The Wireless Constructor

6d

Vol. XVI. JULY, 1933. No. 81.

FOR ALL CONTINENTS

A SHORT-WAVE SUPER-HET CONVERTER

Also

THE LATEST TABLEGRAM

The DOUBLE PENTODE THREE

Parallels of History No 4

CAPTAIN JAMES COOK

hero of many triumphs; author of many adventures; discoverer of New Zealand and many of the Oceanic islands. His name has been famous for over 150 years, and because of his determination and fearlessness, he has earned the respect of the whole world. It is this same spirit of determination to accomplish an ideal that has enabled Dubilier to bring their products to the high standard of efficiency that they enjoy, an efficiency that is the climax of 21 years successful trading.

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As some of the arrangements and specialties described in this Journal may be the subjects of Letters Patent the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

Published by The Amalgamated Press, Ltd., The Fleetway House, Farringdon Street, London, E.C.4.

The WIRELESS CONSTRUCTOR

The EDITOR'S CHAT

Those Letters About the "S.T.400"—An Unexampled Tribute—Star Sets of the Future.

IT is exactly seven months ago since the "S.T.400" was described in THE WIRELESS CONSTRUCTOR. Since then, some scores of letters of praise from readers of every type, and from every part of the country, have been published in our columns.

S.T.'s Next Step

We have lately received a communication from Mr. Scott-Taggart, in which he says :—

"I think that the publication of readers' letters concerning the 'S.T.400' should now be discontinued, as I am very busy on new sets for the next season."

We agree with Mr. Scott-Taggart that, in the circumstances, it is much fairer to readers to do as he suggests, since new and better sets would appear to be "on the stocks." Consequently, we have decided to discontinue publishing "S.T.400" letters after this issue.

But we wonder if readers fully realise what a magnificent tribute these letters have been to the inventive and designing skill of Mr. Scott-Taggart. Selected from the many hundreds of letters received in this office, 228 have been published in the columns of THE WIRELESS CONSTRUCTOR.

From All Over the World

These letters have come from Lands End and John o' Groats, from Killarney and Yarmouth, from Stuttgart, Oslo, Basle, Prague, Cape Town, Bengal, Johannesburg—in fact, from heaven knows how many places under the sun. And they provide ample evidence that amateurs all over the world look to "S.T." for set designs and circuit ideas.

This is hardly surprising when we consider the fact that thousands of foreign wireless enthusiasts have gained their knowledge of radio from translations of Mr. Scott-Taggart's text-books, whilst many of the foreign radio concerns popular to-day make use of Mr. Scott-Taggart's patents.

The "S.T.400" has proved to be the only four-valve set which has really achieved undoubted success. It is no secret now that "S.T." himself, in editorial conference, realised that he would be faced with overcoming strong prejudices by introducing the "S.T.400"; and, moreover, the set allowed for the introduction of features which were radically different from current practice. In fact, "S.T." placed himself deliberately aside from all other designers, and every feature of the "S.T.400"—quality, range, selectivity, power—has since then been approved by tens of thousands of constructors.

ON TWENTY METRES

Very long range reception is possible all the year round on short waves, and many amateurs transmit regularly to distant continents on low-powered gear of this kind. It is station G 6 L L, and is owned and operated by Mr. J. W. Matthews of Hackney.

Promise and Fulfilment

We are not writing this editorial in a spirit of vainglory, but, on the other hand, it is appropriate to compare promise with fulfilment; and if we, in the office of THE WIRELESS CONSTRUCTOR, feel very pleased with ourselves at having had the foresight to secure the exclusive services of Mr. Scott-Taggart as our chief contributor, we are sure that very few readers will gainsay us our little trumpet solo!

Bear in mind those 228 letters we have just mentioned, and which you have probably read from time to time when they have been published in THE WIRELESS CONSTRUCTOR; and when Mr. Scott-Taggart introduces future star sets, remember those tributes, which refer not so much to one design as to *one designer*.

There can be little doubt that the national scale on which "S.T." star sets are built immediately they are published is due to the faith which has been built up over a period of twenty years, and intensively over the last ten years.

A Point to Remember

"It's a new 'S.T.' Set" will persuade nearly a quarter of a million constructors to read about it, and a very large proportion to build it forthwith. So remember. If you "wait and see" before building an "S.T." set you may miss the delight expressed so variously, and yet so consistently, in the "S.T.400" letters we have been publishing. Keep in mind this nation-wide corroboration of his claims when Mr. Scott-Taggart again offers you his lastest set developments.

"ON THE GRID"

What is Selectivity?—Bending Aluminium—A Technical Puzzler—Television and Studio Effects.

I REFERRED last month to the misconception of some listeners that Broadcasting House is an ordinary broadcast transmitting station. There is another mistaken idea held by quite a number of constructors which I have come across frequently in letters. It concerns selectivity.

A Constructional Tip

"The selectivity is poor; I can only get two or three stations," is quite a common phrase. In these cases selectivity seems to be confused with the choice of a number of stations and is not taken to mean separating one transmission from another.

"Selectivity," as used in radio, should invariably refer to sharp tuning, and have nothing whatever to do with the range of a receiver.

Turning to something more practical, I note that chassis receivers are steadily growing in popularity, and many constructors make their own. Here is a tip on ensuring neat right-angle bends if you have a vice.

The jaws of the latter are seldom long enough to provide a grip for the whole length of the desired bend. They must be lengthened in some way.

Two strips of right-angle brass, about a foot long, are best for this, the adjacent sides forming the right angle being about 1 in. wide. If the aluminium to be bent is gripped between these by the vice, a sharp metal edge along which to make the bend is provided.

You'll find that neat chassis work becomes easy with these strips of angle brass, and is quite a pleasurable job.

Concerning Volume

Here's a poser for the theory "hounds." It is generally agreed that 3 decibels is the smallest increase in volume that is easily discernible. And an increase of 3 decibels needs a doubling of power.

But if you change one small power valve for another with a somewhat similar undistorted power output, results often are louder. How can this be if it requires double the power to hear an increase in volume and yet the outputs of the valves are approximately similar? H.T. voltage is assumed to be constant and the correct grid bias used in each case.

Seeing's Believing

When more or less perfected television comes along, as it most certainly will eventually—much of the genius displayed by the artificial sound effects of the B.B.C. dramatic department will be of little avail.

Rustling paper for a burning house, banging coconuts for horse effects, and so on, will have to be replaced very largely by the real thing. No doubt, though, a new technique of fake will be developed, and many of the schemes of the film producer will be called in. For instance, the use of models and miniatures can be made quite convincing.

A useful idea that will most likely get used, is to project a moving picture from a cinematograph machine placed behind a white screen that thus forms a convincing background.

A. S. C.

THE MONTH ON SHORT WAVES

All the interesting news about this fascinating waveband.

FROM now until pretty well the end of the Summer the opportunities for short-wave reception under conditions of darkness are necessarily brief unless you happen to be one of those ardent enthusiasts who is prepared to sit up half the night.

Personally, although I revel in a late night (or perhaps I had better say more accurately an early morning) occasionally, I do not make any drastic changes to my short-wave listening habits as a result of the long light evenings.

Avoiding Late Nights

I prefer instead to concentrate my efforts on wavebands that happen to be more suited for daylight transmissions. In other words, the only changes I make at this time of year are to my tuning coils.

Although it is very difficult to lay down any hard and fast rules as to the upper limit of wavelengths most suited for daylight transmission and reception, experience tends to show that anything appreciably above 20 metres comes over better under conditions of darkness.

Unfortunately, with many short-wave receivers, 20 metres is getting on towards the lowest wavelength receivable, and consequently the listener is apt to assume that summer-time short-wave listening is not worth while simply because the "usuals" drop down to a mere whisper.

A Surprise in Store

If that happens to be your impression, take my tip and adapt your set for reception down to ten metres, and you will have a pleasant surprise in store. As a rule the alterations are easily effected, and if your set is a good one, it should only be necessary to change the coils.

Reception isn't really difficult, and it is an experience that is very well worth while, especially in view of the increasing interest in the seven-metre localised broadcasting scheme.

As an indication of what can be done at this time of the year on waves below 20 metres, it is significant that the majority of my successful logs during the past month have all been on waves below this arbitrary division, particularly from the Western Hemisphere.

Daylight Reception

W 8 X K on his 19·72-metre wave has been coming over at speaker strength on several occasions. I have also logged him once or twice on 13·93 metres.

Of the other entries, the most outstanding ones are L S L (Argentine) on 14·27 metres, W 3 X A L on 16·87 metres, D J E (Zeesen) on 16·89 metres, W 2 X A D on 19·56 metres, and H V J (Vatican City) on 19·84 metres.

They have all been excellent signals, and in daylight, too!

G. T. K.

THE thermionic valve is a development of the ordinary electric light lamp. It was invented by Fleming owing to his investigations into the blackening of the glass of a carbon lamp with its "shadow" of the filament, and known as the Edison effect.

Thus it was natural, if not inevitable, that the development and commercial manufacture of the valve, from the Fleming diode to the modern multi-grid amplifiers, should mainly be in the hands of electric lamp makers.

Transmission Technique

And electric lamps have perforce always been made of glass. What was more natural than that the radio valve should be made of the same material?

Possibly it would always have been made of glass, or, rather, glass enclosed, if the need for special anode cooling had not arisen in certain transmitting valves. This need was the cause of the development of the water-cooled anode valve, known as the "cooled anode transmitter," and regularly used in transmitting stations all over the world.

In this valve the vacuum is inside the metal anode, which acts as the vacuum container, and which is water cooled in a special jacket. The glass envelope had been abolished for this type.

Subsequently the method of construction of the C.A.T. valve (as it is called) was considered from the point of view of its application to receiving valve design, and after much experiment in manufacturing technique the first "all-metal" or non-glass receiving valves were introduced to the British public.

Important Feature

These you have probably heard about, for they are the much-talked-of "Catkin" valves, their name being a derivative of the older C.A.T.'s, or more familiarly "Cats."

Introduced by Marconi and Osram, the new "Catkin" valves have rapidly made their mark on the minds of the radio trade, and are worthy of the fullest consideration by the home constructor.

They have many points of special interest and appeal, for they are practically unbreakable mechanically, and they offer technical advantages that cannot be gainsaid.

The most picturesque quality, one that has appealed greatly to the general public, is the almost unbreakability of the "Catkin" valve. Drop it on a hard concrete floor and you will do no damage whatever—not even shift the electrodes.

Some of the ADVANTAGES

The glass bulb has been entirely replaced by metal.

* * *

"Catkins" are therefore virtually unbreakable.

* * *

Permanently rigid electrode spacing has been achieved, with consequent freedom from "ponging."

* * *

They are the logical outcome of the development of transmission valves and share their powerful prototype's attribute of a "nearly perfect" vacuum.

* * *

Besides the above, there are many interesting points about this development in valve technique dealt with in this informative article.

By EVAN LLEWELLYN.

This latter feature is in practice more important than the fact that no envelope fracture can occur, for it means that enormous rigidity of construction is imparted to the electrodes—a definite score over the glass-enclosed valve, where structural rigidity is very hard to achieve.

In the case of the glass valve all the electrodes are mounted by supports sealed into a glass pinch, an arrangement that not only necessitates bent electrode supports (they cannot be taken straight down through the glass owing to lack of room), but also makes it difficult to pre-determine the *exact* relative positions of the electrodes and thus completely standardise the various types of valves.

Very close accuracies in the disposition of electrodes are required if different valves of any one type are to be identical in characteristics. These accuracies are almost impossible of achievement where the glass valve is concerned, but in the "Catkin" method of assembly they can be realised, with the result that batches of valves having a wonderful degree of standardisation can be made.

Accurate Rigidity

The reason is not very far to seek when one compares the methods of electrode mounting of glass and all-metal valves. In the former, apart from mica spacers, all the rigidity the electrodes have comes at the foot of the bent supports in the glass pinch. Not very mechanical.

In the "Catkin" much more rigidity and accurate localisation are obtained. First this is due to the fact that the electrode supports come straight down into a steel and mica clamp. This holds them absolutely rigid, and there being no bend anywhere the tendency for the electrodes to spring is absent.

Further, above this clamp is a mica spacer, and then above the electrodes comes another spacer and a locating piece of mica which keeps the electrodes rigid inside the anode at the top. Small wonder that everything is rock rigid, especially as the anode—the heaviest electrode in normal valves—is external to all this, being the copper container for the whole valve.

Non-Microphonic

A most important practical result accruing from the rigid construction of the electrode assembly is the non-microphonic nature of the "Catkin" valve. This I can vouch for personally, for I have had several on test observation in a powerful set for some time now, and though the amplification provided by the receiver would soon show up the slightest microphony, there is not the slightest sign of this, even when the valves are sharply knocked with a wooden mallet—

All About the "Catkin" Valves—*continued*

sharply enough to break a glass-enclosed valve.

The accuracy of assembly and its resulting standardisation of type characteristics should be extremely welcome among set designers and manufacturers, for replacements and standard batches of valves will be reliably close in behaviour to the valves used in the tests of the sets before they leave the manufacturer.

Low Dielectric Losses

This should result in the possibility of the sets being "hotted-up" very much more, there being no need to allow latitude against the possibility of the set user getting hold of inferior or of superior samples of valves, with the result that the set either functions badly or begins to become unstable.

Returning to the "Catkin" valve, we must also realise that the doing away with the glass pinch in favour of a mica-lined clamp should result in less dielectric loss between the electrodes and thus greater efficiency of the valve in H.F. circuits.

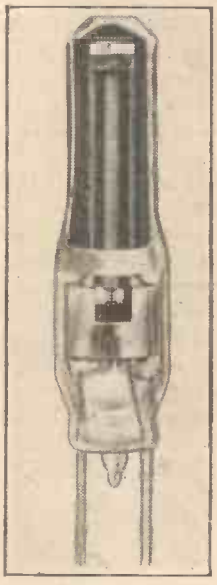
valves being the all-metal counterparts of the V.M.S.4, M.S.4B, M.H.4, and the M.P.T.4. The H.F. valves are supplied with a metal screen surrounding the whole structure, so that the result is a perfectly screened valve, while the M.H.4 can be obtained either with or without a screen. The cover is, of course, earthed to the cathode.

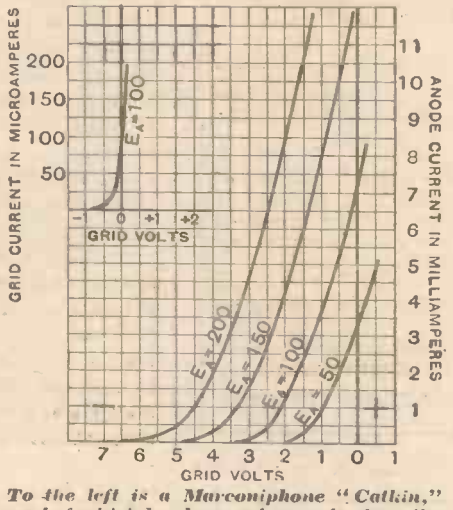
As the metal container of the valves—in the cases of the unscreened variety—is also the anode, it is at a potential of up to 250 volts above earth, and is therefore liable to be "uncomfortable" to the touch. To insulate the anode to prevent shocks a special enamel coating is used, which allows adequate cooling to take place while rendering the surface electrically non-conductive.

Air-Cooled Anode

Mention of cooling brings us to a further strong feature of the "Catkin" valve, for no longer has the anode to be cooled by heat radiation only, as in the case of the glass type

HOW THEY ARE MADE—WHAT THEY CAN DO





To the left is a Marconiphone "Catkin," part of which has been cut away to show the internal construction. The valve on the right is a non-metallised M.H.4, the characteristics of which for various anode voltages, etc., are shown in the central graph.

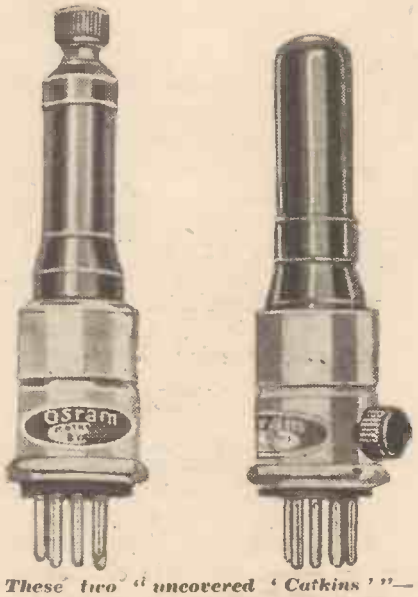
Being metal and completely surrounding the other electrodes, the anode of the "Catkin" should act as a valuable electrostatic screen in cases of the detector and pentode valves, thereby greatly reducing the danger of mains hum pick-up, or other external disturbances.

We should state here that as a start only the A.C. range of "Catkin" valves is being marketed, the

where the anode is in a vacuum, but it is cooled by direct means—by air currents as well as by radiation. This results in a very much cooler-running valve—or conversely in the possibility of obtaining much more power from a valve without overheating taking place.

Probably you are wondering how the "Catkin" valves are made vacuum tight inside the anode if the electrodes come out through an obviously non-gastight clamp. The vacuum is obtained inside the anode by the use of a specially designed glass-

S.G. AND PENTODE



These two "uncovered 'Catkins'"—officially known as non-metallised types—are the V.M.S.4 and M.P.T.4, for use in A.C. mains receivers.

to-metal joint wherein metallised glass is welded to the base of the anode, the glass eventually coming down to the normal evacuating pip.

Below the mica-metal clamp the electrode supports are welded to wire connectors, which are passed out radially through the foot of the glass seal to the pins on the valve cap. They are widely spaced where they pass through this, so that the inter-electrode capacity caused thereby is too small to worry about.

Rubber Insulation

The whole valve assembly is then mounted in a rubber ring, providing anti-microphonic support, and firmly fixed in a metal base in the foot of which is a low-loss five-pin base. Here, again, the "Catkin" scores over the glass valve, for there is no cementing of the base to be done, it being rigidly clamped in position, whence it cannot come adrift.

As regards size the "Catkin" is much thinner than the corresponding glass type, and is not quite so tall. It is completely interchangeable with the glass valve, however, the characteristics of the Marconi and Osram M.S.4B., V.M.S.4, M.H.4, and M.P.T.4 glass valves being the same as the

Close Standardisation of Type Characteristics

corresponding valves in the "Catkin" series.

This is a wise move on the part of the manufacturers, who have thus made it possible for mains set users to change over from glass to metal valves as and when they so desire, with the sure knowledge of what the results will be.

DIMENSIONS DEFINED

Marconi and Osram have set a new standard in valve design, and we shall eagerly await the application of the "all-metal" construction to other types than A.C. mains valves.

So far no information on the subject of battery-operated "Catkins" is available, but we understand that eventually all valves made by these two concerns will be of the new construction, completely replacing the old electric lamp system.

A Future for Glass?

But while one must undoubtedly take one's hat off to the research departments of both Marconi and Osram, whence the new valves have emanated, one must not lose sense of proportion and expect to see the familiar glass "bottle" immediately swept off the radio map.

The "Catkin" valve is still largely in its infancy; it is a pretty lusty infant, we must admit, but it has yet to mature, and there are many types of valves that have yet to be all-metallised, if one can use the expression.

We have been introduced to a useful workable team of four A.C. indirectly-heated "Catkins," and, though the signs point to an eventual all-metal valve era, we have yet to see how kindly the new construction takes to main rectifiers, double diode triodes and pentodes, large power output valves, and a host of different types that we have come to know in their glass-enclosed vacua.

Many Problems Ahead

The double diode valves and the "Class B" types especially will tax the ingenuity of the "all-metal" valve designer, for he has a multiplicity of electrodes to arrange that will give him plenty of room for thought. That the "Catkin" version of all these valves is a possibility we have no doubt, but in fairness to valve manufacturer and dealer, and to the general radio public, the cold unvarnished facts must be pointed out.

The "all-metal" "Catkin" valve has arrived in certain types; it can be used to replace directly the glass equivalents of those types. But it would be foolish to expect a "Catkin" cascade of all sorts of valves, great and small, mains and battery, within, perhaps, a few months.

Such an avalanche will not occur. The new valve will be gradually developed, and until the "all-metal" replacement for any particular glass valve we are interested in arrives, we must carry on as before.

Considering the Public

The best indication of the prospective gradual growth of the "Catkin" valve is perhaps the fact that the "all-metal" valve exponents themselves have just produced a new glass valve—the M.H.D.4, an A.C. operated double diode triode.

So don't hold up your set construction, or the purchase of a new valve, because of the possibility that the glass valve is to be made obsolete in a few weeks. That will not occur. If you wait for a "Catkin" of the type you require you may wait longer than you anticipated. The market is not going to be flooded with "all-metal" valves of all sorts—it will gradually be infiltrated with them in such a way that the corresponding types of glass valves may be replaced by purchasers as and when convenient.

The "Catkin" method of valve construction is a definite advance in valve technique, but it has to be used sanely and deliberately if its full value is to be obtained. The valve makers recognise this, and you may rest assured that the future of the "Catkin" will be carefully and logically arranged.

FROM C.A.T. TO "CATKIN"

A good idea of the size of the "Catkin" is obtainable from the picture on the left, whilst that to the right has an historic interest.

It shows one of the original Marconi water-cooled transmitting C.A.T. valves being compared with the first "Catkin" receiving valve. The former stands nearly five feet in height, and it needs about 1,500 horse-power to work it!

MAKING SPEECH CLEARER

How does speech sound on your set? If it is deep-toned and gruff instead of being perfectly natural, try the simple device described below.

By K. P. HUNT

TONE control in some form or another is now a prominent feature of all really up-to-date radio receivers. But not everybody can afford, in these hard times, to build a new set which incorporates this desirable improvement of adjusting frequency response to the ear of the individual listener.

Moreover, I believe that many listeners in this country have reached a point of regrettable complacency as regards radio quality. I know several who are content to describe their sets as "not too bad."

Lack of Tone Balance

Their receivers have been bought or home-made during the past two or three years, and attain a certain standard of selectivity, sensitivity and quality which, whilst falling short of the best reception their owners may read about to-day, is nevertheless reasonably satisfactory.

Until designers evolve something overwhelmingly superior, or receiving conditions demand it, many thousands of more or less satisfied listeners will not think that the prospective improvement warrants any drastic change of apparatus involving any considerable expenditure.

In the meantime, however, any inexpensive method of definitely improving the performance of the existing receiver is of great interest.

The particular point to which I invite attention, and which numerous listeners will immediately recognise as applicable to their own sets, is the distressing inequality of tonal balance between music and speech. This shows itself on any set not provided with corrective devices, when working at full volume.

Whether it can be justified or not from a strictly musical standpoint, it is a fact that the average listener prefers rather an excess of bass. He also has a tendency to push volume to a point that is technically unsuitable to the dimensions of the room containing the set.

