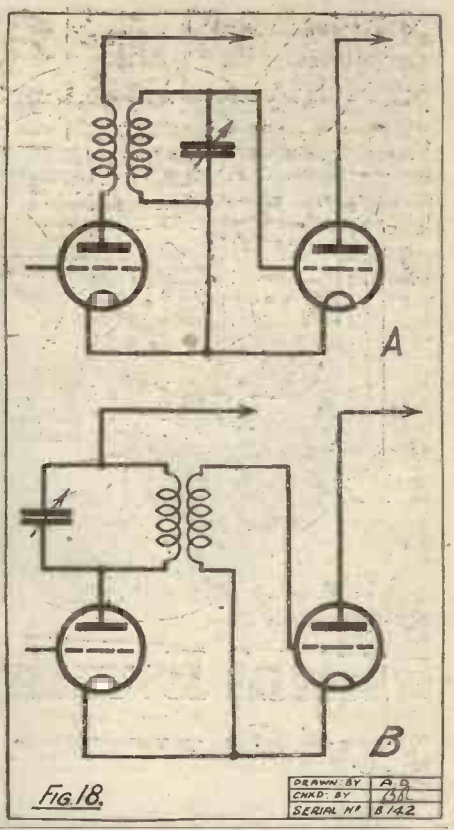


Fig. 18.

CHECKING YOUR WIRING.

By D. K.

IT is surprising, even after four years of broadcasting and the home-construction of wireless sets, how frequently one hears of cases where valves are burnt out owing to the H.T. getting across their filaments because wrong connections have been made in the receiver. It is, in the writer's opinion, far more excusable to make a wrong external battery connection than make an error in the *internal* wiring of a set. If the wiring is properly checked up before the set is tested there should be no chance of a mistake passing unnoticed.

That is the reason why point-to-point lists of connections are published with constructional articles, but even if such lists were not available it is a simple matter to check over even a complicated set.

The Checking List.

Assuming that the point-to-point list is not provided the constructor must fall back on either the practical wiring diagram or the the oretical circuit. The writer prefers to work from the latter, but it makes no odds which is used.

When the wiring has been completed, the constructor should carefully clean up the set and then set to work on the checking process—which must be done methodically. In the first place, he should take either the theoretical or practical diagram and make a list of the main points of his receiver—LT+, L.T.−, H.T.−, H.T.+ terminals, A and E, and so on, and then he should write against them *all* the points with which they make connection, marking the lines off on the diagram as he goes on. When he has finished, any lines not marked off should be noted and he is ready for the actual checking on the receiver.

Many points will, of course, overlap, but that will only emphasise the checking. For instance, the earth lead will be found in most cases to go to L.T.+ or L.T.− and to one set of valve filament sockets. This will be duplicated when the L.T. leads are dealt with, but it is advisable not to omit the L.T. terminals from the list even if some of the points *are* duplicated.

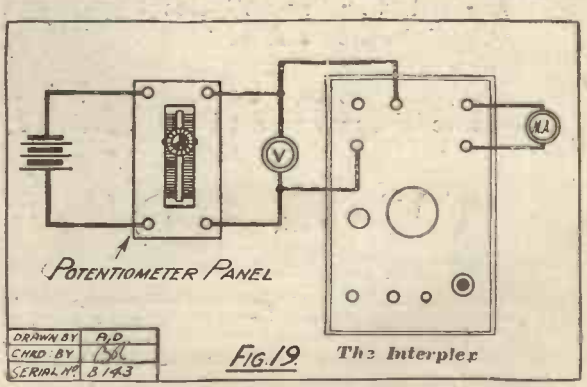


Fig. 19. The Interplex

The list should be taken as written, and the points and their connecting wires noted on the set, each joint being tested for strength and cleanliness as the constructor goes on. After this, which does not take so very long, he can rest assured that the set is wired as described in the diagram, and he can go ahead with the practical test, feeling sure things are all right "down under."

Apparatus Tested

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

SUPERIAL SIMPLE-STRIP.

ALTHOUGH soldering is quite a simple task the fact remains that many constructors hesitate to tackle it; indeed, if it were not possible to assemble a wireless set without soldering, it is probable that there would be a much smaller number of home-made sets in use. Quite an efficient alternative to soldering, however, is the use of "Simple-Strip," a product of the New London Electron Works, Ltd. It is ¼-in. strip copper heavily tinned, in which oval holes are stamped. These holes are very close together, but the material is tough and pliable and retains sufficient strength to stand against very rough handling.

"Simple-Strip" can be cut quite easily and bent with the fingers into any desired shape. Owing to the holes being oval no difficulty is experienced in getting the material to lie snugly under terminal nuts, even if slight miscalculations in length of lead are made. Of course, "Simple-Strip" can be soldered, if desired, and, as a matter of fact, it takes solder as well as does tinned copper wire.

In view of its large surface area it forms a very efficient conductor, and a receiver connected up with it offers a very attractive appearance.

Superial "Simple-Strip," as it is called, is sold in packets containing 12 ft. at 2/- per packet.

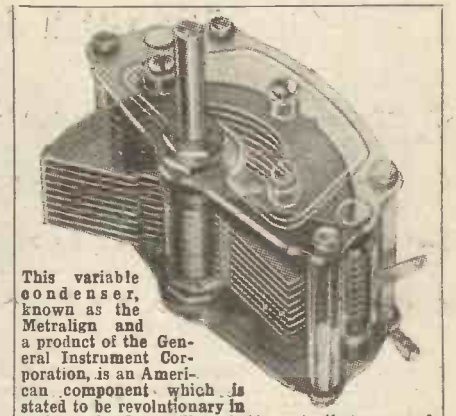
THOSE MARCONI VALVE BOOKLETS.

The Marconiphone Co., Ltd., recently published two very interesting booklets—"The Story of the Marconi Valve" and "The Marconi Valve Booklet." These publications will interest all valve enthusiasts, and we expect that many copies of the November 20th issue of "P.W." are now minus the coupon which appeared on page 657. This coupon entitles any reader of "P.W." to obtain either one of the booklets gratis and post free. Unfortunately a printer's error occurs in it, and the following asterisked statement should have appeared at the bottom of the coupon: * "Strike out what is not required." In some copies this appears partially corrected, and in others it is omitted altogether. Readers are welcome to a copy of either booklet, by writing to the company at 210, Tottenham Court Road, W.1.

A PRICE CORRECTION.

Will readers please note that the price of the Eureka Orthocylic Variable Condenser is 15s. 6d., with a capacity of ·0005 mfd., and not 13s. 6d., as was stated in the advertisement columns of our issue for November 6th. With a ·0003 mfd. capacity the price is 14s. 6d.

(*Continued on page* 774.)



This variable condenser, known as the Metralign and a product of the General Instrument Corporation, is an American component which is stated to be revolutionary in design. Readers will probably note that one end plate at least is transparent.

APPARATUS TESTED.

(Continued from page 772.)

THE BROWN CRYSTAL AMPLIFIER.

We have recently had a "Brown" Crystal Amplifier under observation, and at the conclusion of a series of tests carried out in varying localities, we are able to form a definite opinion as to its capabilities.

It is contained in a polished case provided with a lid, and on to which are mounted six terminals. To two of these must be connected a small 4½-volt dry battery—the only source of local power required. The other four include two terminals for the loud speaker and two for connecting up to a crystal set by its telephone terminals.

Beneath the lid are two levers for adjusting the instrument. These levers are not finicking little things, but each moves over a distance of two or three inches, and neither is at all a critical control. Even so, very precise instructions are provided, showing exactly how these levers should be handled to get best results, instructions that anyone who can read could understand.

Now, whenever crystal signals are comfortably strong in telephone receivers, this Brown amplifier will bring them up to good loud-speaker strength. Good in both volume and purity too. We have never heard such pure, mellow, microphonic amplification before as that given by this instrument. And volume is excellent, notwithstanding the fact that only the one tiny battery is used.

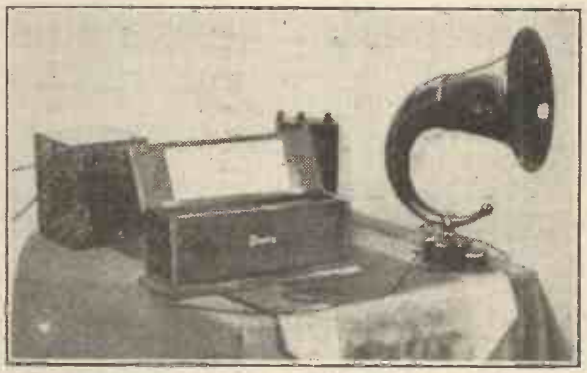
In view of the fact that such results are obtainable, it is surprising that Messrs. Brown have managed to keep their new amplifier within such practical bounds of stability and robustness; indeed, it is rather wonderful and once again testifies to the supremacy of the S.G.B. people in this particular branch of radio. In our opinion, the Brown Crystal Amplifier is far and away above everything else of the kind, and, moreover, it is a precision instrument fitted with "man-in-the-street" controls. Eliminating, as it does, both valves and accumulators, at £4 4s., it is a proposition that requires serious consideration.

THE "ELECTONE" AUTOMATIC CONTROL.

One of the cutest little gadgets we have seen is the "Electone," an automatic switching device due to Messrs. Frederick J. Gordon & Co., Ltd., 92, Charlotte Street, London, W.1. It consists of a small clock around the face of which are situated 24 plug sockets. Six plugs are provided and at whatever point a plug is inserted the clock movement closes a switch inside for a period of half an hour. The "Electone" is placed in series with one of the L.T. battery leads, and this switches the L.T. on and off in accordance with the plug positions.