Preference for Bass

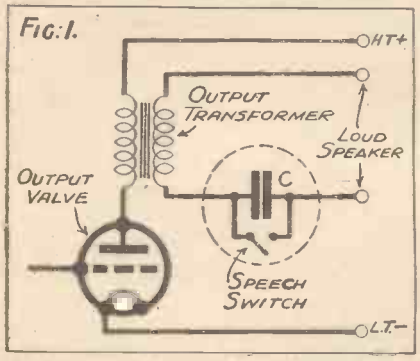
There are some sticklers for complete fidelity, but I suggest that most of us do not feel satisfied unless radio music is really loud, and the bass strongly marked to an extent which a musical purist might consider a definite over-balance in favour of the lower notes.

Certain considerations in radio receiver design are accidentally agreeable to this general preference. For instance, in the vast majority of sets now in use, which incorporate no tone control or means of preventing side-band cutting, the dependence for sensitivity upon fairly close reaction or several tuned H.F. stages necessarily causes a big reduction in high-note response.

An Aural Trick

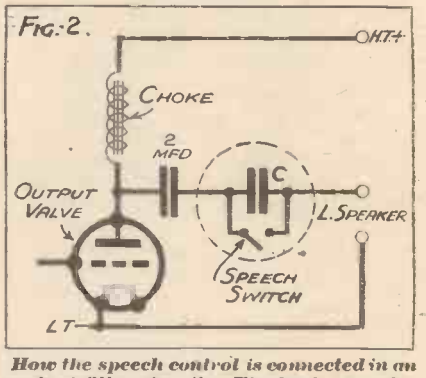
Particularly when working on full volume, the unescapable result, unless corrected, is to reproduce music that is proportionately over-full in the bass. Fortunately, this happens to be in accordance with the prevailing taste of many listeners who are not super-critical about musical quality.

USING A TRANSFORMER



In this case the speech control is joined between the secondary of the output transformer and the L.S. terminals.

THE OUTPUT FILTER SCHEME



How the speech control is connected in an output filter circuit. The best value for the condenser C should be found by trial.

But what happens when the announcer speaks or a talk is in progress?

The proud possessor of the same set that pounds out music so admirably now looks rather puzzled. Speech at full strength is disagreeably gruff, husky, deep-toned and unnatural.

I fancy many listeners will admit this to be an accurate account of their set's behaviour.

Even if the amplifier and loudspeaker together have a perfectly straight-line frequency response, it is an acoustic paradox that when music is reproduced at less than actual volume, as it usually is, the human ear feels an inadequacy of bass, but when listening to speech reproduced at greater than actual volume, the ear responds as to an excess of bass.

It is a little trick of our aural apparatus that we cannot help.

The simple corrective for this shortcoming is to include a device in the radio set which, for speech reception only, will cut down bass response.

(*Please turn to page* 154)

What is ELECTRICITY?

BY JOHN SCOTT-TAGGART A.M.I.E.E., F.INST P

"KEEN STUDENT" writes to me: "What is electricity?"

Unfortunately, only one person has ever known what electricity was. He was a student at college, and not a very attentive one. The professor, noting that he was dozing, asked him suddenly: "What is electricity?" The student replied: "I did know, but I've forgotten."

Looking Ahead!

The professor held up his hands in mock horror and despair: "What a tragedy! You are the only man who has known what electricity is, and now you have forgotten."

[Yes, I know. I was told this chestnut when I was seven. It has appeared in 1,403 text-books, 7,356 articles, described in 317,425 lectures, and is now dished up in the hope that some of you will titter. Those who refuse to titter may give a reluctant snigger at the following story of another student and another professor. This student suddenly woke out of a doze and cried to the lecturer in great agitation:

"In how many years did you say the world would come to an end?"

"In two hundred million years," repeated the professor.

"Thank heavens!" replied the student, leaning back with relief and mopping his brow. "I thought you said two million."]

"Keen Student" goes on to say: "Why does an electric current travel the same speed whatever it travels through?"

Fast and Slow

This is news to me. Oh, yes, I know all about travelling like lightning, 186,000 miles per second, the same speed as light, etcetera.

That, of course, is all tripe. An electric current can whizz along or merely ooze, and I shall now mount the rostrum and give you all a little lecture.

There are three main forms of conductors: metals, gases, and the vacuum. Metals are normally used, but gases are sometimes employed in rectifiers, and a vacuum is used in a wireless valve.

We are always taking our hats off to electrons as the heroes of an electric age. But this is S.T.'s opinion;

"If we could catch an individual electron and whitewash it, or fix an aluminium ring round its left ankle, and if we then kept an eye on it, we should find it a very dull dog."

True, of course! But you will find this article about the electron is anything but dull!

This sounds dull, but tell me this! How long does it take the electricity that enters a home to travel along its copper wire? How long would it take to travel one inch? No, I thought you would say that! It would actually take eight seconds!

How can such a crawling current drive motors and trams, illuminate cities, and electrocute human beings? The answer is: the current may be slow, but it can be provided in huge quantities.

EXPLODING THE ATOM

In 200,000,000 years.

An electric current is supposed to consist usually of the passage of electrons which are infinitesimally small particles. An atom of copper consists of a nucleus (or centre) surrounded by 29 electrons, one of which is allowed to go on the loose. It is called a free electron, and is so loosely held by the rest of the atom that it can freely stroll about amongst the other atoms.

The drift of free electrons along a wire is called an electric current, and the passage of the electrons is set up by applying a voltage across the wire.

Niagara in a Lamp

Imagine that this copy of the WIRELESS CONSTRUCTOR is made of copper. How many free electrons would there be in it? The answer is:

15000000000000000000000000

I dare say the printer has added or left off a few noughts. There should be 23 noughts, but just count them and see; but one or two more or less will not worry us.

If every free electron in this copper were regarded as a drop of water, there would be enough water to fill the Atlantic ten times over.

At the moment of writing this, I am sitting under an electric lamp through the filament of which are passing so many free electrons that if each were a drop of water the total in one hour would be equal to the flow of water over Niagara Falls for six thousand years—probably equivalent to five minutes rain in Manchester.

Quantity that Matters

The number of free electrons available for making a current of electricity is thus very large. Their actual speed of travel is not so important.

I have stood by the molten lava of the volcanic Mount Etna and the movement has been hardly noticeable. I have stood on a huge Swiss glacier which moves about two feet a year. But I should definitely jib at being placed between either the lava stream or the glacier and a stone wall.

Now, what about currents in gases? Well, boys, gases are normally non-conducting. For example, air (except perhaps in St. Helens) consists chiefly

"Electricity is Not Necessarily a Fast Mover!"

of nitrogen and oxygen, and we know that unless there are high voltages involved (as in lightning discharges), air is an insulator.

This is because there are normally no free electrons in gases. We can, however, by starting an arc, produce free electrons which will then move from atom to atom of the gas, just as we saw they did in the case of a metal wire.

Creating Free Electrons

In the case of a very low-pressure arc in a tube (i.e. the gas being highly rarefied), large currents may be passed, but note this: the number of free electrons may be one-million-millionth of the number these would be if the gas were replaced by copper. The speed of the electrons is, however, very much faster. They can, so to speak, travel along arterial roads and "tread on the gas." Instead of travelling one inch in eight seconds, as in the case of the copper wire, they will travel 1,000 miles in one second.

If we "thin" the gas still more, we will find that, as we approach a perfect vacuum, it becomes more and more difficult to get any current because of the absence of adequate free electrons.

Five Minutes' Rain in Manchester.

A perfect vacuum is a perfect insulator unless we can produce some free electrons. Fortunately, it is a simple matter to manufacture free electrons by heating a metal in the vacuum and using another piece of metal as the receiving depot for the free electrons.

The hot metal (usually a metal filament heated red-hot or white-hot by an electric current) throws off free electrons which are attracted by the other metal which we give a positive voltage with respect to the filament.

The free electrons, which are negative particles of electricity, have a gorgeous time travelling from filament to anode. They have no bulky atoms of gas or metal to bump into; they have a clear road—and don't they take advantage of it! They think nothing of doing the trip at 36,000,000 m.p.h.

This, of course, is quite slow compared with the speed of wireless waves (669,600,000 miles per hour but by the application of very high voltages across vacuum tubes having an extremely high vacuum, some amazing speed records have been achieved, and nobody knows quite what will happen if we force the pace still further. Exploding the atom—and perhaps, but I hope not for the next forty odd years, the world—may become a pastime for the ultra-fast electron.

Filling the Atlantic.

Meanwhile, we use the vacuum tube in radio and control the electrons instantaneously and completely by a "grid," which we cannot do effectively when a gas-conductor is used.

From the above explanation you will see that electricity is not necessarily a fast mover, although its passage through gases and especially through a vacuum can be far from sluggish.

In a wire, where we might at first expect high velocities because of the good conductivity, the current crawls along at the pace of a spry old tortoise or an athletic young snail.

Whitewashing the Electron.

It does not, however, take 30 years for a telegraph signal to be cabled to the U.S.A., otherwise British speculators in American stocks would probably make money instead of losing it.

Where is the catch? Why has electricity won itself a reputation for instantaneous behaviour?

Because when electrons start trekking at one end of the wire, the brother electrons all along the wire and at the other end start doing the same at almost the same moment.

Just Bores

When the doors of a picture house are opened, the queue immediately begins to move, although it may be ages before you or I get inside. If we could catch an individual electron and whitewash it, or fix an aluminium ring round its left ankle, and if we then kept an eye on it, we should find it a very dull dog.

Electrons, in a wire at any rate, are just bores.

A SHORT-WAVE SUPER-HET CONVERTER

DESIGNED & DESCRIBED BY THE WIRELESS CONSTRUCTOR RESEARCH DEPT.

GREAT RANGE OF RECEPTION

EXCELLENT SELECTIVITY

SIMPLE OPERATION

COVERS ALL SHORT-WAVE BANDS

WHY not convert your ordinary broadcast receiver into a short-wave superhet? It can be done very easily, and inexpensively, and will enable a host of short-wave telephony or C.W. stations to be received with the greatest of ease.

A short-wave superhet is very much more simple to operate than the so-called "straight" type of set, for there is no reaction wangling to be done—the stations just come straight in as the tuning dials are turned.

There is only one requirement, and that is that the ordinary broadcast set shall have at least one stage of H.F. amplification. That it will cover the long waves is a foregone conclusion, unless some well out of the ordinary type of set is being employed.

What it Does

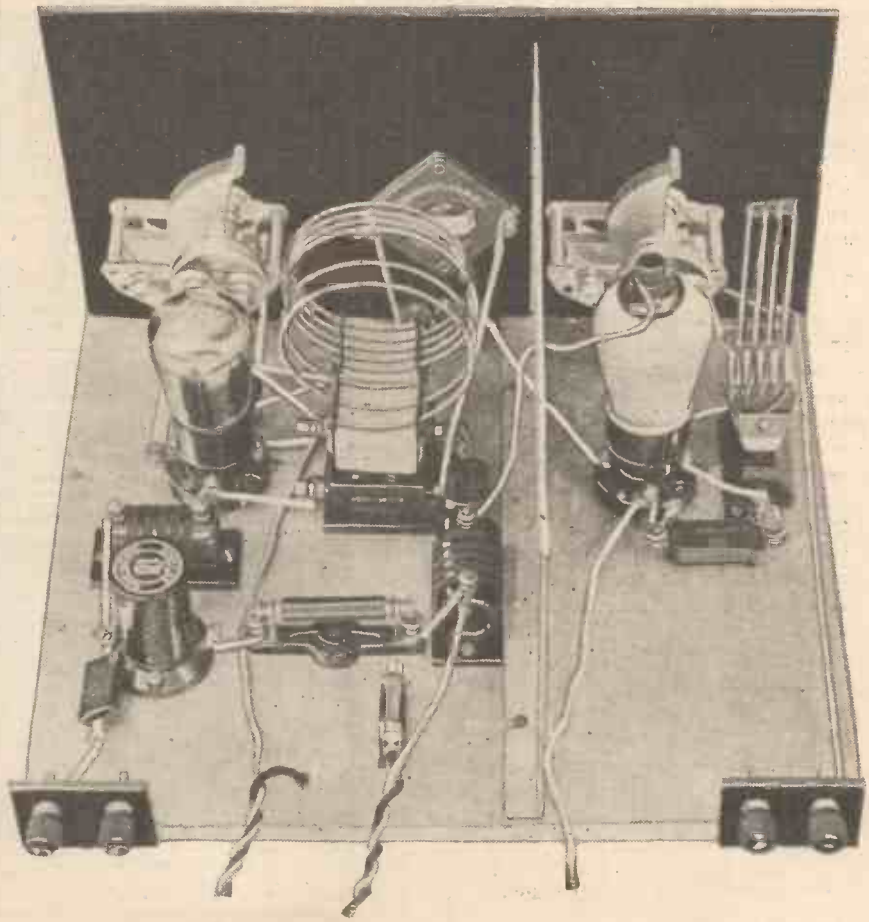
What the short-wave converter does is to provide an attachment to your set that at once converts it into a superhet receiver, the oscillator and mixer portions being in the converter and the intermediate frequency amplifier, detector and L.F. parts being in the standard broadcast receiver.

It does not matter whether the set is of the battery or mains variety as regards the operation of the converter, for this is operated by batteries. There is a risk, however, in the case of mains sets, that a certain amount of mains hum may be present when the set is used on the short waves, for mains are very prone to upset the reception of the ultra high frequencies.

The attachment of the converter to the standard receiver is simplicity itself, only one lead being required to the aerial terminal. The same batteries for the set and converter are used, so that the alterations of the set are absolutely nil, and the connecting up or disconnection of the converter is a matter of a few seconds only.

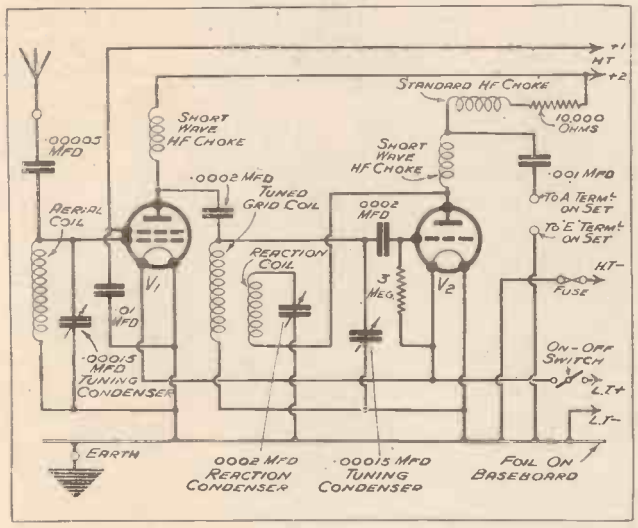
The method of short-wave reception is this. The incoming short-wave impulses are amplified through a screened-grid H.F. stage, and are

MAKES YOUR SET A SUPERHET



The completed converter is here shown with the valves in position, ready for connecting up to your existing set. It is suitable for use with any broadcast receiver which incorporates an H.F. amplifying stage.

A Short-Wave Superhet Converter—*continued*



STABLE AND EFFICIENT

The converter has an S.G. valve preceding the first-detector-oscillator, the aerial and H.F. circuits both being fully tuned. Plug-in coils are employed, thus enabling a wide variety of wavelengths to be covered simply by using the appropriate coil sizes. The baseboard is covered with copper foil and, as can be seen from the diagram below, certain leads are taken direct to this metal covering.

has normal reaction applied to it by the usual methods of reaction coil and condenser.

Connection to Set

The output of this valve is taken to the output terminal, for it is to be applied to the aerial terminal of the receiver. The earth of the converter and the earth side of the receiver are common (either by direct connection or via the L.T. battery negative), so that the output of the converter is actually applied across the aerial and earth of the receiver; in other words, across the grid circuit of the first valve in that set.

When operating, the converter is tuned to a short-wave station, with then passed on to the mixer and oscillator circuits.

In ordinary superhets, for the reception of normal wavelengths it is not possible to use one valve for mixer and oscillator unless a special valve is employed. In the case of short waves the ordinary detector type of triode valve can be used to provide both rectification and heterodyning, due to the very high frequency on which the receiver is working.

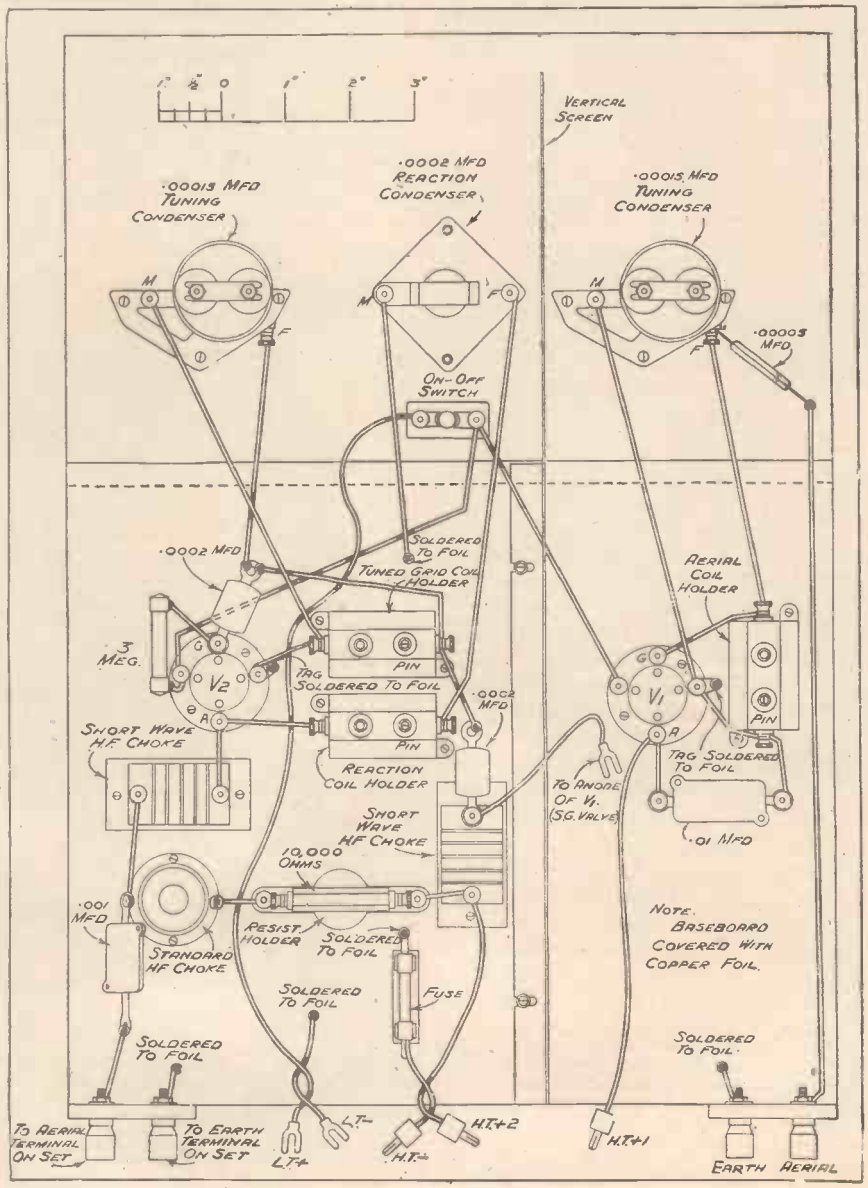
Simple Oscillator

Especially is this possible if the intermediate frequency of the superhet can be fairly low—the lower the better. This can be achieved if the broadcast receiver can tune up to about 2,000 metres.

In such an instance the beat frequency required is a matter of some 150 kcs., and at 20 metres one has to go a mere 150 kcs. out of tune in order to make a single detector circuit react on itself and provide a beat note of 150 kcs.

In other words, instead of tuning to 20 metres we tune to 19·802, a very close reading on the tuning dial. Such a small matter of "off-tuning" is of small moment, and provides excellent results with extreme simplicity of construction; so we decided to use the scheme (known as an "autodyne" oscillator) in the converter. It is simply an oscillating detector of the simplest type, as will be seen from the circuit diagram and the photographs of the converter.

From the S.G. stage of the unit, then, we feed the impulses into an ordinary grid-leak detector, which



Simple In Construction—Easy To Operate

the detector in an oscillating condition. Then (though this comes quite automatically when the converter is in use, and is not a separate operation) the detector circuit is slightly mistuned to the extent of the number of kilocycles that correspond with the tuning of the broadcast receiver.

Adjusting the Receiver

This latter is tuned to the longest wavelength that is possible—the longer the better, for the lower the frequency this is tuned to the lower will be the frequency that has to be fed into it from the converter. In other words, the lower will have to be the beat frequency and the less will the detector of the converter have to be mistuned.

For 2,000 metres on the broadcast set the converter detector will have to be 150 kcs. out of true tune. Not a great deal, is it, for it is only a fraction of a metre? But the less that detuning is necessary the better will be the sensitivity of the converter, so that the longest wave possible on the broadcast set should be employed.

It will be seen that it would be useless to use the broadcast set on the medium-wave band, for the beat frequency fed from the converter would have to be comparatively high. In other words, the detector would have to be very much off tune, and would thus be very insensitive.

Step by Step

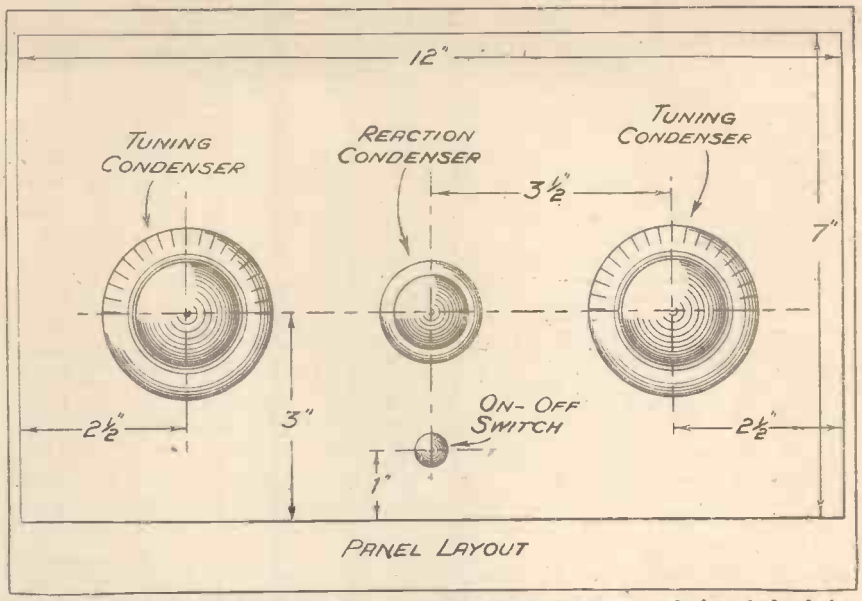
All this sounds fairly complicated, no doubt, but in practice it is the simplest thing possible. The broadcast set having been tuned to its greatest wavelength (it must be clear of a long-wave station, of course), it is set oscillating gently.

The converter is connected to the aerial terminal of the broadcast receiver, the aerial itself being taken to the converter. The earth terminal of the converter is taken to earth, and the earth from the standard set is removed.

Now the detector of the short-wave section is set oscillating, this will be heard in the loudspeaker as a rushing noise, perhaps a squeal if the oscillation is too fierce.