If a plug is inserted in the socket opposite eight o'clock the set is switched on a few minutes before eight, and switched off again a few minutes after eight-thirty. If another plug was inserted at the eight-thirty point, the set would carry on till nine o'clock.

The device is quite small and neat in appearance, and as it is essentially a clock, does not look out of place by or on top of a receiver. The clock movement is not a Benson one, of course, but it is robust and keeps excellent time. Certainly the "Electone," combining as it does a clock with an automatic switching device, is one of the most useful radio accessories we have seen. With one of these little instruments the amateur can leave his set in the morning, and have music turned on and off for the benefit of the household without any but his own hands touching a single switch, even a dial. We have had an "Electone" in use for several weeks now, and not once has it failed to do its duty. There is a slight noise when it switches off or on, but otherwise it is perfectly silent. In our opinion, it forms one of the best solutions to the problem of distant control so far placed before the radio public, and should command a very ready sale at 27/6.



The Brown Crystal Amplifier, which is described on this page.

RADIOTORIAL

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

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

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.

Readers' letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers. The envelope should be clearly marked "Patent Advice."

TECHNICAL QUERIES.

Letters should be addressed to: Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4.

They should be written on one side of the paper only, and MUST be accompanied by a stamped addressed envelope.

Queries should be asked in the form of the numbered questions: (1), (2), (3), etc., but may be accompanied by a short letter giving any necessary additional particulars as briefly as possible.

For every question asked a fee of 6d. should be enclosed. A copy of the numbered questions should be kept, so that the replies may be given under the numbers. (It is not possible to reproduce the question in the answer.)

BLUE PRINTS. A series of 20 Blue Prints can be obtained from the Query Dept., price 6d. per Blue Print.

Only a limited number of circuits are covered in this series and full details of the circuit arrangements available in Blue-Print form are published fortnightly in the advertisement columns of this journal.

All other back-of-panel diagrams are specially drawn up to suit the requirements of individual readers at the following rates: Crystal Sets, 6d.; One-Valve Sets, 6d.; One-Valve and Crystal (Reflex), 1s.; Two-Valve and Crystal (Reflex), 1s.; Two-Valve Sets, 1s.; Three-Valve Sets, 1s.; Three-Valve and Crystal (Reflex), 1s. 6d.; Four-Valve Sets, 1s. 6d.; Multi-Valve Sets (straight circuit), 1s. 6d. Except SUPER-HETERODYNE DIAGRAMS, all of which, irrespective of number of Valves used, are 2s. 6d.

If a panel lay-out or list of point-to-point connections is required an additional fee of 1s. must be enclosed.

Wiring diagrams of commercial apparatus, such as sets of any particular manufacture, etc., cannot be supplied. (Such particulars can only be obtained from the makers.)

Readers may submit their own diagrams, etc., for correction or for criticism. The fee is 1s. per diagram, and these should be large, and as clear as possible.

No questions can be answered by 'phone.

Remittances should be in the form of Postal Orders.

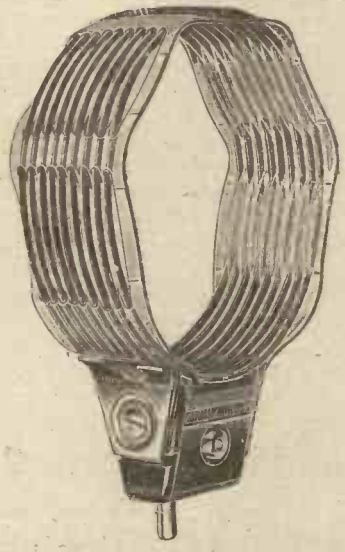
Questions and Answers

A 2-valve Amplifier.

E. A. B. (Tatsfield, Surrey).—"I have a good one-valve set in use, which has given such excellent results that now I intend using a loud speaker. I wish to retain the one-valve set as the first part of the new receiver. To get really good results I shall need three-valves in all, so could you recommend me a 2-valve amplifying circuit?

(*Continued on page* 778.)

ALL WAVELENGTHS



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A user of Igranic Coils has written to tell us that he has built a receiver with which he can receive ALL wavelengths from 10 to 100 METRES when using IGRANIC PLUG-IN COILS. With other makes of coils he could not receive the short waves.

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or 10/-, set of four.

For wavelengths above 100 metres, use IGRANIC "XLLOS" COILS or IGRANIC TRIPLE HONEYCOMB COILS. PRICES from 2/9 each.

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Parrs Ad.

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4-volt ·06 *amps*	**each**	*4-volt* ·06 *amps*
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RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 776.)

I am thinking of using a 25/- L.F. transformer and I am uncertain whether to follow this with another transformer-coupled stage, or whether to use the last stage resistance-coupled. I understand that very great purity is obtainable in this way, and I shall be glad if you can tell me whether the volume would be such that the loud speaker would be working at full strength, or whether for this purpose I should need to use two transformers?

As your present receiver is already giving excellent results, you should be able to work a loud speaker comfortably with two additional valves. In view of the fact that your transformer is a good one, we recommend you to follow it with one stage of resistance-capacity, which would give great clarity of reproduction, and, provided you are using an ordinary good aerial, the signal strength will leave nothing to be desired.

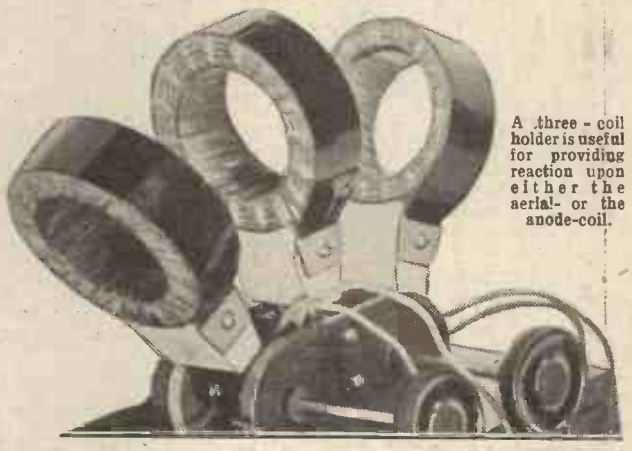
You will find that the "P.W." blue print, No. 15, shows a circuit of exactly the kind you require. The back of panel diagram in this instance is that of a flat panel type, but as the blue print shows the circuit in theoretical form, and also the connections in pictorial form, you should have no difficulty in making any slight modifications that may be necessary to fit the proposed cabinet.

AERIAL OR ANODE REACTION.

"ALTERNATIVE REACTION" (Streatley-on-Thames).—I have a straight three-valve receiver in which the first valve is employed as H.F. amplifier, working upon a tuned anode principle. The other valves are detector and L.F. amplifier respectively, and the reaction coil is connected between the primary of the L.F. transformer and the plate of the detector valve. I am told that by using a 3-coil holder (instead of the 2-coil holder at present employed) I could have the reaction coil coupled to either the aerial coil, or the anode coil, at will. (At present it is coupled only to the aerial coil in a two-way coil holder.) How should the coils be arranged in order to give this form of alternative reaction?

The method of using a three-coil holder (see accompanying photograph) is only effective where the set in question allows plenty of room for the two outer coils to open right out, at an angle of 90 degrees from the centre coil. (Both the outer coils must be capable of movement, although the centre coil is fixed upright.)

(Continued on page 780.)



A three-coil holder is useful for providing reaction upon either the aerial- or the anode-coil.

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from previous page.)

respectively were 35 and 150, now we have to use 100 and 300. I might mention the aerial and earth are all that is to be desired, as we have examined same.

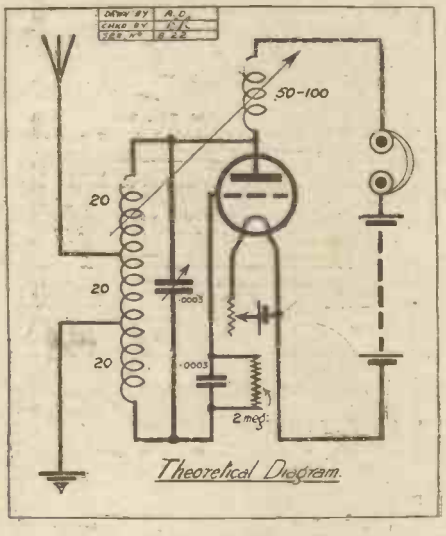
The fault complained of is a very unusual one, and appears to be due to a break in the circuit of the aerial tuning condenser. From your description we think that one of your condensers leads or joints has broken, leaving this condenser disconnected.

The wires and terminals should, therefore, be examined carefully, and when the break is remedied it should be possible to work again with the 35 and 150 coils, for the local and 5 X X stations respectively.

THE ULTRA COIL.

P.S. (Pendleton, Manchester).—Having been very successful with the "P.W." Ultra Crystal Set, I should like to try an Ultra coil in a one-valve receiver. What are the connections?

The connections for Ultra coil tuning of a 1-valve set are shown in the accompanying diagram. The



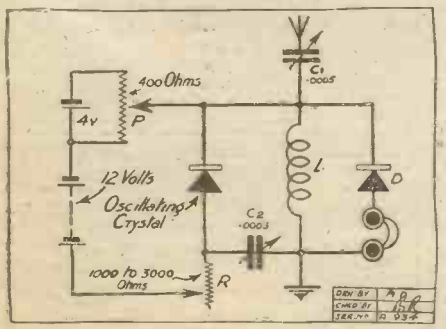
construction of a set of this kind was fully described in "P.W." No. 222 (September 4th, 1926, issue).