Next the two tuning dials are rotated in step slowly. It will be found that the aerial circuit is quite flat, but that the detector tuning is sharp. As a matter of fact, the aerial circuit can often be left set at the middle of the scale and tuning carried out only on the other condenser until the carrier of a short-wave station is heard, when the tuning can be adjusted accordingly.

Rotation of the dials will soon bring in a carrier, and it will be found that there are two points on the detector tuning where the carrier can be heard. These points correspond with the frequency that is 150 cycles above and below that of the station being received.



***THE PANEL DIMENSIONS** are all given in the above diagram, only four holes being needed for mounting the components. The two tuning condensers control the aerial (left-hand dial) and H.F. circuits (right), the dials preferably having slow-motion adjustments to enable accurate tuning to be obtained.*

THE COMPONENTS REQUIRED TO BUILD THIS EFFICIENT UNIT

Component	Make used by Designer	Alternative makes of suitable specification recommended by Designer
1 Panel, 12 in. x 7 in.	Peto-Scott	Becol, Goltone
1 Baseboard, 12 in. x 10 in., with foil covering.	Peto-Scott	—
1 Cabinet to fit above.	Peto-Scott	Camco, Pickett
2 ·00015-mfd. variable condensers with slow-motion dials	Ormond No. 6 Friction control	Polar short-wave type
1 ·0002-mfd. reaction condenser	Graham Farish	Polar, Ormond, Igranic
3 Coil holders for plug-in coils	Igranic	—
2 Sets short-wave coils	Atlas	Igranic
2 Short-wave H.F. chokes	Bulgin H.F.3	Igranic, Keystone, Telsen
2 Four-pin valve holders	W.B.	Benjamin, Telsen, Lissen
1 H.F. choke, standard type	R.I. "Quadastatic"	Telsen, Lissen, Varley, Wearite, Keystone
1 ·01-mfd. fixed condenser	Dubilier 670	T.C.C., Telsen, Ferranti
2 ·0002-mfd. fixed condensers	Dubilier 665	T.C.C., Telsen, Ferranti
1 ·001-mfd. fixed condenser	T.C.C. type M	Dubilier, Ferranti, Telsen
1 ·00005-mfd. fixed condenser	T.C.C. type M	Dubilier

Component	Make used by Designer	Alternative makes of suitable specification recommended by Designer
1 10,000-ohm resistance with horizontal holder or with wire ends	Graham Farish "Ohmite"	Dubilier 1 watt
1 3-meg. grid leak with wire ends or terminals	Dubilier 1 watt	Graham Farish "Ohmite" Goltone
1 Single fuse holder	Belling-Lee No. 1034	Bulgin, Telsen, Goltone
1 Fuse	Belling-Lee No. 1056	Bulgin, Goltone, Telsen
1 Standard screen, 10 in. x 6 in.	Magnum	—
2 Terminal strips, 2 in. x 1½ in.	—	—
4 Indicating terminals	Belling-Lee type R	Goltone, Bulgin, Igranic, Eelex
1 On-off switch	W.B.	Keystone, Telsen, Bulgin
3 Wander plugs	Igranic	Bulgin, Belling-Lee, Goltone
2 Accumulator spades	Clix	Belling-Lee
3 Yds. 18-gauge tinned copper wire	Goltone	Wearite
2 Yds. insulating sleeving	Goltone	Wearite
Flex, screws, etc.	—	—

A Short-Wave Superhet Converter—*continued*

Choose the setting that gives the loudest results. Then decrease the reaction of the detector until a setting is found at which the carrier is loudest. The reaction is then left, and the carrier is "resolved" by decreasing the reaction on the *broadcast set*, carefully re-tuning this to keep the station in at full strength.

THE CORRECT VALVES

Make	S.G.	Det.
Cossor	220S.G.	210H.L.
Mullard	P.M.12	P.M.2D.X.
Mazda	S.215	H.L.2
Marconi	S.22	H.L.2
Osram	S.22	H.L.2
Eta	B.Y.6	B.Y.1815
Hivac	S.G.210	H.210

Obviously, tuning either the broadcast or short-wave sections will have the same effect on the station being tuned in, for both alter the frequency of the intermediate stage. Final adjustments in tuning are usually carried out on the broadcast set, however, as here they are not so critical as on the short-waver, and can be carried out more rapidly without any fear of losing the station.

For C.W. reception the long-wave set is kept oscillating as well as the converter, while the different short-wave bands are covered by the plug-in coils on the converter. Two sets of these are required to cover the whole range properly from about 14 metres or so to round about 80.

Valves and Voltages

The construction of the converter needs no discussion, for it is the task of but an hour or two. The baseboard is foil-covered, and the moving vanes of tuning and reaction condensers are "grounded" to eliminate body capacity effects.

The valves required are ordinary 2-volt types. An S.G. goes into V_1 valve holder and an H.L. type into V_2. About 120 volts H.T. is ample for the anode of V_1, and about 75 or 80 for the screen of V_1 and the anode of V_2.

The same H.T. and L.T. batteries can be used for the converter and the broadcast receiver, so that no extras in the way of power are required.

If desired, the converter can be used with phones connected from the output terminal to the earth terminal for the reception of short waves without the superhet effect. In this case, the converter would be connected to the aerial and earth, and to batteries in the usual way, but would not be connected to the broadcast receiver.

The tuning would be done as before, but the reaction would have to be used as in a normal set; that is, reduced to just below oscillation setting when a carrier has been heard, and not kept oscillating, as is the case when the converter is used as a superhet unit.

What to Listen For

With the aid of a good broadcast receiver the converter is capable of providing many hours of reliable short-wave reception from the corners of the earth. American broadcasting has, as a matter of fact, frequently been received on it, in conjunction with a one-stage S.G. four-valver, at Tallis House during the afternoon, though the fading usually made the reception of little value from a programme point of view. Strength varied from weak to full loudspeaker strength, at which latter it could be easily heard all over the laboratory.

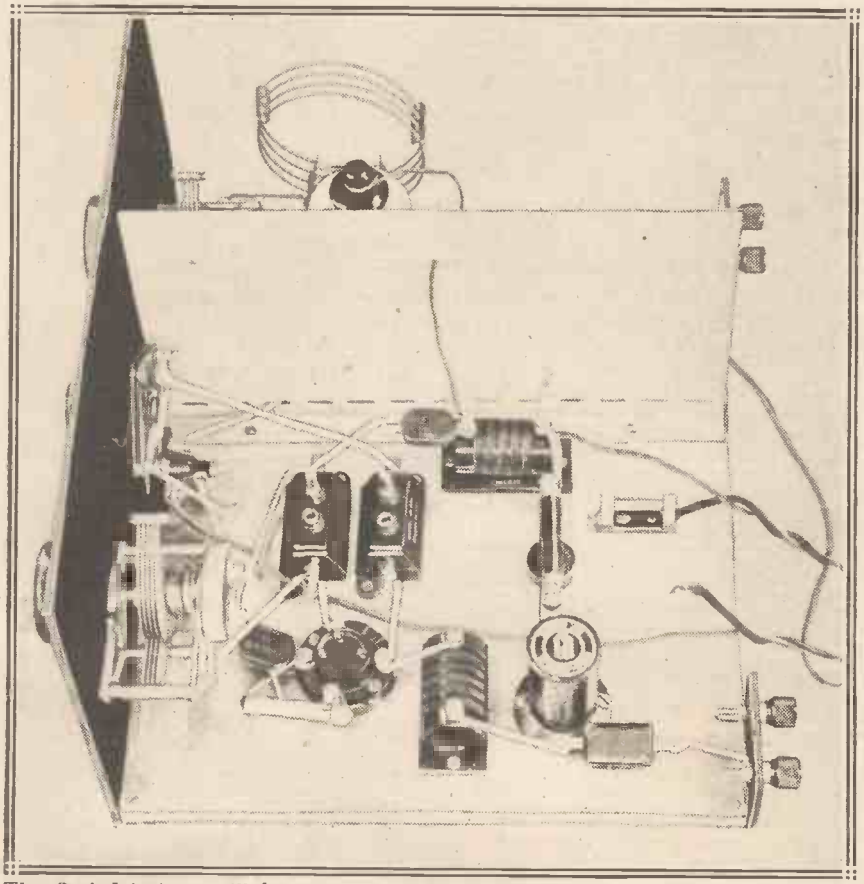
In the evenings, however, a number of Americans can usually be heard, and as the evening darkens the strength of most of them increases and becomes steadier.

There are hosts of stations that the owner of this converter will be able to pick up, and the exact stations received will, of course, depend upon local conditions and the time of the year.

At the moment the following transmitters are worth listening for on the 45 to 49-metre band. YV11BMO, of Maracay, Venezuela; YV1BC, Caracas, Venezuela; HKC, Bogota, Colombia; and HC1DR, at Quito, Ecuador. All these come over late at night at good strength.

Lower down the wavelength scale we have some of the more popular Americans in W2XAD, Schenectady; W8XK, Pittsburg; and W2XE, Wayne, N.J.

AN IDEAL SHORT-WAVE UNIT



The first-detector-oscillator together with its associated components are clearly shown in this photograph. Three H.F. chokes are used, two of these being of the short-wave type and the other a standard all-wave pattern. The vertical shield prevents undesirable interaction between the two tuning circuits.

USING THE NEW VALVES

by VICTOR KING

Our well-known contributor, in his usual inimitable fashion, tells of his adventures with radio's latest developments. Every constructor should read these authoritative comments on "Class B" and Automatic Volume Control—the result of practical experiments under a variety of conditions.

I HAVE been very busy lately; indeed, not for years has my radio experimenting been so continuous and so interesting. As a matter of fact, there has been so much to do that for the first time since I began writing for this journal I have had to seek help in the construction of experimental sets.

"CLASS B" OUTPUT

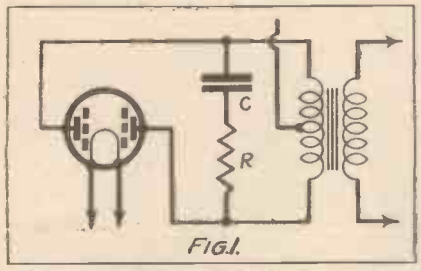


FIG.1.

The "Class B" valve is in one respect like the pentode, since it tends to over-emphasise the high notes. To obviate this it is usual to join a compensating device—consisting of a resistance in series with a fixed condenser—across the primary winding of the loudspeaker transformer.

Naturally, I prefer to do everything myself, not because I think no one else could do a job of assembly, for instance, as well as I could, but simply because I hold the opinion that unless one does do the whole job from start to finish one cannot learn all there is to learn about it.

But with three or four different "Class B" valves and a multitude of different makes of "Class B" components, double diode triode valves, "cold" valves, "Catkin" valves, and many other things, all showering down from the blue in the space of a few weeks . . . . !

Right Up to Date

However, I believe I have thoroughly tried *all* the new developments, and in so doing have brought myself right up to date. And with my notebook in front of me as I write, I propose to tell you something about my adventures—particularly with the new valves.

In regard to "Class B," the fact which stands out is that its successful operation depends very largely upon a very careful choice of components. Some of the "drive" transformers which were hurried into production are rather poor, and so amateurs should take careful note of the types and makes recommended for use with THE WIRELESS CONSTRUCTOR sets.

"Class B" is capable of giving impressive performances, but, in my opinion, it is not difficult to fall into distortion.

Eliminating Risk

However, the risk of that is largely eliminated if discrimination in the selection of components is used. And it should be remembered that there is a rather closer association between the functions of the "drive" and "Class B" valve and their associated parts than tends to exist in any ordinary set.

THE BASIC CIRCUIT

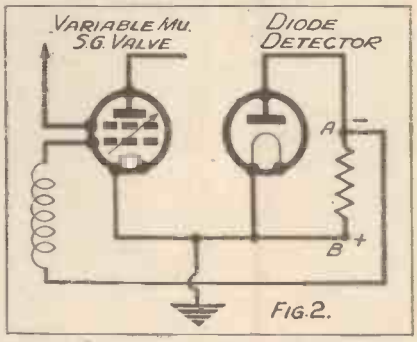


FIG.2.

This diagram shows the skeleton of an A.V.C. circuit in which the voltages developed across the resistance A B are used for biassing the grid of a multi-mu S.G. valve.

At least, it is a somewhat more critical association.

And different valves require different treatment. That is why "drive" and output transformers are being provided with tappings, enabling various ratios to be obtained.

But these defeat their own ends if the balancing of their windings is not maintained with close electrical precision in each case.

As you may know, the secondary winding of the "drive" transformer is split, and so is the primary of the output choke. Efficient "Class B" results are impossible if the sections do not accurately match.

Pentode Characteristics

You have to leave that to the manufacturer, however, and your safeguard is to take note of the makes recommended by THE WIRELESS CONSTRUCTOR.

The "Class B" valve appears to have pentode characteristics, in that it tends to emphasise high notes. A certain amount of high-note exaggeration is sometimes desirable, but too much of it becomes objectionable.

The effect will be increased should any of the preceding stages be "toppy," due, perhaps, to the use of one of those "cheap" L.F. transformers I discussed in a recent article.

It is especially in such circumstances that a tone adjustment is desirable. The usual method is to connect a resistance and condenser in as series across the "Class B" output shown in the first one of my diagrams.

Correction Values

I have found that usually the most suitable values for these are 10,000 ohms and ·01 mfd. And it often happens that the resistance can be left out without noticeably upsetting the correction.

A POINT TO WATCH!

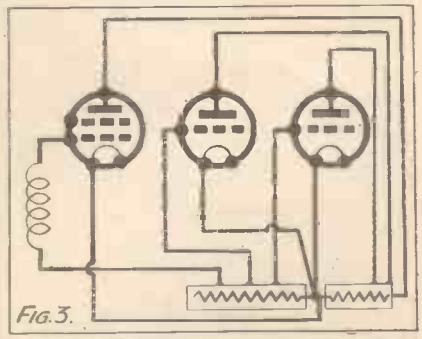


FIG.3.

With circuits of the A.V.C. type special care has to be taken to avoid instability troubles. In this diagram it will be seen how the anodes and grids of the valves are linked by the common H.T. and grid-bias batteries, a fact which renders adequate decoupling and screening absolutely essential.

Using The New Valves—*continued*

In regard to the H.T., there will be no need for me to dissertate on the necessity of maintaining the correct voltages, for it must now be common knowledge that a falling H.T. and an increase in its resistance are likely to upset "Class B" very badly.

Wide Variations

Automatic volume control is extremely interesting to experiment with; you can vary its effects so widely. The control can be either very light or very heavy, and the time between the arrival of a strong signal and the operation of the control can be varied within pretty wide limits.

In case some of you don't know how it works, I will give a brief description of the essentials of its working.

You know how a variable-mu S.G. valve functions? Its amplification is altered by applying a varying grid bias to it.

To cut down the volume you increase the G.B. and so reduce the amplifying powers of the valve.

Fig. 2 shows the skeleton of an A.V.C. circuit.

The current which flows in the anode circuit of the diode detector depends directly upon the strength of signal delivered to it by the variable-mu S.G. valve.

As the current increases so the voltage across the resistance rises. This is simple Ohm's Law (for $V = C \times R$, remember). R, the resistance, cannot change, and so, if the current flowing through it rises, obviously there simply must be a greater potential difference between its two ends A and B.

Now A is connected to the grid of the H.F. valve, while B is joined to the filament circuit either directly or indirectly.

You will now be able to see that the resistance acts as a self-adjusting automatic grid bias, and the stronger the input to the diode detector the greater will the bias be.

A Constant Level

If the value is correctly chosen the result is that the volume is maintained at a constant level.

In practice, an additional grid bias, perhaps from a battery, or, more commonly, by the usual automatic grid-bias method, is arranged so that by manual control the variable-mu valve can be set at any initial operating condition required.

The double diode triode valve is really only a diode detector and a three-electrode amplifier combined in the one bulb, though the circuits for its use at first sight look horribly complicated.

In addition to a normal grid and plate, there are two small plates or anodes for the diode action, and these can be employed for full-wave rectification, and, of course, automatic volume control.

I am afraid I haven't the space to go into the subject of A.V.C. in detail on this occasion, but there is one thing which I must not omit.

With A.V.C. and even variable-mu circuits for manual volume control, there will be a strong inherent tendency towards instability.

I have found it necessary to take very special steps in A.V.C. sets to prevent instability, especially when using multi-mu pentodes.

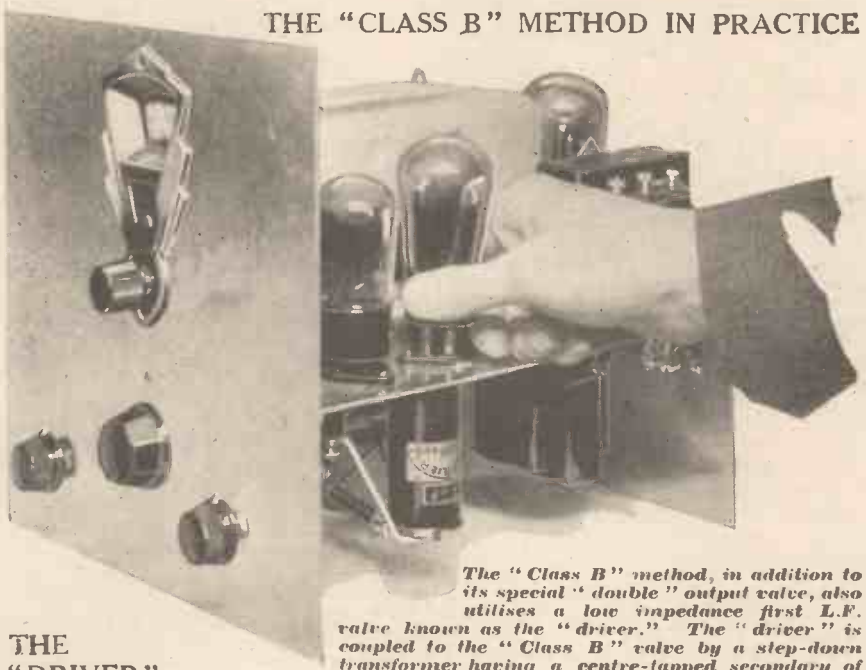
In one outfit I even had to screen every lead!

There are those who say that a little instability in a variable-mu set doesn't matter so long as it is controllable by the volume control and is heard only when right over to full volume.

Mangled Reproduction

I don't agree. I believe complete stability under all working conditions must be aimed at, otherwise there is a danger of overlooking that form of instability which is not audible as a howl, but "silently" mangles the reproduction.

THE "CLASS B" METHOD IN PRACTICE



The "Class B" method, in addition to its special "double" output valve, also utilises a low impedance first L.F. valve known as the "driver." The "driver" is coupled to the "Class B" valve by a step-down transformer having a centre-tapped secondary of low D.C. resistance.

THE "DRIVER"

But don't let that frighten you, for it can be kept in check, providing it is borne in mind that adequate H.F. decoupling and screening are essential, as well as is a well-planned layout.

It must be obvious why there should be this danger of instability when it is realised that there is an H.F. grid taken right back to the detector circuit, or even to a common grid-bias supply in addition, in a battery set, to the anodes linking in a common H.T. battery. (See Fig. 3 for a skeletonised circuit.)

And a battery is a resistance whose value goes up with use!

An insidious fault which many listeners are unable to diagnose.

Now, what about the "Catkins"? I like the name, don't you? It has a pleasantly homely sound, and is a vast relief after a torrent of purely scientific terms, such as Double Diode Triodes, Quiescent Push-Pull, and so on.

As for these novel, "all-metal" valves (they do contain a little glass, but not enough to affect their physical strength in any way), I consider them to be very sound propositions. They work well, are non-microphonic, and look fine in a metal chassis outfit.

NEW TUNING METHODS

ALL ABOUT THE LATEST TUNING DEVELOPMENT UTILISING THE IRON DUST CORE

By W. R. GERRARD.

THE Ferrocart coil has already shown us something of the possibilities of the iron-cored inductance in the tuned circuits on the high-frequency side of the set. But there is another kind of iron-cored coil, made on entirely different lines, which makes it possible to tune receiving sets by a system that is quite unlike anything now in use. This is the Polydoroff, or dust-cored, coil.

Varying Inductance

There is hardly a set in use to-day whose high-frequency circuits are not tuned by means of a variable condenser in parallel with a fixed inductance. This method is far from ideal, but it has ousted all others. The alternative method of tuning, which has for some time been discarded, is to make the inductance variable. This was done in some cases by the use of a variometer; in others by means of a coil with a sliding contact; in others with the help of a large number of tapping points, and in others again by bringing a metal "spade" into the field of the coil.

Superhet Advantages

The great trouble with any of these systems of tuning, whether the capacity or the inductance is variable, is that they do not give a constant performance over the waveband covered. Every reader knows, for instance, that down near the bottom of the medium waveband any "straight" receiving set tends to show great sensitiveness but poorish selectivity, whilst near the top of the band conditions are exactly reversed, the selectivity being at its best whilst the sensitiveness falls off. The superheterodyne is very much better in this respect since the greater part of the amplification (other than audio-frequency amplification) and of the filtering that take place are done in the intermediate-frequency stages, which are tuned to a constant frequency. Still, even the superheterodyne is not perfect in its performances, for the signal-frequency portion of its tuned circuits suffers from the defects that have been described.

Constant Performance

The factor which is the chief enemy of constant performance in tuned circuits is high-frequency resistance.

THE PRINCIPLE

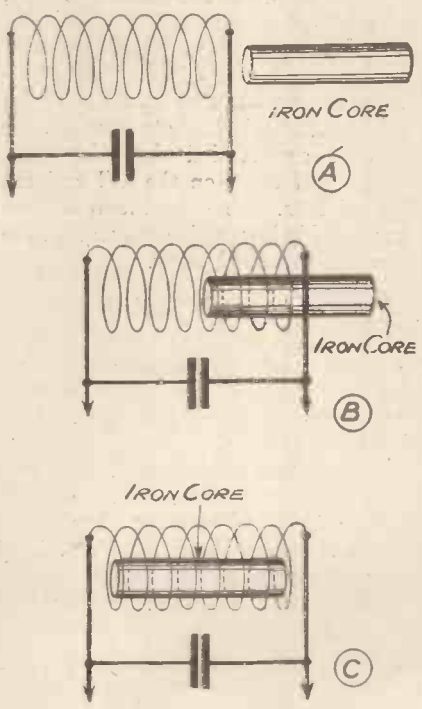


FIG 1

In the above diagram we have a solenoid coil in parallel with a fixed condenser. When the iron core is completely withdrawn, as in A, the coil is tuned to its minimum wavelength. As the core is thrust farther into the coil the wavelength increases until it reaches its maximum, as at C.

For the set to have constant selectivity with constant sensitiveness over the wavebands which it covers, the proportion of resistance to inductance must remain unaltered. Is there any way in which this can be done?

Fig. 1 shows a solenoid coil with a fixed condenser in parallel and a movable core of iron. Now, if the core is fully withdrawn, as shown at A, the circuit is tuned to its minimum wavelength. As the core is thrust farther and farther into the coil, as seen at B and C, the wavelength of the circuit increases. By means of the special Polydoroff core such a circuit will show constant performance as regards both sensitiveness and selectivity over the whole of the waveband that it covers.