Note.—Back numbers of POPULAR WIRELESS are obtainable from The Amalgamated Press (1922). Ltd., Back Number Dept., Bear Alley, Farringdon Street, E.C.4. Price 4d. each, post free.

REACTION WITH A CRYSTAL SET.

"CRYSTAL CRAZY" (Slough, Bucks).—Is it really possible to oscillate and obtain reaction with a crystal set? If so, how is it done?

It is quite possible to obtain reaction and oscillation effects, using for that purpose a crystal instead of a valve. A specially chosen "Oscillating Crystal" has to be used, in an additional circuit that includes



resistances and batteries. Such an arrangement can be added to an ordinary crystal set which has the tuning condenser in series, as shown by the accompanying diagram.

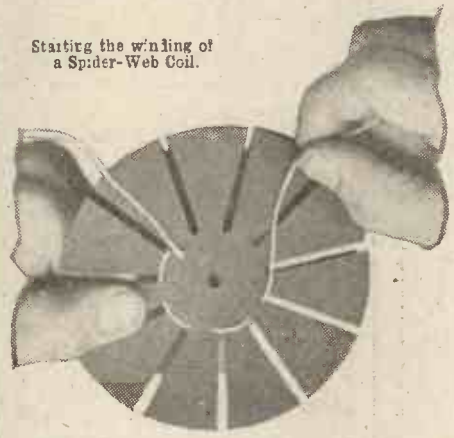
(Continued on next page.)

RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from previous page.)

STARTING A SPIDER-WEB COIL.

S E. J. (Billericay, Essex).—I have a spider-web former and some 26 D.C.C. wire to make a 50-turn coil for a crystal set. I know the way to wind the coil, but how is the wire held in place at the beginning of the winding?



Starting the winding of a Spider-Web Coil.

All that is necessary is to make one or two holes in the former and thread the beginning of the wire through these, to make it fast.

RESTORING DULL-EMITTER VALVES.

J. F. M. (Ireland).—How can I restore dull-emitter valves which have lost their sensitiveness?

This depends upon the type of valve, and fortunately many '06 amp., and similar types, are curable after this sort of mishap. In any case, the procedure is to burn the valve at the correct voltage for about half an hour or more *without any H.T.* on the plate. This will bring some of the special chemicals to the surface of the filament, and normal electron emission will result.

Another way is known as "flashing," but it is decidedly risky. It consists in connecting one filament leg of the valve to one side of the H.T. battery, and just brushing the other H.T. connection on the other filament leg. This should have the same effect as the above.

If the "brushing" is not done quickly, and the filament is connected too long to the H.T., it will burn out. One method of ensuring that too much current does not pass when "flashing" a valve in this way is to do the flashing from a fixed condenser.

All that is necessary is to connect a very large fixed condenser (say, 1 mfd. or more) across a high-tension battery of 100 volts or so. Disconnect the H.T. battery, and then connect the filament legs across the fixed condenser.

This latter will, of course, discharge itself via the filament, and as the current is limited by the capacity of the condenser there is no danger of applying the current for too long a period.

CORRESPONDENCE.

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

The Simmonds Short Wave Set.

The Editor, POPULAR WIRELESS.

Dear Sir,—On September 20th I finished a short-wave set similar in design to that shown by Mr. Simonds in "P.W." No. 230 (October 30th). Results are certainly excellent, all parts are British, and all connections thoroughly soldered. So far I have heard K D K A four times (I enclose confirmation [copy of] from K D K A) and W G Y twice. Also 3 T N and 3 A L, Australia, on C.W. Morse.

On telephony I have got—British: 2 B W Z, 2 W N, 2 N M, 2 U G, 2 B M, 2 I T, 5 T Z, 5 D A, 5 W K, 5 W W, 5 D T, 5 T Z, 5 D C, 5 A Z, 5 Z G, 5 U S, 5 H J, 6 U Z, 6 I A, 6 Q O, 6 M U, 6 M O, 6 T X, 6 K K, 6 O H, 6 T R, 6 U T, 6 K S, 6 U P.

North Ireland: 6 Q O, 6 M U.
France: 1 A E, 8 A R T.
Italy: 8 A U.
U.S.A.: K D K A, 2 X A F (W G Y).
Germany: Koenigswusterhausen.
Australia: 3 T N, 3 A L (Morse).
All between 30 and 70 metres.

I am, yours,
London, E.C.3. G. M. MITCHINER.

The "Hale" Receiver.

The Editor, POPULAR WIRELESS.

Dear Sir,—I notice in your editorial of the Radio Constructor this week that you ask readers to write and give you their experiences with the "Hale" receiver described last week.