Permeability Tuning

When we insert the core we are not actually increasing the inductance of the coil. What we are doing is to increase the permeability of the medium surrounding the coil. The net result is an increase in the effective inductance, and the system is known as permeability tuning.

It will be clear that no kind of solid or even laminated iron core could possibly be used, for the losses would then be so enormous that the circuit would be quite useless. Permeability tuning became possible only when an iron core of a novel and most ingenious kind was developed.

By the employment of an intricate chemical process iron can be reduced to particles so minute that they will float in air. Such extreme fineness is not required, but the particles used in the Polydoroff core are only about four ten-thousandths of an inch in diameter. To cover a square inch of surface with a single layer of these particles no less than 6,250,000 would be required.

Special Insulating Process

The next process is to coat each individual particle with a thin layer of a special insulating material. If you want some idea of what Polydoroff iron at this stage would look

New Tuning Methods—*continued*

like if seen under high magnification, imagine a quantity of marbles, dipped separately into melted paraffin wax and subsequently allowed to cool; or we may liken the particles to sugar-coated pills, the sugar coating representing the insulation and the "business" part of the pill the iron within. In Polydoroff iron the insulation is approximately 1 micron in thickness.

The iron dust prepared in this way is now mixed with bakelite "dough," and from the mixture cores of any desired size or shape can be moulded readily.

Midget Proportions

Owing to the tiny size of the iron particles and to the fact that each is separately insulated, losses in the core are exceedingly low, and it becomes immediately possible to make a coil of high efficiency but of very small dimensions. Fig. 2 shows in sectional view the coil with its screening box and core. It will be seen that the screen is only 2 in. in diameter by $2\frac{1}{4}$ in. in length, whilst the coil within has the midget proportions of $\frac{5}{8}$ in. in diameter and $1\frac{1}{8}$ in. for the length of the windings.

The core is drawn in Fig. 2 "cut away" so as to make its construction

CONVENTIONAL COUPLING

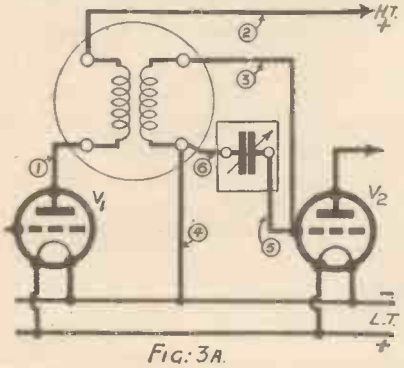


FIG. 3A.

In this arrangement—the conventional circuit of an H.F. transformer tuned by a variable condenser—six distinct connecting leads are required. Compare this with Fig. 3B.

plain. It is actually a combination of internal core and an external sleeve. The core portion moves into the coil former whilst the sleeve surrounds the windings when the whole is pushed right home. The total movement required is about $1\frac{1}{4}$ in.

Within the screen and near the base of the coil is an adjustable condenser connected in parallel with the windings. The turns themselves are comparatively few in number, and by means of the parallel condenser the circuit is tuned to exactly 200 metres with the core fully withdrawn. When the core is completely inserted the wavelength of the circuit is rather more than 550 metres. It thus covers the entire broadcast band easily.

Further, the same coil, without any additional windings, can be made to

IN SECTIONAL FORM

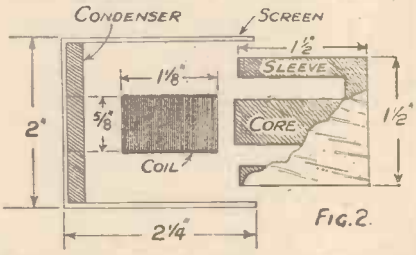


FIG. 2.

This is a sectional view of a tuning coil using the Polydoroff core for adjusting the effective inductance. The coil and its fixed condenser are contained in a screening box.

cover the long-wave band as well by the employment of a larger parallel condenser, also of the adjustable type, which is set to tune the circuit to, say, 1,000 metres with the core fully withdrawn.* Wavechanging then becomes a matter of switching from one parallel condenser to another. It will be appreciated that the small number of turns on the coil and the use of Litz. wire keep the resistance remarkably low, which means that the coil is of great efficiency.

Ganged Tuning

Ganging a number of tuned circuits is a very simple business. Each is set initially to the required minimum frequency with the core withdrawn. The cores are then arranged to be moved simultaneously by means of a single knob, a gear and a bridle. Once the initial adjustment has been correctly made the circuits will keep in step over the whole range.

This last fact brings two great advantages. In the first place it becomes possible to obtain increased selectivity and sensitiveness by tuning the aerial instead of leaving it "aperiodically" coupled. Secondly, in superheterodynes the oscillator is kept at exactly the right frequency no matter how many circuits are ganged.

Regular Station Spacing

Another strong point of permeability tuning is that the separation of stations can be made even from end to end of the scale. On both sides of the Atlantic channels are allotted on a frequency basis, the separation being 10 kilocycles in America and 9 kilocycles in Europe. Perfectly regular spacing in a circuit consisting of a fixed inductance and variable condenser can be obtained only if the condenser is of the straight-line frequency type. This kind of condenser, however, does not lend itself readily to ganging, so that the use of the log mid-line condenser has become almost universal, with the result that there is more crowding in some parts of the band than in others.

Making Calibration Easy

The moulded iron-dust core can be designed without difficulty to give a straight-line frequency action, and in

PERMEABILITY TUNING

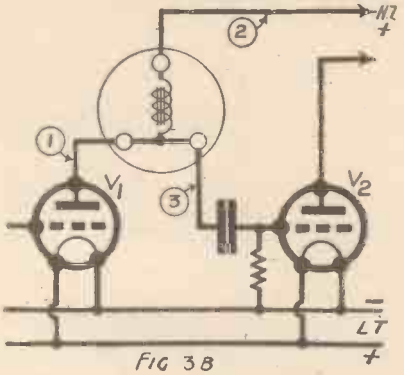


FIG 3B

In this case the circuit incorporates a permeability tuning unit, and it will be seen that only three connecting leads are needed, thus simplifying the wiring.

this form it gangs up without any trouble. The dial separation is thus constant, and both the operation of the set and its calibration become very much simplified.

But we have still to come to some of the most important of all the benefits that permeability tuning is likely to confer as soon as it has been

(*Please turn to page* 153)

* N.B.—In a circuit designed for use on the medium waveband only, the Polydoroff core is made with an inductance (without the core) of approximately 60μH, and the parallel capacity is of the order of ·0002μF. For working on either medium or long wavebands a 300μH coil, with alternative condensers of ·00004μF and ·001μF might be employed; or 200μH with ·00006μF and ·0015μF.

REMEMBER THESE— NEXT TIME!

MANSFIELD (Notts).—"There may be 'tripe' in Nottingham, but there's no tripe about the 'S.T.400.' I have enjoyed the 'S.T.300' and 'S.T.400' battery models, and have heard an A.C. 'S.T.400.' Glory!—what volume and quality!"—G. H. Smedley, Intake Avenue, Mansfield, Notts.

JOHANNESBURG (South Africa).—"I, too, must pen congratulations to Mr. Scott-Taggart on the outcome of his latest set, the 'S.T.400.' It is 'Some Tugger' at stations. I've built some real good sets and have always been proud of them, so it took some hard thinking before building this latest set. I offer my heartiest congratulations to S.T. When your paper brings out another set, it will have something to do to better the 'S.T.400.' I am surrounded by American superhets, but I wouldn't take £50 and one of them for my 'S.T.400' outfit. Visitors say when they hear the 'S.T.400': 'Ah, what a lovely tone.'"—N. H. Cato, Ninth Avenue, Mayfair, Johannesburg, S. Africa.

EDINBURGH.—"We had a battery 'S.T.400' and have now converted it to work off the Edinburgh A.C. mains, and the results are excellent."—Gordon Wood, Ashley Terrace, Edinburgh, 11.

SOME MORE LETTERS FROM ENTHUSIASTIC BUILDERS OF "S.T." RECEIVERS.

MIDDLESBROUGH. — "I am highly satisfied with my 'S.T.400'; the results are amazing."—G. E. L. Saltmer, 5, Corporation Road, Middlesbrough.

SHIREBROOK. — "I built your 'S.T.400' in February, and find it is by far the most selective and best (in all respects) set I have ever built."—T. Spencer, 56, Warren Terrace, Shirebrook.

SOUTH AFRICA.—"As soon as the 'S.T.400' came out, my friend wanted his 'S.T.300' converted. I did the whole job for him, and we were surprised with the results. Volume and selectivity are marvellous."—M. G. Paxinos, Bothaville, O.F.S., S. Africa.

ST. JOHN'S PARK (N. 19).—"I live only three miles from Brookmans Park! After I had corrected a fault, the 'S.T.400' sprang into all its beauty; superhets with umpteen valves have become crystal sets compared with your 'S.T.400.' The tone and punch are marvellous. With the exception of about eight stations I can get anything I want. I know I can defy anything up to 7-valve superhets. You deserve a double halo for having designed such a marvellous receiver."—D. Pericles, St. John's Park, N. 19.

CHORLEY.—"Thanks for a receiver that really *is* a receiver, and for all the good work you are doing." S. S., Corporation St., Chorley, Lancs.

STOCKTON-ON-TEES.—"I intended writing much earlier to thank you for your 'S.T.400.' I cannot express its worth—it is more than amazing. It is the only circuit that I found which claims all that you say. I have been so tired of other circuits that I have scrapped them, but I am entirely satisfied with the 'S.T.400.' Many of my friends are full of praise for it, and intend to build it the first opportunity. Many thanks for your wonderful circuit."—Reverend H. G., Stockton-on-Tees.

TRURO.—"I have built your 'S.T.400' and am getting jolly fine results from it, although I understand very little about wireless."—R. Hawkins, Steamer "Sankeon," Port of Truro.

DUKINFIELD.—"I bought one of the author's kits of your 'S.T.400' and had joy and pleasure in building it without any help whatever. It was so simple and an easy job. (I am 74 years of age.) From the moment it was put together it was wonderful, and I and my family were delighted.

"S.T.400" In India

Hasan Munzil, Mymensingh, Bengal, India.

Dear Sir,—Allow me to offer you my hearty congratulations on your "S.T.400" which I have only just constructed.

I have been a radio "fan" for a number of years and must have built and handled over fifteen sets, including a six-valve superhet, which was my last. None of these gave me the pleasure and satisfaction which the "S.T.400" is giving me now.

The purity is simply superb. The selectivity is masterly. It was with great difficulty that I could separate Bangkok from Bombay on my superhet, but it is only a matter of two divisions on the "S.T.400."

I can log Colombo (1,500 miles), Calcutta (250 miles), Bombay (over 1,200 miles), Bangkok (1,000 miles), Manila (2,100 miles), Nanking (2,100 miles), Prague (4,400 miles), Milan (4,600 miles), and many more, including a further dozen at least of European, all at loudspeaker strength. Each night I add a station or two to my log book. Considering the great distances that I have to cover, you will admit that my achievement is not bad. [Editor's Note: His average range on European stations works out at 4,300 miles.]

Thanking you again for your excellent set,

Yours truly, S. M. HOSAIN (Lieut.).

"The Dials Simply Bristle with Stations"

I beat my son-in-law, who lives a few miles away and was building a similar set; neither of us knew of each other's doings!"—B. Butler, Butler & Son (B. & S. Valves), Ltd., Dukinfield.

SOUTHAMPTON.—"For nearly 12 months I was the proud possessor of the 'S.T.300,' and I must say that I have never met a 3-valve set with such high quality, sensitivity, and, well, as to selectivity, it was great. When the 'S.T.400' was published, I determined to convert as soon as circumstances permitted, and now for some eight weeks I have been enjoying the delights of the 'S.T.400.' Its quality is superb, the selectivity

The A.C. "S.T.400" "A Complete Success"

Coronation Terrace,
Pakefield Street,
S. Lowestoft.

Dear Sir,—I feel I would like to let you know how very pleased I am with the A.C. "S.T.400," the more so because it is the first attempt I have made at putting a set together—and by following your instructions have found no difficulty. The set is a complete success.

Yours truly,
F. J. FRANKLINS.

the last word, and its distance capabilities tremendous. The dials simply bristle with stations. I have purposely refrained from writing until experience and results have backed up my first enthusiasm, and I must say that to me 'John Scott-Taggart' spells 'Radio as it should be.' Thank you for a magnificent set. Your claims for it are too modest."—Victor C. Wesley, 95, Stafford Rd., Southampton.

HAMPSTEAD (N.W.6).—"I have now had my 'S.T.400' built over four months, and it still grows on me! My aerial is of the picture-rail type, and I have an indifferent earth, but in spite of this I can receive dozens of stations at excellent strength."—N. W. Houghton, Belsize Rd., Hampstead, N.W.6.

BOLTON.—"I have converted the 'S.T.300' to 'S.T.400,' and I must say what a fine circuit is the latter. I have had some friends down to my house and they brought with them their £20 commercial super sets. We tried them in turn on my aerial, and for power and DX results the 'S.T.400' left them flat."—J. E. Crompton, A.Sec., Y.M.C.A. Radio Club, 19, Oliver Row, Bolton.

SALFORD.—"I wish to add my thanks to the many others who have written to you. It is a real musical instrument. Whatever station I get is always free from any other. I have been connected with orchestras and bands for thirty years. The set is one par excellence for pure tone, plenty of punch, freedom from distortion or assistance from other bands in other lands. I am proud of my set and you, as my friends could tell you were they not bored stiff with my eulogies of the 'S.T.400' and its designer. I will conclude by again expressing my sincere thanks for a really fine set."—J. E. Draper, Wynford Street, Salford.

DERBY.—"I have looked in vain for a word of appreciation from Derby. May I tender my sincere thanks. The quality is really marvellous, and the volume extraordinary. Anything in the programmes I require is merely tuned in, whether it is Moscow or Midland Regional. I would definitely say it will do all you claim for it. It is a real beauty. I've built sets for myself since 1926, but I could write pages praising its merits."—L. H., Norfolk Street, Derby.

BOMBAY.—"While on a voyage to Bombay last December I constructed the 'S.T.400.' I think it is a splendid set, much better than the 'S.T.300.' Its distance-getting is really great. With 50 feet of insulated wire slung up the foremast without insulators, I received the London

FOR THE ECONOMIST

The August issue of "The Wireless Constructor" will contain full details of how to build an extremely compact two-valve receiver of unusual design, giving good quality and good volume in return for a very low consumption of current.

On Sale July 15th.

National both in Bombay and Karachi. Also when coming up the Spanish coast I received K D K A on 306 metres on the loudspeaker at fair strength. Its selectivity is as good as its distance-getting. When within ten miles of Algiers I was able to receive the London Regional with only slight interference. I have delayed my appreciation so long because I wanted to give it a thorough test at home. I would like to add that it passed with flying colours."—L. Moule, Shirley, Southampton.

WHY NOT 100 PER CENT QUIESCENCE?

By JOHN SCOTT-TAGGART

QUIESCENCE is in the air. One cannot get away from it; and those who have tried it, don't want to.

But why not a receiver which takes no H.T. current at all except when signals are being received?

This suggestion of mine is not as preposterous as it sounds. I do not say it is immediately practical, but economy could be obtained on all the valves of a receiver.

For H.F. Amplification

The H.F. amplification could be carried out by a quiescent double-valve (two S.G. valves, say, worked near the bottom of their characteristics). The detector, I suggest, would be preferably a Westector rectifier, so arranged that positive impulses are given to the grid of a "driver" valve.

The "driver" valve would be operated at the bottom of the straight portion of its grid volts—anode current characteristic curve. This form of quiescent amplification was proposed by me in 1918 as a step towards economy.

A Complete Chain

The output of the "driver" valve is delivered to a "Class B" valve, completing a chain of quiescent valves, none of which passes any substantial current until either a carrier (in the case of the H.F. valves) or modulated signals (in the case of the L.F. valves) are received.

The H.F. valves would not be impressively economical, because a carrier wave would produce anode current, but the whole arrangement presents features of interest.

The DOUBLE PENTODE THREE

Designed and described by
VICTOR KING.

This attractive receiver is the first A.C. all-electric radio-gramophone to use one of the new multi-mu H.F. pentodes. In addition to this, the design includes a pentode capable of delivering over two watts of undistorted energy to the loudspeaker—an outstanding example of valve economy combined with remarkable amplification and power-handling capacity.

THERE are many advantages in a receiver with a small number of stages. And chief among these is the fact that there are fewer places where feed-back may take place.

It is also an easy matter to ensure that each stage is working up to scratch. A feeling often exists with a multi-stage receiver, although it may not be apparent, that one valve is not working properly and is preventing results from being as good as they might be.

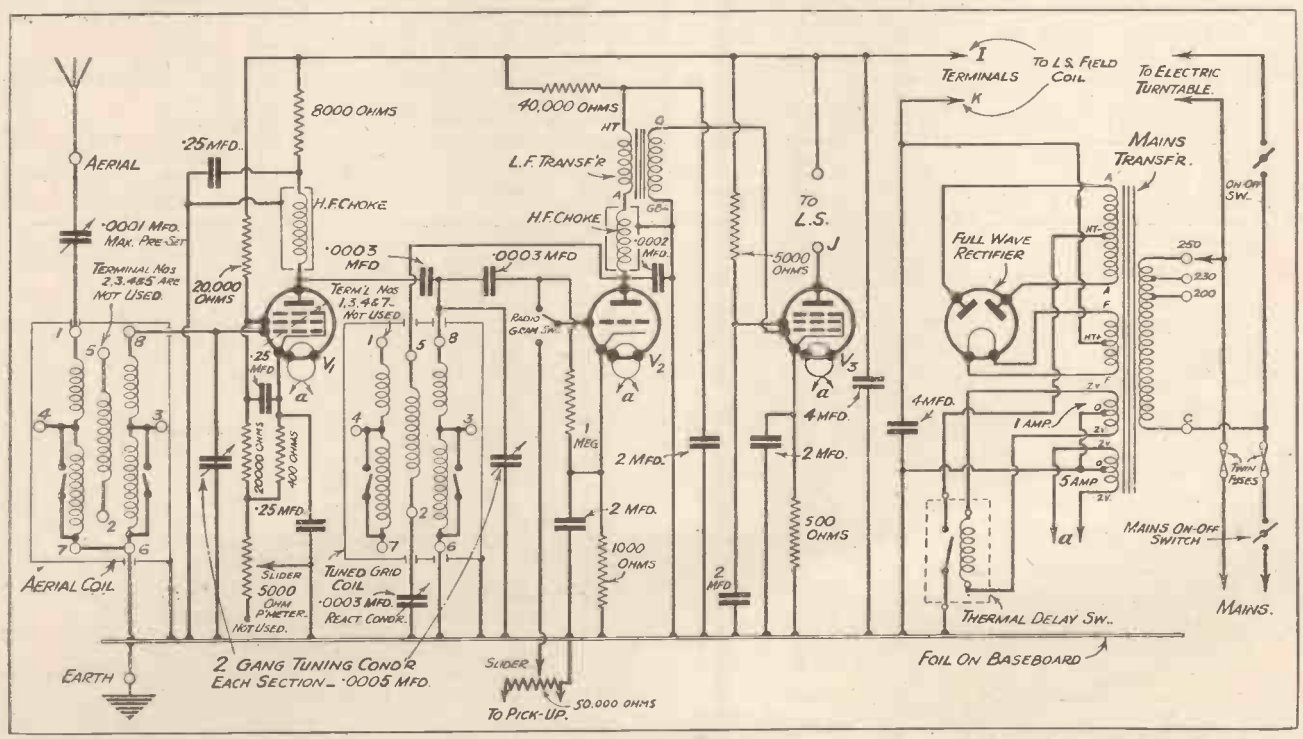
But, you may say, if super results are wanted one has got to have quite a number of stages. That is not strictly true these days. There are schemes whereby high amplification can be achieved with few valves.

When considering a mains receiver, as in this article, we have a good start in the very high efficiency of indirectly-heated mains valves. Added to that there is now an entirely new super-amplifying mains H.F. valve.

For some time we have been hearing rumours of H.F. pentodes, and hearing stories of their fine magnification. Now they are actually on the market and can be purchased by the home constructor.

In principle they are the same as the L.F. pentodes with which we are all familiar, but the electrodes are arranged to give characteristics more

HIGH AMPLIFICATION PER STAGE IS THE SECRET OF ITS POWER



To say that the circuit is an H.F.-Det.-L.F. is to tell but a small part of the story! The H.F. valve is an entirely new type—an H.F. pentode—which gives a tremendous amplification, making the set a splendid distance-getter. Then there are the output pentode, which provides a really powerful undistorted volume; the thermal delay switch; the mains-excited speaker, the field winding of which acts as H.T. smoothing choke; the electrical gramophone equipment, and many other attractive features.

The Double-Pentode Three—*continued*

suited to high-frequency amplification. For instance, the V.P.4 has a magnification factor of 5,000!

Some valve! And you will immediately realise how useful one of them is in keeping down the number of stages on the H.F. side of the receiver.

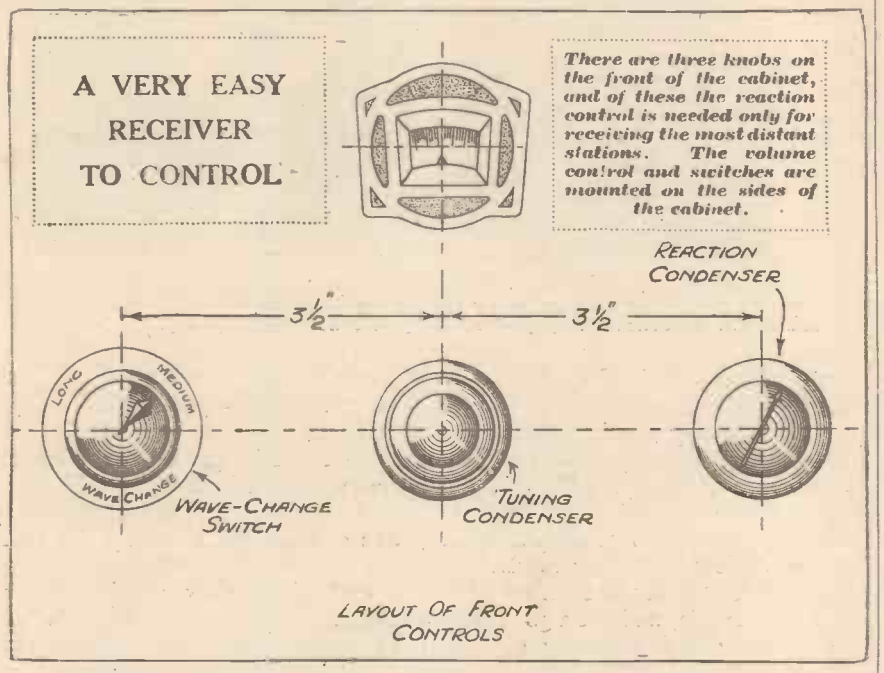
The Double-Pentode Three also has a pentode valve for output. The need for more than one L.F. stage is thereby eliminated.

Add a good detector to our single but efficient H.F. and L.F. valves, and you have a simple three-valver. But power is in no way sacrificed because of this inherent simplicity.

The distance-covering properties, as well as the volume available, are no less than remarkable. And I use remarkable in a perfectly genuine and correct sense.

But in dealing with the small number of valves, we have by no means exhausted the claims to renown of the Double-Pentode Three.

The set is a complete radiogram, with the pick-up and turntable incorporated, the design being of a type which we may conveniently call "tablegram." In layout it is rather similar to the popular console style of cabinet, but stands on a table instead of on its own legs.



LAYOUT OF FRONT CONTROLS

Simplified Construction

The construction is simplified by having all the components, including the mains rectifier valve and other power-supply parts, on the same baseboard. The tuning control is on the front of the cabinet, and the switches, excluding the one for wave-changing, are on the sides of the case together with the radio volume control. This latter performs its duty by varying the voltage of the grid bias that is automatically applied to the H.F. pentode valve.

The tuning condensers, together with the wavechange coil unit, are ganged, and another interesting point in the design is the thermal delay switch.

COMPONENTS THAT THE DESIGNER ADVISES YOU TO USE

Component	Make used by Designer	Alternative makes of suitable specification recommended by Designer
1 Cabinet	Cameo "Tablegram"	—
1 Baseboard, 15 in. x 15 in.	—	—
1 Double-gang .0005-mfd. variable condenser	Polar "Uniknob" with cover	—
1 Pair matched canned coils	Telsen	—
1 .0003-mfd. reaction condenser	Graham Farish	Telsen, Polar
1 4-mfd. fixed condenser	T.C.C. type 80	Dubilier 400-volt wkg., Ferranti
1 4-mfd. fixed condenser	Dubilier LSA	T.C.C. type 80, Ferranti
2 2-mfd. fixed condensers	Dubilier BB	T.C.C., Telsen, Igranic
2 2-mfd. fixed condensers	T.C.C. type 50	Dubilier, Telsen, Igranic
3 .25-mfd. fixed condensers	Telsen	T.C.C., Dubilier
1 .0003-mfd. fixed condenser	Igranic	Dubilier 665, T.C.C. type M
1 .0003-mfd. fixed condenser	Goltone	Dubilier 665, T.C.C. type M
1 .0002-mfd. fixed condenser	Igranic	T.C.C. type M, Dubilier 665
1 .0001-mfd. max. compression type	Sovereign	Telsen
2 20,000-ohm resistances, with horizontal holders	Graham Farish "Ohmite"	Colvern Strip
1 8,000-ohm resistance, with horizontal holder	Graham Farish "Ohmite"	Colvern Strip
1 5,000-ohm resistance, with horizontal holder	Graham Farish "Ohmite"	Colvern Strip
1 40,000-ohm resistance, with horizontal holder	Graham Farish "Ohmite"	Colvern Strip
1 500-ohm resistance, with horizontal holder	Graham Farish "Ohmite"	Colvern Strip
1 400-ohm resistance, with horizontal holder	Graham Farish "Ohmite"	Colvern Strip
1 1-meg. resistance, with vertical holder	Graham Farish "Ohmite"	—
1 1,000-ohm resistance, with vertical holder	Graham Farish "Ohmite"	—
3 Five-pin valve holders	Benjamin	W.B., Telsen, Ferranti
1 Four-pin valve holder	Benjamin	W.B., Telsen, Ferranti
1 Screened H.F. choke	Wearite HFPA	—
1 Screened H.F. choke	Graham Farish HMS	Bulgin, Standard, Goltone, Wearite
1 Power transformer	Ferranti SV84	—
1 L.F. transformer	R.I. Hypermu	Ferranti, Telsen, Lissen, Varley, Igranic
1 Thermal delay switch	Varley	Bulgin
2 Mains on-off switches	Bulgin S85	—
1 Radiogram switch	Bulgin S86	—
3 Escutcheon plates for above	Bulgin E3	—
1 5,000-ohm potentiometer	Igranic	Varley, Colvern
1 Twin fuse holder	Belling-Lee 1033	—
1 50,000-ohm potentiometer	Lewcos	Bulgin, Igranic
1 Terminal block	Sovereign	—
2 Indicating terminals	Belling-Lee "R"	Bulgin, Goltone, Igranic, Eelex
4 yds. insulating sleeving	Goltone	Wearite
8 yds. 18-gauge tinned copper wire	Goltone	Wearite
3 yds. spiral screened insulating sleeving	Goltone	—
Flex, screws, etc.	—	—
2 pieces of wood, 14 in. x 1 in. x ⅝ in.	—	—
1 sheet copper foil, 15 in. x 15 in.	—	—

The Double-Pentode Three—*continued*

This safeguards the power components against a possible breakdown by completing the connections to the transformer's H.T. secondary only after the valves have warmed up. Only then does any current flow through anode circuits of the valves.

Concerning Switches

In view of the presence of this switch, the set will not gradually come into operation as the valves warm up. It will come on at full volume with a click, a little while after turning on the mains switch at the side of the cabinet.

Next to this mains on-off switch there is another similar switch for the turntable, which incorporates its own synchronous motor. This motor is started and stopped by hand, the switch merely being for the purpose of connecting it up to the mains.

These two switches are on the right-hand side of the cabinet as you look at it. On the other side there is the radiogram change-over switch and a volume control.

This volume control is, of course, for radio reception only. A separate control for adjusting the volume when using the pick-up is provided on the motor-board.

No smoothing choke is used for the H.T. Not because the mains do not require smoothing, but because the field winding of the moving-coil loud-speaker is utilised for the purpose.

After all, the winding of the loud-speaker field is the same thing as a choke, and it has got to have an exciting current; so it is convenient to "kill two birds with one stone." But the amount of current taken by the valves is carefully worked out to suit the current requirements of the speaker pot, and no efficiency is lost by adopting this procedure.

Use Specified Parts

For this reason it is most vital that the specifications in the component and accessories boxes should be adhered to in every respect. With such a design as this, the chances of spoiling results by deviating from specification are too great for it to be worth while to use wrong parts just because they happen to be on hand, or simply to save expense.

The first thing that will strike you when you look into the construction is that no panel is employed. The gang condenser and the coil units are carried by the baseboard, so that only the reaction condenser and the dial-viewing aperture have to be mounted on the front of the cabinet.

The relative positions of the controls on the front are shown in a diagram, but not the distances from the edges. It is best to mark the condenser spindle position after fitting the baseboard into the cabinet, and then to drill the hole for it from the inside. The positions for the other holes can then be marked by measuring from the one for the condenser spindle.

Except for the two screened leads to the volume control, all the leads for the reaction condenser and components on the cabinet sides should be made with flex. These leads can be connected at the baseboard end before the set is fitted into its case.

For the three switches sunken metal fixing plates are used. These are known as escutcheon plates, and are fitted with screws after round holes about one inch in diameter have been cut for them.

Covered with Foil

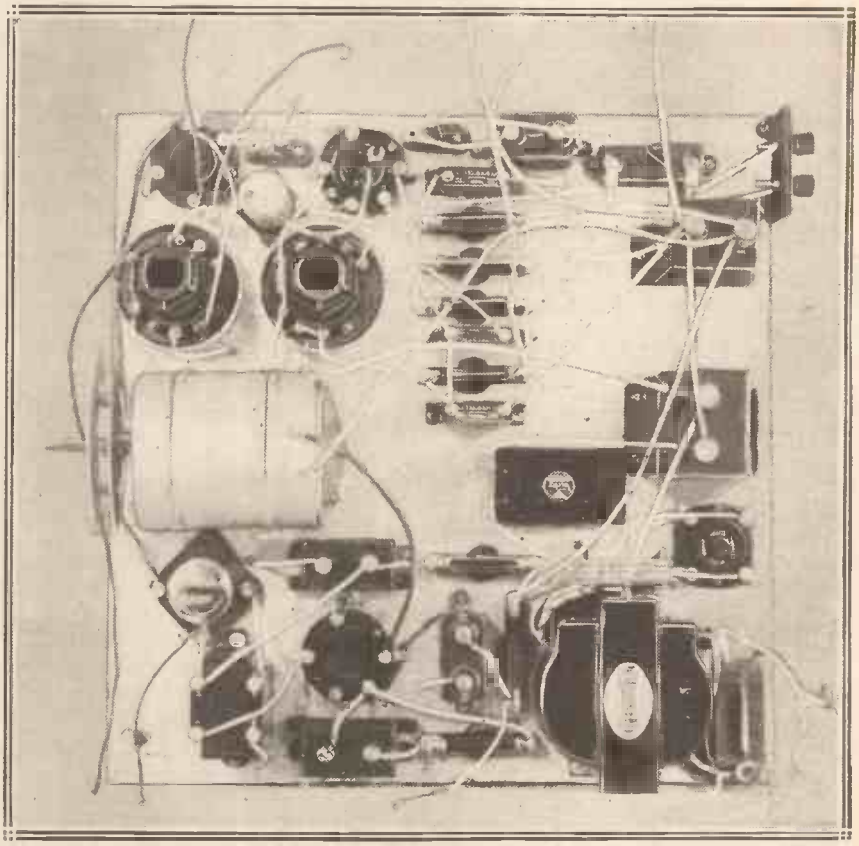
Before any parts are screwed to the baseboard, it has to be covered on the upper side with copper foil. One or two small brads or drawing-pins will be sufficient to hold this in place till the components are fixed, which will themselves completely secure the foil.

You will see that a number of connections are made to this foil by means of screws and washers clamping the wires against it. Care should be taken to clean the foil well at these points, removing any lacquer that may have been applied to keep the foil bright.

Ensuring Good Contact

Since the earthing of the gang condenser and also the screens of the two coils is via the foil also, you must see that the foil is sufficiently clean

REMARKABLY SIMPLE ASSEMBLY



Apart from the controls fixed to the cabinet, all the parts, including those for the H.T. and L.T. supplies, are mounted on a single foil-covered wooden baseboard.

The Double-Pentode Three—*continued*

underneath them to ensure good contact. At the same time there are certain components that must not come into contact with the foil.

Avoiding Shorts

To avoid possible contact in the case of the valve holders and fixed-resistance holders, a piece of stiff paper or thin cardboard should be inserted between each of these components and the foil.

Another important earthing point concerns the screened leads. There are quite a number of these, and they are very clearly indicated in the wiring diagram by the striped connections.

Screened insulating sleeving is the most convenient material to use for these shielded wires. It is like ordinary systoflex on which is closely wound a thin strip of tinned copper.

Always remove this strip copper for a quarter of an inch from the ends of each piece of systoflex. Otherwise there is the possibility of it making contact with the wire inside the sleeving.

To avoid continually making connections between the casing of the screened leads and the foil, the casing is bonded together at convenient points where the wires cross. A short piece of the screening strip, that has been removed from the sleeving, is ideal for the purpose. Just twist it two or three times tightly round the wires where they cross.

Earthed Leads

In the case of the two leads running close to the front of the baseboard, to the reaction condenser and one of the H.F. chokes, earthing is by means of a soldering tag screwed to the foil. The remaining screened leads are all bonded together and are earthed at the 4-mfd. condenser next to the earth terminal. If you examine the inside terminal of this condenser in the diagram, you will see that the casing of the screened lead from the volume control is connected to it, as well as the lead itself.

Do not be tempted to do without screening for any of these leads. Their screening serves a very important purpose, because with the colossal magnification represented by each stage in this receiver, particular care has to be paid to ensuring complete stability.

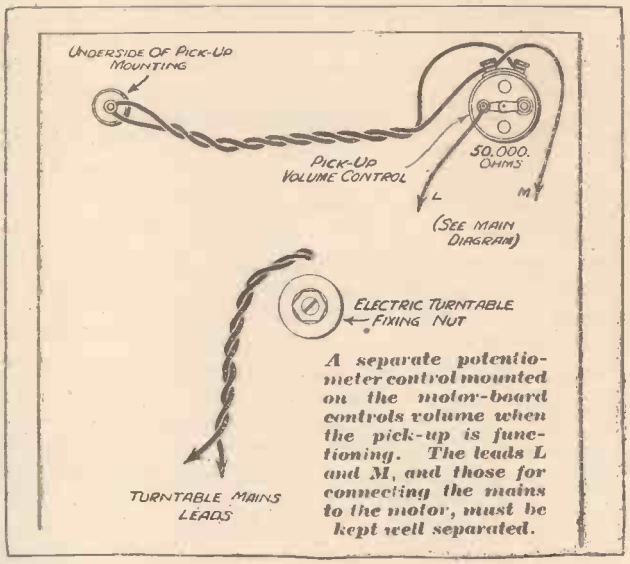
There is just one more small point concerning the earthing of leads before leaving the matter of casing, foil, etc. The lead which earths the moving vanes of the reaction condenser is taken to one of the fixing down screws of the adjacent H.F. choke. Do not make more than a tiny starting hole for this screw in the baseboard, or it may not make proper contact with the foil. Allow the screw to open the hole in the foil as it is screwed home.

Transformer Wiring

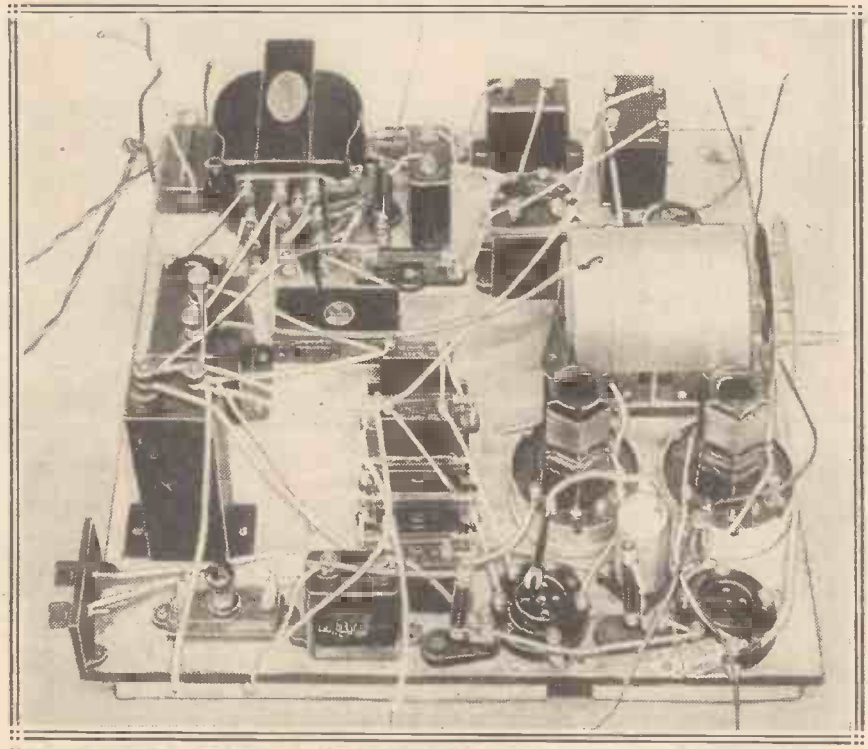
The "E" terminal on the mains transformer is not connected, but there are twelve terminals in all on this component to which leads are taken. The method of showing them in the wiring diagram will be perfectly clear with the actual component to compare them with.

Note that there are two 2v.-0-2v. windings, one for the thermal delay switch and the other for the heaters of the valves. Do not get these reversed for they have quite different output amperages. The bottom ones are those which supply the thermal delay switch.

UNDERNEATH THE TURNTABLE

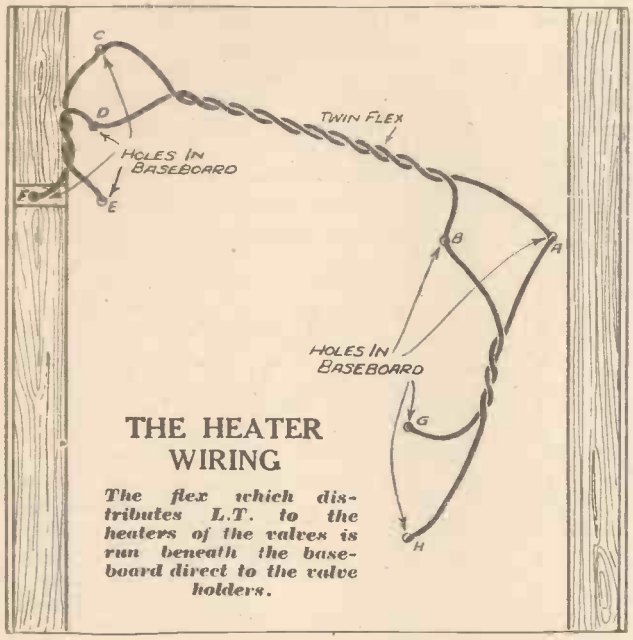


HOW THE TWO-GANG CONDENSER IS FIXED



Screw the tuning condenser to the baseboard in such a position that the ivorine scale is all but flush with the front edge of the baseboard. This will ensure that its spindle will project far enough through the front of the cabinet for the control knobs to fit on properly.

The Double-Pentode Three—*continued*



The connections to the heaters of all three valves are run beneath the baseboard, being taken there through holes drilled in it. You will find the connections made quite clear in a separate diagram of the underside of the baseboard. Flexible wire is used, and to save making joints beneath the baseboard the wires are taken twice through the holes A, B, C, and D, connection being made at the terminals on the valve holders.

Numbered Valve Holders

It is immaterial which way round the heater terminals are joined. Incidentally, you will find that the terminals on the particular valve holders used are numbered instead of lettered in the more usual manner.

For those whose valve holders are marked in the ordinary way, here is the relation between the numbering and the lettering: 1 equals P, 2 equals F, 3 equals G, 4 equals F, and 5 equals C.

On the S.G. H.F. choke (the one next to the two tuning coils) there appears three connections. One by a flex lead to the terminal on the S.G. valve, and the other two by means of terminals.

The flex lead is common to the terminal to which it is nearer. So take care to mount this component the same way round as in the diagram.

The terminal to which this flex lead is joined is connected to one end of a ·0003-mfd. condenser which is of the tubular or "grid-leak" type. Two leads are taken from the other end of the condenser, one to 8 on the front coil and one to the ·0003-mfd. condenser joined to the radio-gram switch on the side of the cabinet.

The Terminals

On the gang condenser there are three terminals, two of which are not used. The one at the back is for connection to the moving vanes, a connection which is made in the case of this receiver via the foil, and the other to the front set of fixed vanes.

Connection to these vanes is made by a lead running to a screw on the opposite side of the condenser. This screw is much more convenient than the terminal, from the point of view of wiring.

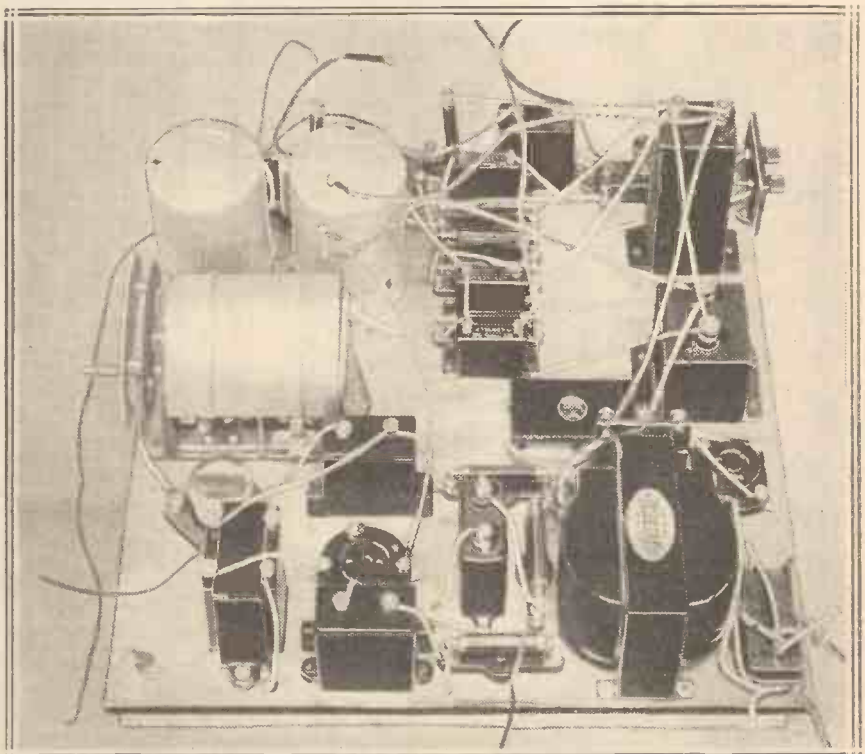
Incidentally, while referring to the tuning condenser, it is worth mentioning that the template provided with this component enables the exact position for the hole to take the dial-viewing plate to be marked out once the spindle hole has been fixed.

There are four terminals on the loudspeaker, two for "speech" input and two for field-exciting current. But as two of these are joined together on the speaker itself and are connected nowhere else, only three leads are shown going to the speaker from the baseboard.

Wiring the Controls

When the baseboard wiring is completed, fit the set in position at the bottom of the cabinet. The knobs can then be placed on the front, and the controls on the sides of the cabinet wired up. The exact positions of the latter are not important. Slight countersinking from the outside may be necessary in the cases of the reaction condenser and volume control. The flex leads to

THE BASEBOARD IS SLIGHTLY RAISED



To accommodate the heater wiring which, as shown in the diagram at the top of the page, is beneath the baseboard, the latter is raised by two half-inch thick battens. One of these is clearly visible in the forefront of this photograph.