On Thursday evening of last week, as soon as I reached home, I wired up the circuit roughly and with an old Phillips D.E. Power valve and 120 v. H.T. and 1½ v. bias 2 L O was tuned in with a strength on the L.S. that can only be likened to a 3-valve set (v. 2) and with crystal quality. Members of my household begged me to make up the set in a proper cabinet and scrap my two-valve Reflex set ("P.W." Combination and L.F. amplifier), which I have had in use now for about two years. This I have done, and on Sunday morning I was able to get Hilversum for an hour on the L.S., and after it had closed down Koenigswusterhausen came in also on the L.S. even more strongly, then Radio-Paris. Several evenings this week I have had an evening's hunt and so many stations come tumbling in that I hesitate to write them down in case I should be thought guilty of prevaricating. One thing I should like to do, and that is, make the set more selective. If this can be done perhaps you will tell us in the near future.

Two of my neighbours have decided to scrap their existing sets and build the "Hale."

Many thanks for introducing such a fine circuit to "P.W." readers, and may I express a Coue-ism, that Every Day, etc. Yours faithfully,
Gwynne Road, S.W.11. J. A.

More than "Astounding!"

The Editor, POPULAR WIRELESS.

Dear Sir,—I beg to write in appreciation of your wonderful circuit in "P.W." October 30th. I refer to the "Hale" receiver. I wired this up on Sunday and added one stage of L.F. in the ordinary way, and I am absolutely astounded at the volume and purity. I am always "playing" with my set, but know very little about wireless except how to wire up from a diagram. Your circuit gives greater volume and purity than the four-valve (1–v–2) which I pulled down in order to try it, and in fact is miles better than any circuit I have ever tried.

You hesitate in your article to use the word "astounding." The circuit, in my humble opinion, is poorly described by the adjective, and I thank you for giving us the chance to try it, and I look forward to a further article on it. I am able to get many other stations, but have great difficulty in bringing them in clearly, as the least touch on the reaction sends the set into violent oscillation, but directly I loosen the reaction a shade I lose the station. My only other trouble is continuous crackling between each item, and I cannot trace this to H.T., transformers, loose contacts, or anything like that. Is this a peculiarity of the circuit?

For the sake of curiosity I am at some time going to try a further stage of transformer-coupled L.F.; and by what the present two-valves are doing, while I write, I should imagine the addition of a further L.F. will about blow the horn off the loud speaker. I am using 2 Cossor valves and a Red Diamond permanent crystal (2s.) which I haven't touched since Sunday, and two quite cheap transformers. Well, I must close, or I'll bore you stiff; but, by Jove, you've found a wonderful circuit. Thank you very much.

Yours sincerely,
D. MACKENZIE.
34, Church Street, Croydon, Surrey.

BRINGING THE SUPER-HET UP-TO-DATE.

From a Correspondent.

ALTHOUGH it is a comparatively short time ago since the super-het became popular with British amateurs, the earlier types are already becoming out-of-date.

Nowadays it is generally recognised that a series of untuned intermediate transformers must necessarily lead to inefficiency. It is almost impossible for the maker to match a set of transformers and filter so exactly that no discrepancy creeps in. Consequently owners of super-hets with untuned intermediate stages must carry out a few alterations.

Tuned Intermediates.

There is no need to scrap the untuned transformers and fit the tuned type. This would be most expensive, and a lengthy business to change all the multitudinous connections of a super-heterodyne receiver. Instead the reader should buy some good vernier condensers to fit to his transformers.

These condensers should be as small as possible in order to save space. Take care that they come from manufacturers of good repute and are of the low-loss pattern. They should be connected across the primaries of the transformers.

Increased Purity

When everything has been finished switch on the valves and turn the vernier condensers to zero. Tune in some distant station which is noted for its clear and pure transmissions, such as San Sebastian. Then adjust the first transformer vernier until signals reach their maximum strength. Repeat this operation in turn to each of the other verniers. Return to the first vernier and make the final adjustment. After this there will be no further need to touch the transformer condensers again. The reader will be surprised at the great increase in clarity and tone.

Long Wave Reception.

The older super-hets were only arranged to deal with the broadcasting wave-lengths. To bring the set up to date and to receive stations on the higher wave-lengths, like Daventry and Hilversum, a different type of oscillator coupler must be installed; the best way to do this is to use the plug-in coupler so that the high or the low wave-band may be received at will by the simple operation of changing the coupler. The reader is advised to obtain one of these couplers, which are marketed by many wireless manufacturers.

In conclusion, the reader should take advantage of the new valves of superior efficiency now on the market and to bring his super-heterodyne up to scratch in this respect. Particularly, he is recommended to use a really good power valve in the L.F. stage. This has a great effect on the purity of reception, and is well worth the extra few shillings expended.

"DRY JOINTS."

Their Cause and Prevention.

By G. V. C.

THE art of soldering must necessarily be one of the accomplishments of every amateur who tackles the construction of a set. He may wire the major portion of his set by means of nuts and screws (and wire) and make a good job of it, but there is doubtless some component that is not so provided, and therefore the soldering iron, solder, and flux are essential acquisitions.