The Double-Pentode Three—*continued*

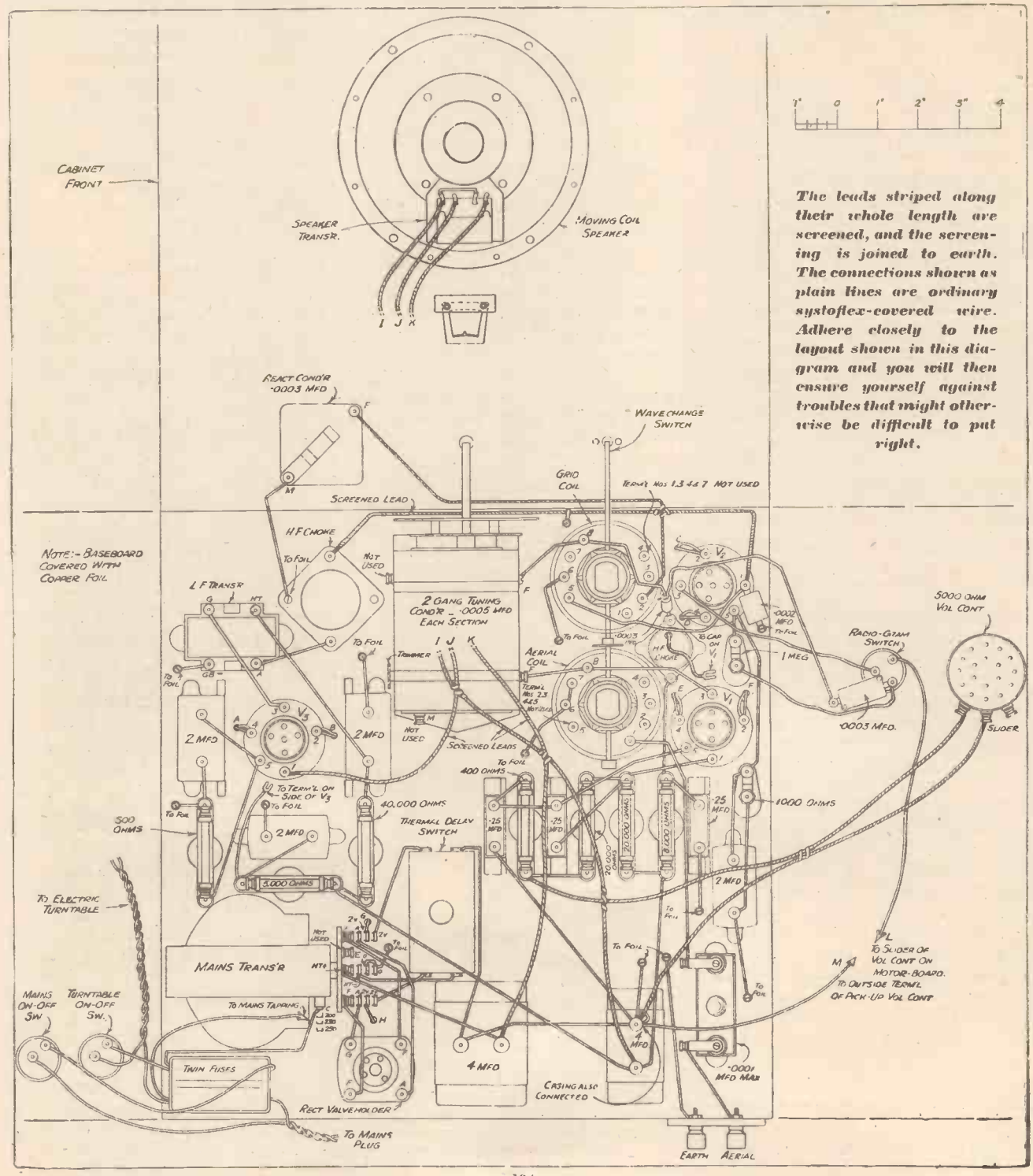
the pick-up volume control and the turntable together with those to the loudspeaker also have to be connected.

The positions of the valves are fairly obvious. V_1 is the H.F. pentode, V_2 the detector, and V_3 the output valve. The fourth valve holder takes the full-wave rectifier valve.

If different valves are used in accordance with the alternatives in the list for V_2 and V_3, different value automatic bias resistances may be needed. Since there are only one 500-ohm resistance and only one 1,000 one in the set, it will be immediately apparent which resistances have to be substituted by the new values.

The operation of the receiver is particularly easy and straightforward. The mains on-off switch turns the whole set off irrespective of whether the motor switch is on or not.

The wavechange switch is turned



The leads striped along their whole length are screened, and the screening is joined to earth. The connections shown as plain lines are ordinary systoflex-covered wire. Adhere closely to the layout shown in this diagram and you will then ensure yourself against troubles that might otherwise be difficult to put right.

The Double-Pentode Three—*continued*

VALVES AND ACCESSORIES

Make	H.F.	Det.	Bias Res.	Output.	Bias Res.	Rectifier
Mullard ..	V.P.4	354V.	1,000 ohms	Pen.4V.	500 ohms	D.W.3
Cossor ..	—	41M.H.F.	1,000 „	H.P./Pen.	300 „	442B.U.
Mazda ..	—	A.C./H.L.	1,000 „	A.C./Pen.	330 „	U.U.120/350
Marconi ..	—	M.H.4	600 „	M.P.T.4	250 „	U.12
Osram ..	—	M.H.4	600 „	M.P.T.4	250 „	U.12
Ferranti ..	—	D.4	1,000 „	—	—	R.4

LOUDSPEAKER.—Rola, 2,500 ohms, pentode type.
PICK-UP.—Radiophone, B.T.H. Minor.
MOTOR.—Simpson.
AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," Radiophone "Receptra" screened lead-in, Graham Farish "Filt" earthing device.

right for medium waves and left for long; the operation of the radiogram switch is entirely obvious. And this also applies to the two volume controls which are entirely independent of one another.

The tuning condenser and reaction condenser are operated in quite the usual manner, which leaves just two small preliminary adjustments to be dealt with.

Final Adjustments

The first concerns the series aerial condenser. This provides an adjustment of selectivity to balance the circuit up with the aerial to be used. Keep it screwed down as far as possible consistent with sufficient selectivity.

The second point is the trimming of the gang condenser. Tune in a weak station and then make it as loud as possible by adjustments of the small wheel at the side of the condenser, with the trimmer knob on the panel set about midway in its travel. After this, try readjusting the main tuning and then once more experiment with the trimmer. If, during this process, which should be carried out on medium waves, the station becomes quite loud, tune to some other station that is weak and which quite likely was inaudible before ganging adjustments were started.

Easily Operated

Once these small adjustments have been made you will have a particularly trouble free and easily operated tablegram. As a matter of fact, the reaction condenser will only be needed for real "DX" work. The centre knob of the tuning condenser will give fine tuning when a station is coming in.

And now, if your enthusiasm has been roused, don't be worried by this warning, but take heed of it and so save yourself a lot of possible worry in other directions. Do not try to make any modifications in layout or components or you may never get your set working properly.

Allow the designer to know best, and not only will you have a simple job in the construction, but you will have a simply operated three-valver that will hold its own with any other three valve set ever described.

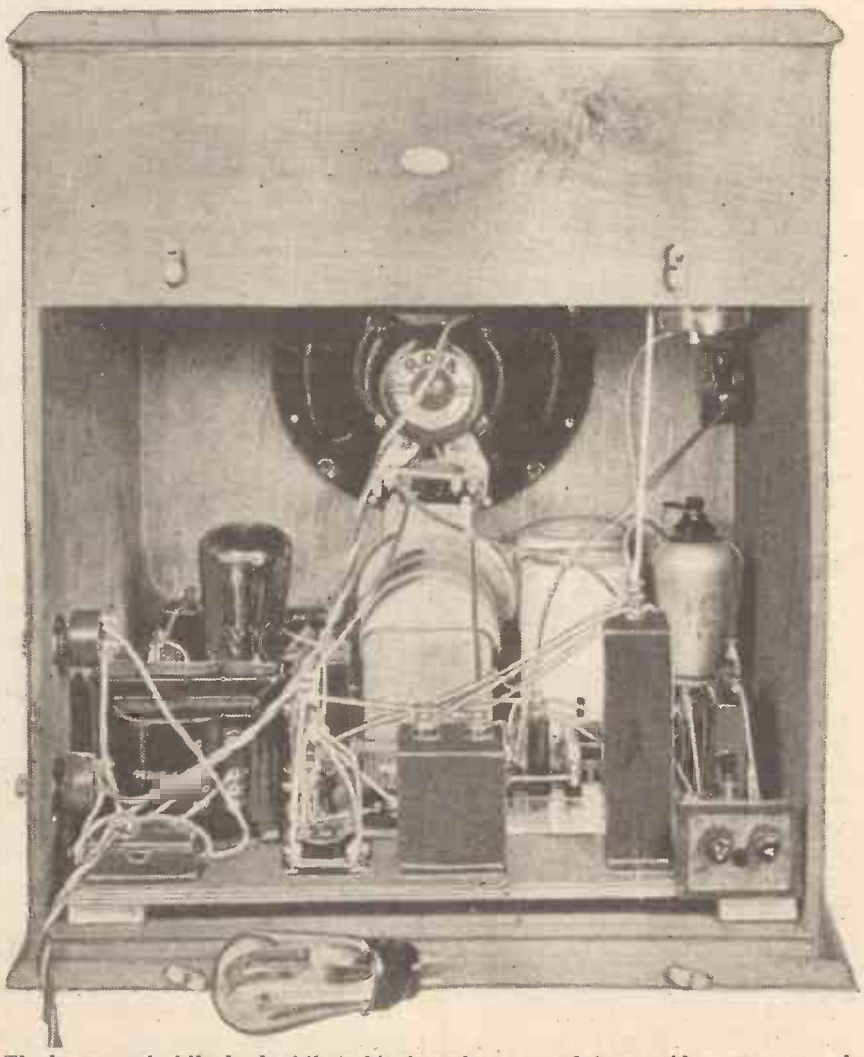
If at any time after the completion of the set you have occasion to make an internal adjustment, it is wise to have the mains completely disconnected. The switch on the side of the cabinet only breaks one mains lead.

Complete Protection

What you should do is either to remove the plug or adaptor that joins the receiver to the mains, or to pull out the twin fuse. The latter is, perhaps, the most convenient method.

Incidentally, this twin fuse provides complete protection, without any of the house fuses being blown, should a fault develop in the receiver or the motor.

HOW YOUR SET WILL APPEAR FROM THE BACK



The lower part of the back of the cabinet can be removed to provide easy access to the set's interior. Holes should be drilled in this removable panel for the aerial, earth and mains leads.

QUESTIONS I am Asked

by JOHN SCOTT-TAGGART

Q. 29. On the "S.T.400" I find that altering G.B.—2 makes no difference to signals—even if the plug is taken right out. What is wrong?

A. I think the fault is either in the grid-bias battery or the grid resistance. Grid-bias batteries are always assumed to be like Cæsar's wife. If they are old they are more like Potiphar's. But a G.B. battery is often blamed for the faulty connections to it, and flex leads and the connections to the plugs should be tested out.

H.T. battery connections do not often give trouble because any fault usually stops signals and you find out what is wrong. A "dis" in a grid circuit (and this applies to all of them) will often produce only a slight but definitely disconcerting and perplexing effect on results.

Q. 30. Is insulated aerial wire any better than bare copper wire? Does it protect one against lightning? Why does the insulation not stop signals?

A. No. The only advantage theoretically is that the insulation keeps the wire from corrosion due to moisture, sulphuric acid fumes in the air, effect of soot, etc. Often, however, the wire contains much steel wire, which theoretically is a disadvantage.

On the whole, one's experience tends to ignore the differences in the wire of which the receiving aerial is made. Insulated wire has about as much effect in resisting lightning as a pop-gun would against a battalion of tanks.

The insulation has no effect on signals because these are supposed to travel through the ether. The air itself is an insulator, so a bare wire would still be covered by a "layer" of insulation.

Q. 31. When working the aerial reaction on the "S.T.400" at maximum, I get a microphonic howl. I have tried different detector valves, but the trouble persists. Please advise me what is wrong.

A. A microphonous S.G. valve seems indicated. The cure is to change the valve.

Many set manufacturers reject a large number of S.G. valves which by mechanical modulation of a strong carrier wave set up a microphonic howl. You should, of course, try altering the position of the speaker. This often effects a cure.

Here are more questions—the kind many a reader might ask—answered with authority. Each month a selection of queries is replied to by Mr. John Scott-Taggart.

Wedging a folded piece of paper between the S.G. valve and the screen through which it passes will also sometimes stop the trouble.

Q. 32. On disconnecting the H.T. lead to the detector (H.T.+ 2) of the "S.T.400," signals continue for a time. If I substitute a condenser and leak in the grid circuit, instead of using anode-bend detection, signals stop at once on disconnecting H.T. + 2. Why?

A. The anode circuit of this valve is decoupled by a 2-mfd. condenser which continues for a while to feed the anode circuit even after H.T. + 2 is disconnected. It takes a little time for the H.T. voltage "stored" in the 2-mfd. condenser to be discharged by the electron current through the valve.

When anode-bend detection is used the valve current is so small that it takes an appreciable time for the condenser to discharge. When leaky-grid rectification is employed the much greater anode current discharges the condenser almost at once.

Q. 33. Can "Class B" amplification be used in sets using mains or when an eliminator is employed?

A. If A.C. mains are the ones in use, it is desirable to keep the H.T. constant by some artificial means, and A. C. Cossor, Ltd., have produced a neon lamp which is connected across the output of the mains unit, and which may, in fact, be used in place of the output condenser.

When the H.T. voltage tends to rise, more current is absorbed by the neon lamp and vice versa. The total current (set plus neon "stabiliser") remains constant and the output H.T. thus keeps steady.

On an ordinary set the bad "regulation" of a mains unit (if suitable for the set) does not matter as the current remains practically steady. When Q.P.P. or "Class B" is in use the current may vary from 4 or 5 to 45 milliamps.

The ordinary mains unit rated at 60 milliamps. may give 200 volts when this current is taken from it, but if the "load" is reduced to zero the voltage shoots up to 400 volts. Hence the desirability of a stabiliser to keep the voltage constant.

American mains sets are now being fitted with "Class B" amplification so as to give 6 watts output. It is, therefore, not unlikely that we shall do the same—in a year or two's time.

Q. 34. Do you propose designing a "Class B" receiver?

A. Yes. You may take that as certain. But I am very busy developing designs for the autumn, and as I propose making another national appeal I should not incorporate any new feature without the fullest consideration. Whether "Class B" will be used or not I cannot say at this stage; but if not, those readers who desire to use this system will be provided with a separate design.

A PRACTICAL MAN'S CORNER

By R. W. HALLOWS, M.A.

Into these pages, month by month, our contributor packs a wealth of practical information and advice on constructional work. The regular reader of this "Corner" cannot help picking up a more or less complete training in radio workshop practice, while every month there are wrinkles to read, gadgets to make, and hints to help you.

Fixed Condenser Terminals

Most of us have had experience at one time or another of a rather annoying kind of casualty in small bakelite-cased fixed condensers. On trying to tighten down a lead when the condenser has been in use for some little time it is found that the nut cannot be made to grip the wire properly, and as we move it with spanner or pliers it simply winds up the end of the lead into a small coil.

The cause of this is that the bolt forming the terminal shank has come loose in its seating. If you don't know how to tighten it up you may consign a perfectly good condenser to the wastepaper basket, though actually the job is one that anyone can carry out.

Tightening the Bolt

Fig. 1 gives an indication of the way in which it is tackled. On turning the condenser upside down we find that the interior of the thin bakelite case is filled with a sealing compound, usually Chatterton's, or something very similar. With a screwdriver or the point of an old penknife dig the sealing compound carefully out above the base of the loose terminal.

It will not be necessary to do this as completely as is shown in the drawing. I had to draw the condenser with the whole of the sealing compound removed at one end in order to make its interior arrangements plain. In a minute or two the head of the bolt will have been uncovered. Scrape the nick in its head clean.

Then apply a screwdriver to this and a pair of pliers to the fixing nut on the upper side of the condenser. Tighten well and you are not likely to have any further trouble. If you want to make assurance doubly sure, take off the fixing nut, put a Shakeproof washer on to the shank, and then put the nut back again.

Filling In

You cannot leave the condenser with the sealing partly removed or moisture will eventually make its way inside. The hole that you have scooped out can be filled up with either Chatterton's compound or ordinary paraffin wax.

Melting "Chatterton's"

If the hole is a very small one it may be filled up by the simple process of dropping grease from a lighted paraffin wax candle in it. The best way of melting Chatterton's compound is to use an old iron spoon, the tip of which is pinched up a little with the pliers to form a pouring lip.

Melt the compound over a small flame of a spirit lamp—and do it out of doors if possible, for there are much more pleasant smells. Don't use a large flame or the compound will probably catch fire. A much more convenient filling-in material is paraffin wax, which is not sticky and is quite mild as a smell-producer. Don't try to melt it over a flame. Instead, make up the useful little melter and pourer illustrated in Fig. 2 and stand this for a few moments in boiling water.

Simple to Make

This little tool is made from a small round tin of some kind in which a pouring lip is made, as shown in the drawing. Cut off about 18 inches of No. 18 S.W.G. copper wire, take two turns tightly round the tin just below

EASILY MENDED

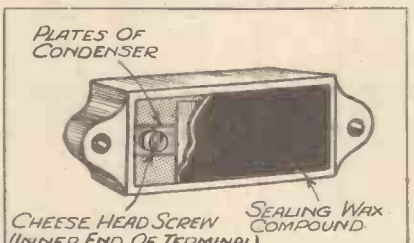


FIG. 1.

If you have trouble through the terminal shank of a fixed condenser coming loose, there is no need to throw the component away. A repair is quite easily effected if you follow our contributor's instructions.

A USEFUL POURER

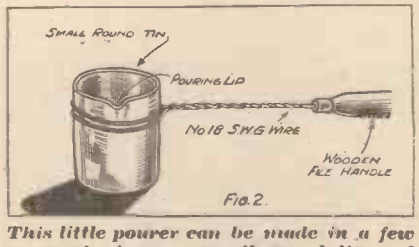


FIG. 2.

This little pourer can be made in a few moments from a small round tin and some 18-gauge wire.

PROTECTING THE IRON

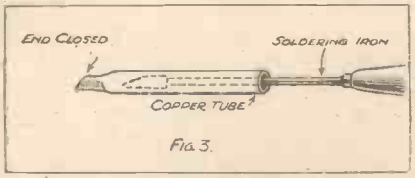


FIG. 3.

A piece of copper tubing with one end flattened can be used for protecting the soldering iron in cases where a coal fire is employed to heat it.

A Practical Man's Corner—*continued*

the lip and then twist the ends together. Finish off by pushing the ends of the wire into a wooden file handle. Paraffin wax is a fine insulator and the melting pot is most useful for many little jobs.

WATCH THIS POINT!

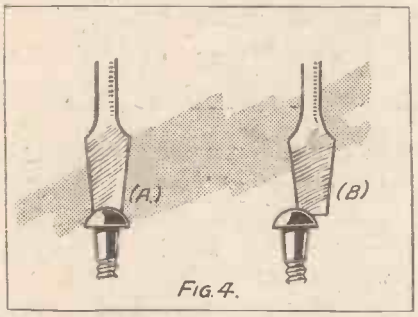


FIG. 4.

Many a screw head is spoiled by the careless use of the screwdriver. The screwdriver blade should be kept squarely in the nick as at (A), and not just in one side as at (B).

Tinning is Easy

Some people seem to have an immense amount of trouble with their soldering irons and particularly with the tinning at the business end of the bit. I don't know really why this should be, for if an iron is properly tinned to begin with and given occasional attention from time to time, it should remain in good condition for a long while.

There is nothing difficult about tinning. The great thing is to get the surfaces at the point of the bit perfectly smooth and clean before you start. If there are any pits in the copper, remove them by filing.

For tinning and for cleaning an iron there is nothing to beat that most old-fashioned of fluxes, killed spirits. Or Baker's Soldering Fluid may be bought ready made up in bottles. Though this is an acid flux, I use it myself a great deal not only for tinning and cleaning irons but also for the actual making of joints in wireless sets.

Use Little Flux

If you use only a very little I don't think that you are likely to have any trouble with subsequent corrosion. Certainly I have never been bothered in this way, though I have employed it for soldering very fine wires.

After all, it is not as though the soldered joints of wireless apparatus had to last for twenty or even ten years. Most people keep their sets and other apparatus up to date by fairly frequent rebuilding.

Heating the Iron

I suspect that one reason why some folks are always burning the tinning off their irons is that they heat the poor things by thrusting them straight into a coal fire. Not only is this bad for the iron, but it also makes for difficult soldering and poor work, since it is almost impossible to keep the bit clean.

If you must use a coal fire make the protector illustrated in Fig. 3. This consists of nothing more than a piece of copper tubing of suitable diameter, one end of which is closed by flattening it with a hammer. Push this into the fire and then put the iron inside as shown in the drawing.

THE WRONG METHOD

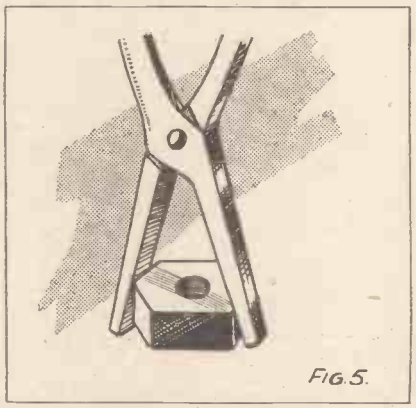


FIG. 5.

This is how nuts often lose their hexagon shape. Pliers of this kind do not grip the nut properly, and rapidly turn the hexagon into a round head.

In this way you can keep it perfectly clean, and unless you allow it to get far too hot you run no risk of burning the point. When you are doing a soldering job always wipe the point of the bit on a piece of waste or rag after it has been heated up and before you take solder with it. Examine the point from time to time, and if you see any indications of pitting beneath the tinning, warm up the iron, scrape off the solder and file out the pit at once.

Another point worth remembering is that whilst a bit made of pure copper retains its tinning, resists pitting, and makes soldering generally easy, a common bit, containing a considerable proportion of impurities, has just the opposite qualities. It pays, therefore, to buy a soldering iron of good quality. The difference in cost between a good one and a bad one is usually a matter of pence.

Spoiling Screws

Watching various keen constructor amongst my friends at work, I am surprised to see how many of them are unable to drive in or to remove a screw without spoiling it by jagging and tearing the nick in its head. The good workman can use even the softish brass screws over and over again, but the careless worker often finds it difficult to remove a brand-new screw that has been driven in for the first time owing to the state of the nick at the end of the job.

The screwdriver in his hands seems like a thing possessed of demons. It is always slipping out of the nick, and every time it does so a piece of the screw head comes with it. These troubles are not difficult to avoid. If you watch a screw-spoiler in action you will see that he does not keep the blade of the screwdriver squarely in the nick as shown at A in Fig. 4.

Practice Makes Perfect

If he starts with it in that position it arrives in that shown at B in Fig. 4 very soon, and at the next instant it slips. Begin by putting the screwdriver squarely into the nick and watch it. If it wants to slide to one side, stop, centre it, and start again.

Pay attention to this point and you will find that practice soon makes perfect. Remember, though, that you cannot treat your screws decently unless your screwdriver blade has a clean straight edge.

(*Please turn to page* 155)

USE THIS TYPE

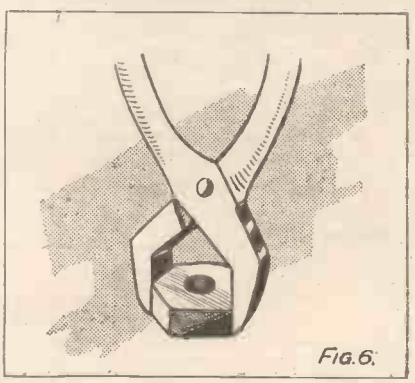


FIG. 6.

Pliers of this type, having parallel jaws, are a good substitute for a box spanner and do not injure the nut.

From My Armchair

by "S.T."

PAPPLEWICK is "for it."

You may remember that the village gained some notoriety by repudiating the "S.T.400." Papplewick, in short, had "smelt a rat." But not only had Papplewick—the blind-spot of the Midlands—smelt my poor little pet rat, but the villagers had smelt plenty of rats previously.

In fact, Papplewick might be a blind-spot, but its sense of smell was singularly acute. Any poor fish of a designer who thought he could produce a rat and get away with it was forgetting the Papplewickian nostrils quivering like those of a starving cat crouched over a hole in the rotted wainscotting of an old barn.