It is quite probable that a former acquaintance with these tools has made him adept at making seemingly good soldered joints, which, even from a close inspection, would make one pronounce "O. K."

However that may be, there is no getting away from the fact that the wiring of many sets after a period of, say, six months, literally "falls to pieces."

From a careful examination of the wiring so deteriorated, it is evident that the breaks are not due to someone pulling on the wires or that the set has been dropped, but rather to the solder crumbling.

Too Much Bismuth.

It is a fact, however startling, that much of the solder sold to-day by wireless dealers for wireless work has far too high a percentage of bismuth mixed with it.

Unfortunately, most amateurs are not sufficiently expert to judge good solder from bad, and the fact that the wireless dealer says it's solder, and they see it has the appearance of that metal, is sufficient for most of them without inquiring further.

A careful amateur or one who "knows" will examine the stick of metal (it is nearly always sold in the form of "blowpipe" solder), and if it has a fairly bright surface, appears to have been cleanly "cast," and offers a fair resistance to bending, will judge it good.

On the other hand, if it lacks a certain amount of lustre, has "cast" lumpy with a rough surface, and is fairly soft to bend, then he will refuse it, for he knows it will cause bad joints and will amalgamate unsatisfactorily with the wires.

Now, the reader may ask "How can I protect myself against the possibility of buying this solder?"

Tinman's Solder.

This can be done in two ways. The first and most obvious is to purchase the solder from a reliable firm, or from an ironmonger who supplies the local builders with solder for zinc roofing, etc.

The second and least known way is to obtain tinman's solder, which is cast in sticks about the thickness of one's forefinger. It is very unusual to get this latter type in a poor quality, so that one can have the satisfaction of knowing that this solder is as good as the best sold as "blow-pipe."

Its only disadvantage is that it takes longer to melt than its thinner brethren, but this is more than offset by the fact that it will give a joint that will at least stand the hand of time.

(*Continued on next page*).

"DRY JOINTS."

(Continued from previous page.)

Another cause of dry joints is a certain class of soldering "tag," and for that matter of terminal too.

Both are often nickelled.

The former are sold as "tinned soldering lugs," and the latter—well, as "attractive" terminals.

Both will take solder well—until you happen to pull on the wire, then the plating comes away with wire attached, and you see a greyish powder left on the surface.

It is considered these facts speak for themselves, and as a precaution the reader is either advised to see that he leaves well alone and buys reliable terminals and tags, or else scrapes every vestige of nickel from those so plated, before tinning them and attaching the wires.

Flux is another thing that books could be written on, and while it is not possible to criticise any particular make, it is assumed the reader is not so ignorant as to use "killed spirits of salts."

Soldering Fluxes.

The forms soldering fluxes take are many and varied, and while many amateurs stick to one popular brand, "Fluxite," there are a few who use nothing else but "Baker's Fluid" or else pure resin.

There is something to be said for all brands, but there is little doubt that "Fluxite," having been in the running for a great number of years, will continue doing so, as it has proved its worth.

Resin is the only flux recommended where two fine wires have to be joined, especially as far as fine instrument work is concerned, because, owing to the small corrosive action of even the best patent brands of flux, the wires (some few thousandths of an inch in diameter) may get eaten through.

THE INEVITABLE EBONITE.

By R. H. BLACKMORE.

EBONITE is, or, rather, should be, composed only of sulphur and rubber.

The raw rubber, which will be familiar to most as the substance used for soling crêpe-soled tennis shoes, is passed between two smooth steel rollers which are revolving in a horizontal position.

Here it is so crushed and heated that it takes on the appearance of a yellow-tinted semi-transparent jelly; this is known as mastication. When this process has been carried far enough, the worker in charge of the machine adds the requisite amount of sulphur to the rubber, which has now layered itself around one of the rollers.

The sulphur is, so to speak, ground into the rubber, and the mixing process is continued till all the sulphur is absorbed and a homogeneous mixture produced.

The plastic mass is skilfully cut from the revolving rollers and passed to the calendering department. It may be noted here that the best class of ebonite has a sulphur content of between 30 and 35 per cent., the rest being pure rubber.

(Continued on page 788.)

Invaluable to EVERY Amateur and Constructor.

The "POPULAR WIRELESS"

BLUE PRINTS

of TESTED CIRCUITS

Every wireless amateur and every wireless constructor will find these "POPULAR WIRELESS" Blue Prints absolutely reliable. They have been most accurately drawn, and every circuit has been tested under normal broadcasting conditions by the technical staff of "Popular Wireless." It will be seen from the complete list given below that the series covers a very wide field. The veriest tyro will find each print most straightforward to follow and the receivers most easy to construct.