A Terrible Thought

Just picture them all—five hundred souls—the total population of Papplewick—all waiting for November 15th, 1932, with straining, dilated eyes, whiskers twitching with ghoulish expectancy, fur electric—and, above all, their long-trained nostrils trembling to catch a whiff of the well-known rat scent.

It is a terrible thought. How glad I did not know of this before bringing out the "S.T.400." I might never have dared to publish the details. While other constructors in the country were waiting for me to let the cat out of the bag, Papplewick was expecting a rat.

And, true enough, when the sun rose on November 15th, Papplewick knew with that instinct that has not failed it since radio began, that a mountain had laboured and given birth to a rat.

Imagine my joy, then, at receiving a letter from Mr. John A. Wilkinson, of Sherwood Hall Estate, Mansfield, Notts. He rallies to my support. He is a bus-driver. He would be.

Good Supporters

I get more support from busmen than any section of the community, except perhaps clergymen.

[Some day I intend to become really friendly with a conductor and get him to let me ring the bell.]

Papplewick—the village that condemned the "S.T.400"—is a victim of S.T.'s pen this month. Snakes, cats and Eskimos also receive attention. Altogether, a good armchairful.

Well, B.-d. Wilkinson writes:

I have just read the letter from J.R. of Papplewick. I'm a bus-driver, and I go through the said village six and seven times a day, and if J.R. will inquire on any of the buses for a driver by the name of "Algy," "Algy" is prepared to lend him, or demonstrate to him, a set that will give sight to any blind-spot—namely, the "S.T.400."

'Nuff sed.

Quite 'nuff! Here's a man who has not only been to Papplewick, but *actually goes through it six or seven times a day!* Probably he has picked up some of the world's greatest rat-smellers.

What they will do to "Algy" and his bus when this issue is published I hate to think. Imagine five hundred sharp-snouted souls deliberately defied, challenged and, worst of all, actually offered a real live rat to sniff at at close quarters.

For myself, if I ever drive through Papplewick it will be in an armoured car painted with aniseed.

Let us pray for "Algy," for his fate is likely to be that of our schooldays' friend:

Algy went bear-hunting,
Algy met a bear;
The bear was bulgy,
The bulge was Algy.

So Did the Snakes!

A reader from Snarksbottom (what extraordinary places THE WIRELESS CONSTRUCTOR readers live in) says that he doesn't believe the yarn about the snakes that were destroyed by wireless waves. "Even if the snakes, by coiling themselves, became inductances, there would be no capacity to form a tuned circuit. The whole story therefore falls to the ground."

That's what the snakes did; but the story still holds water.

Our Snarksbottom colleague has forgotten that an inductance (and therefore a snake) has a certain self-capacity between turns, and thus the whole has a natural resonant frequency.

While on this matter, I may mention that corroboration of my story comes from (Lieut.-Col.) "Pukka Sahib," address not given, Tunbridge Wells.

"Perhaps the Cat has been Electrified"

After a page about the Indian rope trick (which a friend of his very nearly saw), he describes how, after tiffin, he was on his verandah in Bengal when his eye was caught by a family of cobras—a father, mother, and three children—gathered round an outcrop of crystalline rock.

"At five o'clock exactly, when the Children's Hour from the Calcutta station begins, the two large snakes coiled themselves very carefully close to each other, obviously forming a band-pass circuit, while the young snakes thoroughly enjoyed the programme received."

Outside Interference

Here is a queer query :—

Dear Sir,—Since installing my wireless telegraph receiver in the back parlour (it used to be in the front room), I get a loud crackling noise for short periods after 10.30 p.m. The effect comes from outside, as disconnecting the aerial stops it.

I have asked all my neighbours whether they work any electrical apparatus after 10.30 p.m., and the answer has always been "No" (except in one case where the answer was : "What the d—l has it got to do with you ?").

I suspected this latter neighbour, but the crackling went on even when they were out. I found the trouble when I was looking through the window at the lead-in which passes over a wall. A big black tom-cat at that moment walked along the wall, and as it passed the lead-in a loud series of crackles came from the loudspeaker. Is this usual? Does it make any difference the cat being black, or being a tom?"

A Static Charge

Perhaps the cat has been electrified by much stroking and petting before being put out at night. It then walks past the lead-in, a brush-discharge to earth takes place, and hence your crackles.

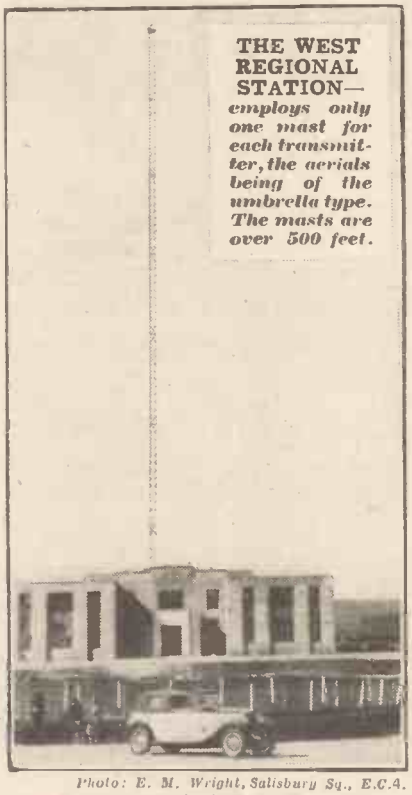
My advice is as follows. Explain the position tactfully to your neighbour and ask him on no account to pet or stroke pussy after 9 p.m. He should also purchase a metal comb connected by a wire to earth. The cat should be thoroughly combed before being put out at night, so that it is thoroughly discharged.

If the trouble persists, an old boot will be found useful.

As regards the last question of your letter, try a few experiments. Whitewashing the cat may make all the difference. As regards the second part of the query, I'm afraid you can't do very much.

Why Live There?

I have received a letter from a well-meaning association for providing Eskimos with comforts. Why anybody should bother to provide Eskimos with comforts I don't know, seeing what an uncomfortable part of the world this race chooses to live in.



THE WEST REGIONAL STATION— ***employs only one mast for each transmitter, the aerials being of the umbrella type. The masts are over 500 feet.***

Photo: E. M. Wright, Salisbury Sq., E.C.4.

I feel rather like the old lady who, on being told that 15,000 people had been killed in an earthquake in Japan, complained petulantly : "Well, why do they live there when they must know it's so dangerous ?"

Apparently the Eskimos are in need of "out-board motors, canned goods, rifles, stoves, portable gramophones and wireless sets." Perhaps I could help with a few discarded wireless sets ?

My Own Opinion

No, my good woman. In the first place I never discard a wireless set, and, secondly, I don't believe in softening this virile people of the midnight sun.

As for canned goods, what's wrong with the jolly old whale blubber ? Has it lost its savour and vitamin D ? Once you start feeding Eskimos on canned goods, they'll stop eating candles and what will become then of our export trade ?

No, charity begins in our own igloos. People in ice houses shouldn't want wireless. But sentimental readers of my notes may feel differently.

Of course, north of lat. 80° they have trouble in winter with wireless and blame the aurora borealis.

"In Wanton Anger"

As this journal penetrates the thickest jungle where English sahibs keep the flag of Empire flying and dress for dinner, I shouldn't be surprised if I get into trouble over my remarks.

There will be some fluttering amongst the igloos. [You will have gathered by now that the only thing I know about the ice-men is that they live in igloos and eat candles and whale blubber.]

Ug, the Chief, will spread out this page and read it by the light of the aurora borealis and the sparkle of icicles. I wouldn't be surprised if he wrings a few penguins' necks in wanton anger.*

But he will get no wireless set out of me. The Eskimos leave me cold.

Change of Address

Mr. C. H. Grover, watchmaker and jeweller, of Barking, offered to help local readers with their "S.T.400s." He has some bitter things to say about constructors who do not follow the author's instructions.

An Essex reader accuses me of having invented Mr. Grover, his address and his testimonial. Apparently, he could find no Mr. Grover at 16, Blake's Market, Barking. The reader has been barking up the wrong tree. Mr. Grover tells me he has recently moved to 20, Cambridge Road, Barking.

Errors in addresses are probably quite common. Readers frequently write as badly as I do, and one has to make a guess at the address.

(*Please turn to page* 151)

* The 378 readers who are about to write to tell me that penguins are only found in the *South* Polar regions and the children's pages of newspapers are thanked in advance.

AS WE FIND THEM

NEW APPARATUS TESTED

Under this heading we publish reviews of apparatus submitted by radio manufacturers and traders for examination and test in "The Wireless Constructor" laboratories.

Magnum Dial

We have had the opportunity of testing one of the new Magnum slow-motion dials which are available for home-constructed designs. The dial can be arranged for either panel or baseboard mounting, and the whole assembly is carried on a frame of rigid construction, the scale being mounted on a substantial bush designed to accommodate spindles of ¼-inch diameter. The spindle is held by a steel grub screw which is arranged in an accessible position.

FINE CONTROL

The new Magnum slow-motion dial is suitable for either panel or baseboard mounting, and is also available with wavelength or degree calibration.

There is a slotted plate on the back of the frame for anchoring the fixed vane portion of the condenser so that this cannot rotate with the moving vanes.

The drive is smooth and free from slip or backlash, and the escutcheon provided is well finished in oxidised copper.

The sample model had a scale marked from 0–100 divisions, but a wavelength-calibrated scale is also available, the calibration being matched up against the standard Magnum "canned" coils.

A pilot lampholder is fitted for scale illumination, and the dial retails at 3s.

The makers of this attractive component are Burne-Jones & Co., Ltd., 296, Borough High Street, London, S.E.1.

Hellesen Condensers

We have recently received samples of the latest Hellesen condensers, consisting of an 8-mfd. 500 volt-peak wet electrolytic type, a dry electrolytic pack with a common negative, and capacities of 6-6-1 mfd.—peak voltage 300—and a number of moulded fixed condensers of small capacity (·0001 mfd., ·0002 mfd. and ·0003 mfd.).

ALL VALUES AVAILABLE

In the above photograph are shown samples from the extensive range of Hellesen condensers. The "pack" is of the dry electrolytic type, and on the right is an 8-mfd. wet electrolytic condenser designed to withstand a 500-volt peak. The three small fixed condensers in the foreground have ruby mica dielectrics.

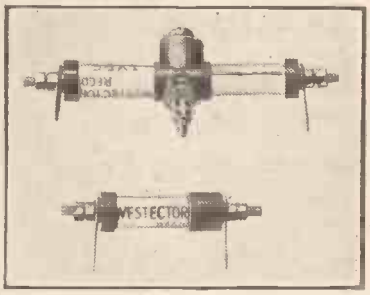
Messrs. Hellesens are now listing a very extensive range of condensers of various types. The moulded mica type, for instance, is available in values from ·00005 mfd. to ·01 mfd. Only the best ruby mica is used in their construction, and each is designed to withstand A.C. voltages up to 750.

The smaller types (up to ·002 mfd.) are available in patterns intended for direct suspension from the wiring, and have no fixing holes. The larger types (available in values from ·00005–·01 mfd.) can be supplied with two fixing holes in the moulding, so permitting attachment to a metal chassis without fear of shorting.

In the case of the electrolytic pattern, these possess, among their several features, low D.C. leakage at normal voltages, together with a rapid increase on exceeding the peak voltage.

These condensers are suitable for use in smoothing circuits or for decoupling, and are given stringent tests before they are passed out from the works. Our own tests proved that the samples submitted were highly efficient, and suitable in every

THE "COLD VALVE"

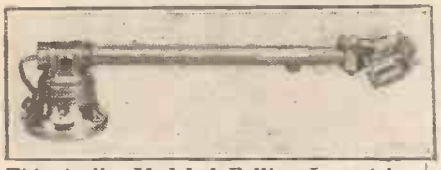


Here are two models of the Westinghouse "Westector." The top one is for use in full-wave rectifying circuits, and the bottom one for connection as a half-wave rectifier.

As We Find Them—*continued*

way for the work for which they are intended. The makers are Hellesens Ltd., Morden Road, London, S.W.19.

HAS ADJUSTABLE ARM



This is the Model A Belling-Lee pick-up in which the arm is adjustable for length and the head swivels.

Atlas Output Choke

The Atlas output choke is designed for use as an auto-transformer filter-feed for pentode circuits. Available both in shrouded and plain types, the choke has a core and windings of dimensions substantial enough for the largest pentodes.

Having a D.C. resistance of only 385 ohms, the Atlas choke does not produce an excessive voltage drop across its windings—less than 10 volts with 25 milliamps. passing.

The inductance at zero D.C. works out at 48 henries, and at 60 ma. this figure drops to some 30–35 ma.

With a pentode it is necessary to match the output load to the valve if satisfactory reproduction is to be achieved. All too frequently the lack of bass so often associated with pentode circuits is due to incorrect matching of the valve and speaker impedances.

In the case of the Atlas choke, tappings are provided along the windings so that ratios of 1–1, 1·25–1, 1·5–1, 1·6–1, 1·9–1, 2·1–1, 2·7–1, 3–1 and 5–1 are obtainable. The component is therefore suitable both for use as a conventional output filter when the speaker windings are arranged for direct connection as in the high-resistance types.

Or, alternatively, it can be joined to the primary winding of an output transformer when the speaker has a low-resistance winding. In each instance a 2- or 4-mfd. condenser—preferably the latter—is needed to keep D.C. out of the loudspeaker or transformer primary winding. The price of the component is very reasonable in view of its many excellent features and good electrical characteristics. The plain type sells at 17s. 6d. and the shrouded model at 21s.

The makers are H. Clarke & Co. (M/cr), Ltd., Old Trafford, Manchester.

Anode-Feed Unit

The anode-feed system has definite advantages. In the first place it enables the anodes of the various valves to be fed from a single H.T. + connection, the voltage applied to each valve being determined by the value of the feed resistance in series with the anode.

Secondly, every valve fed in this fashion is decoupled from the H.T. supply, an important feature in modern highly sensitive designs.

Recently we had the opportunity of trying one of the Ferranti anode-feed units which consist of a resistance and condenser combined in one compact assembly.

The condenser has a capacity of 2-mfd. and is tested at 750 volts D.C. and the wire-wound resistance is

WELL MADE

The Atlas pentode output choke is provided with tappings which enable the output circuit to be correctly matched up with the valve.

of the 2·5 watt type and has any value up to 30,000 ohms in accordance with individual requirements.

The complete unit costs 7s., and we can recommend it. It is robustly constructed and thoroughly reliable.

The makers are Ferranti, Ltd., Hollinwood, Lancs.

The "Westector"

The "Westector," or "cold valve," as it is sometimes called, is already well-known to THE WIRELESS CONSTRUCTOR readers since it has been used in a recent set published in this journal. Two types of "Westector" have been tried with marked success in THE WIRELESS CONSTRUCTOR laboratories. One of these is intended for half-wave rectification and the other for full wave. Both are capable of handling input voltages up to a maximum of 24, and currents of ·25 and ·5 milliamp. respectively.

The "Westector" is, of course, a development of the famous Westinghouse metal rectifier and functions as a non-amplifying straight-line detector. It makes a particularly good second detector for superheterodyne receivers, but in "straight" circuits should be preceded by an H.F. pentode. It is also applicable to automatic volume-control circuits, and we can vouch for its efficiency as a linear rectifier capable of dealing satisfactorily with large inputs.

The makers are The Westinghouse Brake and Saxby Signal Co., Ltd., 82, York Road, King's Cross, London, N.1.

A Good Pick-Up

The Belling-Lee type "A" pick-up which we have recently had the opportunity of trying is specially interesting because of its adjustable arm which provides a variation in length from 7½ to nearly 10 ins.

Moreover, the arm has a ball-bearing swivel with definite stops to prevent it from swinging right across the record, and the head swivels right over for easy needle changing.

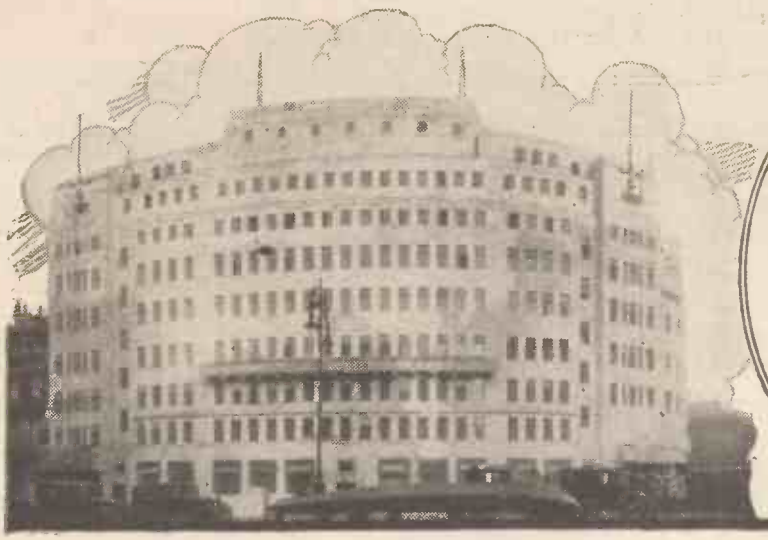
An earthing terminal is provided, and the output is well over half a volt, thus enabling ample volume to be obtained from quite small amplifiers. The response is very good indeed, and the tracking accurate.

There is an alternative model specially suitable for fitting to portable or other gramophones not having room on their motor-boards for the normal type of fixing. A neat base embodying a volume control is provided, and this is easily fixed to the side of the gramophone.

The makers are Belling-Lee, Enfield, Middlesex.

FOR ANODE FEED

Above may be seen one of the Ferranti anode-feed units, consisting of a wire-wound resistance and 2-mfd. condenser arranged to form a compact and efficient unit.



B.B.C. NEWS

Personalities — Radio Drama — Cinema
Organ Relays—West Regional Innovations

By Our Special Correspondent

An Assistant "D.G."

Is Sir John Reith contemplating leaving the B.B.C. ?

The rumours that I hear are not very definite, but in certain quarters much significance is attached to the fact that the Governors have been discussing the appointment of an assistant to the Director-General with a view to his being able to take over sole command in the event of Sir John deciding to leave Broadcasting House.

There is no suggestion, of course, that "the D.G." intends to give up his job at short notice or even, so far as I can see, in the near future. But it is quite definite that the Governors are looking for a man who shall one day succeed Sir John Reith.

The Governors have not yet chosen anyone for the position, but it is to be hoped that they will not look beyond the walls of Broadcasting House for a suitable person. The name that most naturally springs to one's mind is undoubtedly that of Major Gladstone Murray, who is now "on loan" to the Canadian Broadcasting Commission. Within a week or so, if all goes well, Major Murray should be back in London, having refused the tempting offers of the Canadians to remain in Ottawa.

Sir Charles Carpendale

The services of Admiral Sir Charles Carpendale are, it seems, to be retained for a further period of at least one year. Sir Charles, who is Controller of the B.B.C., reaches the normal age for retirement at the end of this year, but the Governors feel that it would be folly to lose the services of such a vigorous and trusty worker for the cause of British broadcasting, and have agreed to make an exception in his case—that is, of course, if Sir Charles be willing.

The Radio Drama Festival

The first Radio Drama Festival is planned to take place in the autumn, when every week for three months, beginning in October, the B.B.C. will revive the most important plays of the past ten years. The plays selected are as follows: "Danger," "The White Château," "Pursuit," "Kaleidoscope," "Carnival," "The Flowers are Not For You To Pick," "Matinée," "Obsession," "Red Tabs," "Romance," "The Path of Glory," and "The Three Musketeers."

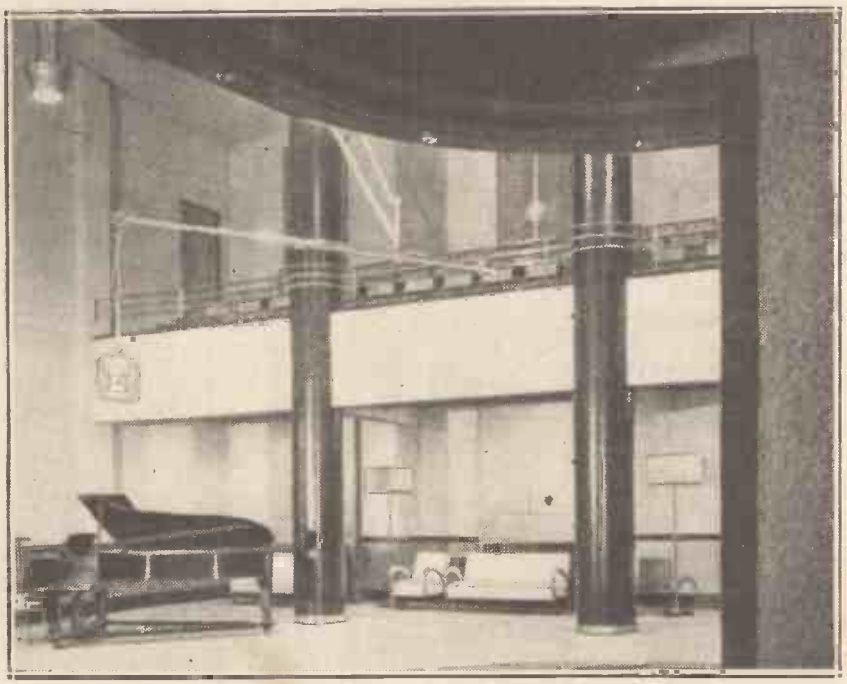
In many cases it is hoped to secure the services of the members of the original casts. All the plays are by British authors.

A feature of the festival, which should do much to arouse interest in radio writing, will be a series of talks on wireless drama given by Dr. L. du Garde Peach, Mr. Cecil Lewis, Mr. Tyrone Guthrie, and other authorities on the subject.

For Northern Listeners

For some years the Heckmondwike Lecture has been an event of considerable importance in the programmes for Northern listeners, and the relay from

IN THE LARGE LEEDS STUDIO



Designed by John C. Procter, F.R.I.B.A., the Leeds studio is one of the best in the country. Note the adjustable arm that allows the microphone to be moved at will over a large area.

B.B.C. News—*continued*

the North Regional station in mid-June was eagerly awaited. One must go back for nearly two hundred years to find the origin of this event, when the Independent Minister of Heckmondwike in Yorkshire conducted a school for the training of preachers.

The minister was distressed at the interference to study caused by the visits of friends of the students at short intervals, and so decided that one day in each year should be set aside as visiting day. The Wednesday after the second Sunday in June was the date fixed, and each visitor was promised a "good plain meal," while it was also provided that a lecture or sermon should be delivered by a preacher of repute.

Years ago the school was moved to join the United College at Bradford, but the dinner survives as part of the annual festival in the three Congregational Churches of Heckmondwike, when sermons are delivered by two well-known and distinguished preachers.

Scotland's Holiday Programmes

The season of holiday relays from seaside resorts in Scotland begins on Friday, June 16th, when a concert party entertainment will be taken from the Beach Pavilion, Aberdeen, where Harry Gordon, "the man fra Inversnecky," has been so popular for several years.