P.W. BLUE PRINT Number

1. DETECTOR VALVE WITH REACTION.
2. UNIDYNE DETECTOR VALVE WITH REACTION.
3. 1-VALVE L.F. AMPLIFIER.
4. CRYSTAL DETECTOR WITH L.F. AMPLIFIER.
5. H.F. (Tuned Anode) AND CRYSTAL, WITH REACTION.
6. H.F. AND CRYSTAL. (Transformer Coupled, without Reaction).
7. 1-VALVE REFLEX WITH CRYSTAL DETECTOR (Tuned Anode).
8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction).
9. H.F. AND DETECTOR (Tuned Anode Coupling, with Reaction on Anode).
10. H.F. AND DETECTOR. (Transformer Coupled, with Reaction).
11. DETECTOR AND L.F. (With Switch to Cut Out L.F. Valve).
12. DETECTOR AND L.F. UNIDYNE (With Switch to Cut Out L.F. Valve).
13. 2-VALVE REFLEX (Employing Valve Detector).
14. 2-VALVE L.F. AMPLIFIER (Transformer Coupled with Switch to Cut Out Last Valve).
15. 2-VALVE L.F. AMPLIFIER (Transformer-Resistance Coupled with Switch for Cutting Out Last Valve).
16. H.F. (Tuned Anode), CRYSTAL DETECTOR AND L.F. (with Switch for Last Valve).
17. CRYSTAL DETECTOR WITH TWO L.F. AMPLIFIERS (with Switching)
18. 1-VALVE REFLEX AND CRYSTAL DETECTOR, with 1-VALVE L.F. AMPLIFIER, Controlled by Switch.
19. H.F. DETECTOR AND L.F. (with Switch to Cut Out the Last Valve).
20. DETECTOR AND 2 L.F. AMPLIFIERS (with Switches for 1, 2, or 3 Valves).

ALL "POPULAR WIRELESS" BLUE PRINTS——6d. EACH

All orders for these Blue Prints should be sent direct to the "Popular Wireless" Queries Department, Fleetway House, Farringdon Street, London, E.C.4, enclosing a stamped addressed envelope and a postal order for 6d. for each Blue Print Ordered.

THE INEVITABLE EBONITE.

(Continued from page 786.)

In the calendering room the ebonite mixing is passed between huge steel rollers in order to obtain sheets of a given thickness. The sheets are then cut to size and conveyed to the vulcanising department. It is at this point of the process that the advent of radio has changed works practice in the manufacture of sheet ebonite. In pre-broadcasting days the next step was to roll tinfoil upon both sides of the unvulcanised sheet. The tin-protected sheets were layered one above the other inside a small tank of water, and the whole box of tricks placed in a large strong iron pan fitted with a screw-down lid. Steam was admitted to the pan at a pressure of about forty pounds to the square inch, and the whole allowed to stand at this pressure for a given time. Sometimes twenty-four hours was necessary for complete vulcanisation.

Leaky Surface.

When the "cure," as vulcanisation is technically termed, was complete, steam was turned off and the pan opened. The tinfoil was stripped from the surface of the sheets, which now resembled the ebonite of commerce. The beautiful polished surface produced by tinfoil proved to be a snare and a delusion, for it was found that the H.F. currents of wireless leaked left and right over the fairly conductive layer of tin sulphide with which the surface of the ebonite was coated.

This was the main reason that the unfortunate amateur was once so urgently advised to scrape the surface of his panel with a safety razor blade or some similar lethal weapon. The advent of matt-finished ebonite led to a cessation of this temper-destroying recreation.

The pleasing appearance of the old type of polished material still lingered in the minds of home constructors, and it was not long before ebonite manufacturers began to produce an ebonite with a polish quite equal to the old, but having a truly non-conductive surface.

One of the principal methods of achieving this object consists of taking the calendered sheets of "uncured" ebonite and placing them inside steel moulds, which are then placed within the shelves of a hydraulic press, the shelves of which can be steam-heated.

Matt Ebonite.

Pressure is then applied, probably over a ton to the square inch, and steam is turned on. The press is left till the ebonite contents are semi-vulcanised—that is, till they are very similar to the rubber of a motor tyre in appearance and feel. The moulds and ebonite are then removed and the ebonite is placed inside a vulcanising pan and there given a long enough cure to finally convert it into hard ebonite.

In order to obtain a non-conductive polish, the matt sheets are sent to the polishers, who, either by hand or machine, scour the sheets with fine emery. The conclusion of the process is the obtaining of the glassy finish by polishing the sheets on rapidly revolving cloth discs of different fineness of cloths.

The sheets are then sawn up into the appropriate panel sizes and passed out into the world of radio, there to fulfil their destiny.

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Cannot be broken except by very roughest handling? YES

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Has up to 5½ times the emission surface of an ordinary filament? YES

Consumes only one-tenth ampere? YES

Gives greater volume for the same H.T. current? YES

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