The customary broadcast, entitled "Doon the Watter," which is really the story of the adventures of a Glasgow family on a trip down the Clyde, has also been arranged, but this year a stop will be made on the Island of Bute, so that listeners can pay a visit to the Rothesay Entertainers.

Meanwhile, the series of attractive talks entitled "Holidays in Scotland" will go on for some time yet, and in addition to the information already given of the facilities provided by the Youth Hostels in Scotland, new ideas for a golfing holiday, and the pleasures to be derived from visiting some of the less-frequented mountains of the country, listeners will be told about the delights of small boat-sailing, the conveniences of the new roads, and the charms of caravanning.

Cinema Organ Relays

Nothing has done more than broadcasting to popularise cinema organs, and few items are more appreciated by the majority of listeners than the regular relays of cinema organ music by such well-known exponents as Foort, Dixon and New.

Last year more than sixty new organs were installed in British cinemas, and Mr. Foort, who has ambitions of starting a school for the training of students for this most interesting profession, has become the editor of a new monthly magazine entitled "The Cinema Organ Herald."

Forthcoming Plays

Cecil Lewis, so prominently associated with broadcasting in the first few years of the B.B.C.'s Savoy Hill days, returns to microphone work in the near future to produce that most exciting melodrama, "R.U.R.," which is conspicuous on the list of plays to be performed during the summer months.

"Across the Moon," "Flags on the Matterhorn," and "The Cherry Orchard" are other well-known plays to be revived, while Philip Wade has written a new one entitled "The Game." The list also includes two stage plays: Drinkwater's "Robert E. Lee" and Vachell's "Quinney's," and adaptations by Howard and Barbara Rose of "Wuthering Heights," and by Leslie Baily of "The Fantastic Battle," a story of the war that ended war.

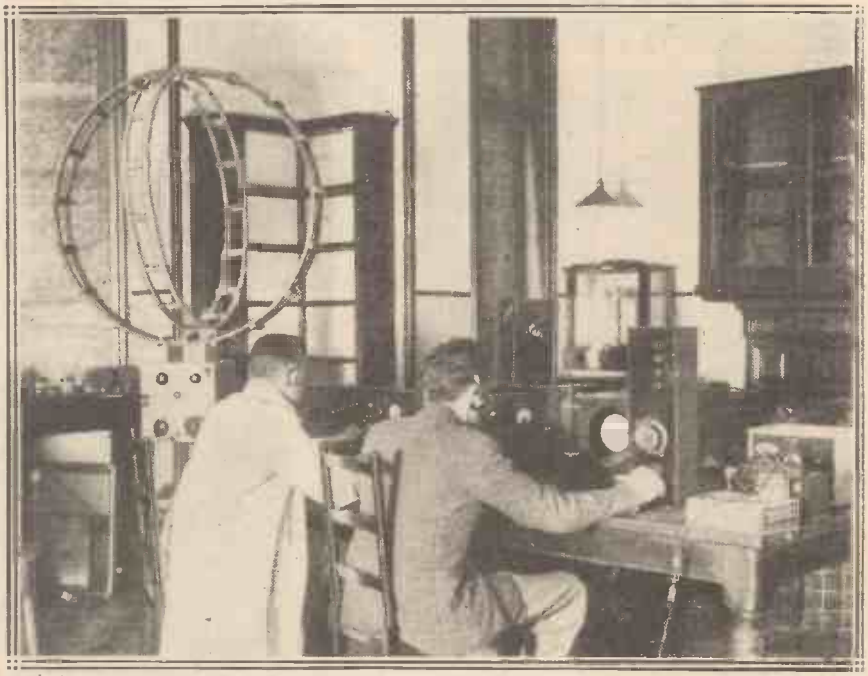
West Regional Innovation

Charity appeals are usually broadcast at specially selected periods in the Sunday programmes, but the West Regional Station is departing from this procedure in the near future when reference will be made in one of the "Channel Currents" series of talks to the necessity for raising £5,000 for the restoration of the famous Parish Church of St. Mary Weston Zoyland, which as all travellers in Somerset know, is a landmark that can be seen for many miles over the surrounding moorlands.

The church was built in the fifteenth century by the Abbots of Glastonbury, and is regarded as one of the finest examples of the Perpendicular style in the country. The royalist army was encamped near the church on the night before the Battle of Sedgemoor, and after Monmouth's defeat more than five hundred of his followers were imprisoned in it for some weeks.

During this time five of them died before the others were marched off to appear before Judge Jeffreys at the "Bloody Assize."

A NEW RADIO RESEARCH LABORATORY



King's College, London, has been provided with new laboratories at Chesterfield Gardens, Hampstead, for the better investigation of radio phenomena. The site is on a hill and free from electrical disturbances, whilst a residence is available for the Professor of Physics, enabling protracted investigations to be carried out more easily.

POTENTIOMETERS IN PRACTICE

There are one or two points about potentiometers that must be borne in mind if they are to be used to the fullest advantage. These, and also an easily-applied method of controlling volume at the speaker, are described

By A. S. CLARK.

POTENTIOMETERS, like fixed condensers and fixed resistances, are ubiquitous components. They are used in H.F. circuits, in the detector stage, on the L.F. side of a set, and also in connection with pick-up work.

But no matter for what purpose they are employed, there is one thing that will definitely upset their efficiency, and that is a bad contact between the slider and the resistance element.

The trouble may exist throughout the whole movement of the slider or at one point only. In either case the best remedy is to increase the tension holding the slider in contact with the resistance.

Graduated Resistance

Seldom, if ever, is it desirable to indulge in scraping the resistance. Indeed, if the potentiometer is wound with fine wire, this may completely ruin it.

There are three distinct types of potentiometers in common use, and they are shown in Fig. 1. There is the plain one in which the resistance is directly proportional to the slider's position, the centre-tapped one which is similar but has an extra terminal for the centre-tap, and the graduated type in which the resistance varies more rapidly at one end.

THREE COMMON TYPES

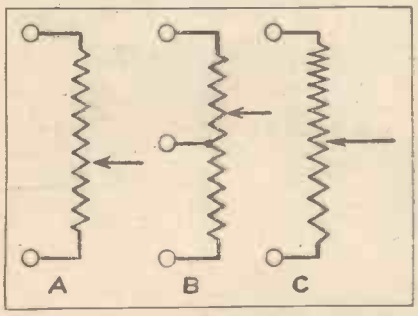


Fig. 1. These are the kinds of potentiometers most commonly used. A is the ordinary one in which resistance is proportional to the slider's position, B is a centre-tapped one for radiogram work, and C a graduated component in which the resistance varies more rapidly at one end.

The potentiometers recommended for use with tone-control transformers are sometimes different from any of the above three kinds. It is therefore advisable with these transformers to keep exactly to the recommended component.

Centre-tapped potentiometers are usually employed as faders for changing over from radio to pick-up. While the graduated type are generally employed in volume-control positions, and the object of the graduation is to even out the effect on volume.

A "straight" type potentiometer sometimes tends to produce a too rapid change of volume at the beginning of the movement. But it is important that a graduated component is wired up the correct way round, or else, obviously, the sudden control effect will be accentuated instead of cured.

Loudspeaker Control

Great advantages accrue from the potentiometer when it is employed as a means of controlling volume at the speaker. Anyone who has used loudspeaker extension leads knows the drawback of going into another room to adjust volume.

A scheme sometimes adopted is a variable resistance connected directly across the loudspeaker terminals. But at small volume it cuts down the higher frequencies.

This attenuation is avoided in the potentiometer connections of Fig. 2. These are drawn pictorially, with their theoretical conception in the corner for purposes of explanation. It is assumed that an output filter is used, so that the steady anode current passes through an L.F. choke.

As the slider is moved downwards (see small sketch), the volume gets less. The resistance "b" also gets less, and tends to attenuate the high notes.

Here is the reason. The non-inductive resistance "b" has a constant value for all frequencies. Not so the loudspeaker, whose resistance is greater the higher the frequency.

Preserving the Bass

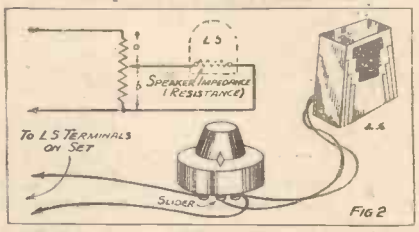
The ratio of speaker resistance at high frequencies to resistance "b" is much greater than the ratio of speaker resistance at low frequencies to resistance "b." Consequently, a bigger by-pass of high frequency takes place.

But as the resistance "b" decreases, the non-inductive resistance "a" increases. And "a" is in *series* with the speaker resistance.

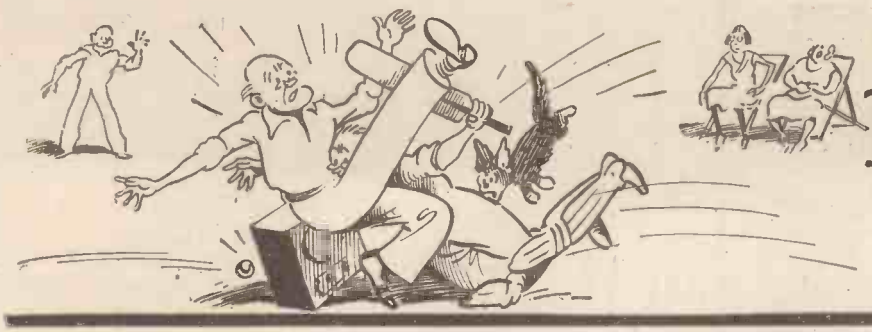
The greater the resistance of the speaker in relation to "b" the smaller the percentage of voltage dropped across "b." As we know the resistance of the speaker increases with frequency, it is clear we shall in this case tend to attenuate the low notes, balancing the high-note loss due to "a."

The best value for the potentiometer depends on the resistance of the loudspeaker, or the transformer primary when an input transformer is employed. With most high-resistance speakers a value between 10,000 and 20,000 ohms is satisfactory.

VOLUME ADJUSTMENT



Control of volume on an extension speaker without adjusting the receiver is achieved in the manner shown in this diagram. A choke output filter should be used in connection with this scheme.



IN LIGHTER VEIN

By "Wayfarer"

Resulting from a game of cricket upon the yellow sands of Winklecombe, the "Sandhopper" Six portable was intended to be the "most superlative set that ever was."

Readers will no doubt form their own opinion on reading Professor S. O. High's candid report.

IT may be said that the "Sandhopper" Six, the wonderful Goop-Wayfarer portable for holidaymakers, was born upon the yellow sands of Winklecombe. Not that the big idea occurred to us there, but things happened which gave a boost to our ingenuity by making it necessary for something quite out of the ordinary to be designed.

The Mudbury Wallow Wireless Club had chosen Winklecombe for its annual seaside outing. All of us having bathed, the male members of the party decided upon one of those jolly games of sea-shore cricket, whilst Mrs. Goop and Miss Worple settled themselves down comfortably to constitute the audience.

GETTING COMFORTABLE

"We hadn't finished taking up sides before they were both soundly asleep. Miss Worple looking quite disreputable with her mouth wide open . . ."

We hadn't finished taking up sides before they were both soundly asleep, Miss Worple looking quite disreputable with her mouth wide open and her tongue hanging out.

"What can we use for a wicket?" inquired Captain Buckett.

We looked around us, but could find nothing at all suitable. Then Primpleson spied Miss Worple's portable set.

Theory and Practice

"The very thing," he cried; and we all agreed, assuring each other that we would take the greatest possible care of it and that no harm would befall it.

I was Bradman to the tune of thirty-three when our side batted, and when we came out to field I became Larwood with magnificent effect. Off my first two overs not a run was scored, but putting into practice the body-line theory, I dismissed Captain Buckett (fourth waistcoat button), Tootle (left eye), and Goshburton-Crump (blinded by explosion of fountain-pen in breast pocket). Then Primpleson came in to bat, and something went wrong with my next ball.

The theory was that it should be a short-pitched, in-swinging express that would probably remove a tooth or two. In practice, it turned out to be a slow half-volley to leg, and Primpleson managed to catch it the father of all belts.

The Peke Joins In

Gubbsworthy dashed in pursuit, whilst the Professor placed himself at the wicket ready to flick off the bails, and I took up a position behind him for backing-up purposes. Pottleson ran out to relay Gubbsworthy's original throw.

Like a hare Primpleson galloped between the wickets. He had notched up fourteen when the ball reached Pottleson, who hurled it at the wicket.

A goodish shot, it missed by millimetres, caught the Professor on the right shin, and cannoned off into the distance. I flung myself after it. Primpleson was just starting his fifth overthrow run when I retrieved it and let fly.

It was at this moment that Tumpsey-Wumpsey, Miss Worple's Peke, decided to join in the excitement. He pursued the fleeting Primpleson, snapping at his heels.

Just as my magnificent throw scored a bullseye in the loudspeaker, Tumpsey-Wumpsey got between Primpleson's legs and Primpleson's bat flew between the Professor's. They crashed in a heap on to the wicket, which subsided beneath them amidst ominous splitting, rending and tinkling noises.

Miss Worple Awakes

The din awoke Miss Worple, who burst into shrieks of jolly laughter at the sight of the struggling heap. She was particularly diverted by the ferocity of Tumpsey-Wumpsey, who was shaking the seat of the prostrate Primpleson's trousers with terrific growlings.

She rose and came over to tell her darling pet what a brave little doggy-woggy he was. Just at that moment Primpleson and the Professor managed to struggle to their feet, and Miss Worple's eye fell upon what had been beneath them.

"What," she inquired in a voice of ice—"what is that?"

The Professor picked up the now somewhat bent portable by its handle and presented it to her with a courtly bow.

"I'm afraid," he said, "that your wireless set has met with a slight accident. How it came here I cannot think. Can you, Buckett?"

BODY-LINE BOWLING

". . . I became Larwood with magnificent effect. Off my first two overs not a run was scored, but putting into practice the body-line theory, I dismissed Captain Buckett (fourth waistcoat button) . . ."

The Captain scratched his head and then shook it. Goshburton-Crump, Gubbsworthy, and Tootle were all equally at a loss, but I suggested that Tumpsey-Wumpsey must have carried it along in his mouth, placing it unfortunately just beneath the flying feet of the players.

In Lighter Vein—*continued*

As Tumpsey-Wumpsey is about the size of a large rat and Miss Worple's set weighs all of twenty pounds, this was not a particularly good effort, but it was the best that I could manage on the spur of the moment. All the others began to assure her that that was exactly what had happened, but Miss Worple silenced them with a glare.

WELL HIT, SIR!

"Primpleson managed to catch it the father of all belts. Gubbsworthy dashed off in pursuit . . . "

"Have you or have you not been using my priceless portable as a wicket?" she inquired, fixing Goshburton-Crump with a piercing look.

"Well—er—er—" admitted Goshburton-Crump. "I suppose—er—you might—possibly put it in that—er—way."

The vials of Miss Worple's wrath were opened. No effort seemed to be required on her part. She just opened her mouth and the words flowed out.

With a majestic gesture she flung the remains of the portable at the sea, but missed because the handle broke at the critical moment. It landed on Pottleson's foot, and his subsequent performance seemed to do her quite a bit of good.

Promised Reparations

The Professor rose nobly to the occasion.

"Dear lady," he said, "there have been misunderstandings all round, and whatever has happened, your set has clearly been bent a trifle here and there. But your loss shall be made good a hundredfold. I am making the most superlative set that ever was, and this I will present to you as a small return for the damage to your set and to your feelings."

Somewhat mollified, though still distinctly ruffled, Miss Worple swept off with Mrs. Goop, calling after the Professor over her shoulder that she would believe it when she saw it.

* * *

"What about this wonderful new set of yours?" I asked the Professor a week or so later. "The one, I mean, that you told Miss Worple you were making for her. I hadn't heard anything about it."

The Professor's Latest

"Nor had I," sighed the Professor, "until that moment, and since then the whole business has slipped entirely from my memory. Now that you remind me of it, it is plain that you and I must put our heads together."

With what success we did so the gentle reader will be able to gather next month when I hope to publish a full description of the "Sandhopper" Portable Six, if the Editor will be so kind as to reserve me twenty-five pages of THE WIRELESS CONSTRUCTOR for the purpose.*

Meantime, I can discuss a few details which may act as a kind of *hors d'œuvre* to the feast that is to come. The set is, of course, designed on entirely novel lines, as all Goop-Wayfarer sets are.

Both of us view the double-diode-triode as something that is quite good as a beginning, but we have gone several steps further in our quadruple-diode-triode-tetrode-pentode, five of which are used in the set.

The Very Last Word

The output stage, again, we do not regard as adequately provided for by the "Class B" valve, and for this reason we have designed our "Class Z" valve, which is being specially produced at rush speed. This valve is really four triodes within one bulb, and may be said to be the very last word in push-push. So secret is it at the moment that the Professor is known to valve manufacturers as the man who put 'ush-'ush in push-push.

The circuit is naturally a little complicated, and I should like the reader thoroughly to understand certain parts of it before he goes on to consideration of the whole.

The circuit employs six valves, and it is one that calls for particular attention, owing to its very neat arrangement. The filaments of all six valves are arranged in parallel with the low-tension busbars and the negative busbar is earthed.

Efficient Switching

A neat and completely efficient switch enables all the filaments to be switched off simultaneously, by breaking the low-tension positive lead. If the reader will be so kind as to trace out this circuit in his mind he will see that the filament of every valve receives its due share of current from the filament battery, and that every precaution has been taken to see that none gets more than it ought to have.

Authoritative Report

In conclusion, I give a candid and completely unbiassed report from Professor S. O. High, to whom the "Sandhopper" Portable Six was sent for test. From considerations of space I have omitted a few unimportant words here and there.†

REPORT ON THE GOOP-WAYFARER "SANDHOPPER" SIX.

It is always a real pleasure to test out a first-rate set . . . such as your "Sandhopper" Six. . . . Such extraordinary productions come one's way but seldom. It is an outstanding example of . . . both design and construction. Owing to the . . . care taken over the wiring, connections are remarkably . . . short. Circuits . . . are masterpieces of . . . ingenuity. Rectification . . . proved . . . perfect. . . . Tuning is . . . of the knife-edge sharpness called for by present-day conditions. In point of . . . quality the set is the most amazing I have ever handled. Its notable . . . sensitiveness is fully in keeping with the rest of the set's performances.

S. O. HIGH.

THE IMPROVISED WICKET

"The Professor picked up the now somewhat bent portable by its handle and presented it to Miss Worple with a courtly bow."

I think you will agree that such high praise from so eminent an authority as Professor S. O. High is most gratifying, and I only wish sufficient space was available in which to print the full report.

* Not a hope.—ED.

† N.B.—The full report is published on page 155, so that readers may be able to see for themselves the "few unimportant words" deleted.—ED.

OUR NEWS BULLETIN

New B.B.C. Appointment

IT was reported in the "Daily Herald" a few days ago that a new B.B.C. chief from Canada will shortly be appointed as Chief of the Programme Department. This report states that Mr. John Burgon Bickersteth, M.A., Warden of Hart House, Toronto University, and son of one of the King's chaplains, has been chosen.

Mr. Bickersteth's name is quite unknown in radio circles over here, although it is said that he is a brilliant expert in broadcasting abroad.

Anyway, we made inquiries about this appointment, and were informed by the B.B.C. that they know nothing about it at all, and that, in fact, there was absolutely no idea at Broadcasting House of appointing Mr. Bickersteth. So that's that!

Assisting Opera

A few days ago we thought it would be interesting to try and find out what the B.B.C.'s arrangements were this season in connection with Opera, for it has been understood that the B.B.C. does not pay these days any fixed amount since the Opera subsidy was stopped.

On inquiries, we find that the Opera Syndicate was allowed a certain amount of financial assistance this year towards expenses, but the amount, it appears, varies. Strenuous endeavours to elicit figures from Broadcasting House resulted in the announcement that no figures can be given for this year.

At Manchester University

An honorary degree of Doctor of Laws was recently conferred on Sir John Reith at Manchester University. Sir John, in his speech, said that as a member of the B.B.C. he was grateful for the honour conferred on him. "The B.B.C. has always endeavoured to merit such appreciation," he went on, "though it frequently gets more criticism. The Corporation cannot cater for the tastes of every one of the twenty million listeners, and those who demand more entertainment should remember that the illimitable power of broadcasting has other purposes than the negative one of relieving a man's boredom."

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OUR NEWS BULLETIN

—*continued from page 149*

Empire Programmes

It is reported that a new two-hour programme is to be added each day to the Empire wireless programmes broadcast through the ultra-short wave station at Daventry. The extra programme will be sent out daily from 11 a.m. to 1 p.m. G.M.T. on various directional aerials at the transmitter. On Sundays, in future, the programmes will be rather shorter, and will be from about 11.30 a.m. to 1 p.m.

New 'Phone Service

A few days ago the Post Office opened its first regular commercial radio-telephone service using ultra-short waves at the new Head Post Office at Plymouth. The new system has considerable possibilities, and it will be particularly useful for communication over short sea routes as an alternative to submarine cables, and over tidal estuaries as an alternative to long and circuitous land lines. The wavelengths used were 4·8 metres in one direction, and 5·1 metres in the other, and the results proved to be highly satisfactory.

The B.B.C. Organ

The B.B.C.'s new £10,000 organ will probably have made its debut by the time this issue is on sale. The new organ has 150 electric stops, and no fewer than 2,362 pipes.

An interesting point about this organ is that the organist can play it in a studio remote from the actual concert hall where the organ proper is installed.

Television in Japan

A Television Research Institute will shortly be opened in Tokio. It is said that the Institute will have six studios in addition to a broadcasting studio and a receiving room. Apparently, in Japan, it is believed that before long radio movies televised from this Institute will be available in every Japanese home equipped with receiving apparatus costing from £13 to £18.

Getting the News!

It is interesting how our contemporary, "Popular Wireless," gets the news these days. Recently "Popular Wireless" published a paragraph stating that a post worth at least £5,000 a year was shortly to be offered at Broadcasting House and that the post would form part of a big reorganisation scheme. Whoever is chosen for this post is obviously going to be a big noise.

"Popular Wireless" also revealed the fact that Sir John Reith had been instructed by the B.B.C. Board of Governors to draw up a list of those whom he considered to be suitable candidates.

Interesting Disclosures

Several newspapers in the country have quoted this paragraph from our contemporary, concluding with: "Officials at Broadcasting House yesterday declined to make any comment on the report."

Of course, this is as good as admitting that the news is absolutely true. In fact, we know it is true, and in the near future there will be some further interesting disclosures to make concerning B.B.C. reorganisation.

Ostrich-Like Attitude

It is a pity, by the way, that the B.B.C. officials should be so fond of this attitude of "declining to make any comment." Several times in the past we have noticed that when advance news has appeared in the Press concerning the B.B.C.'s activities, the B.B.C. officials have taken up the ostrich-like attitude of putting their

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OUR NEWS BULLETIN

—continued from page 150

heads in the sand and declining to acknowledge the authenticity one way or the other of newspaper reports.

When news like this leaks out in the Press, it is always just as well to confirm it or deny it and have done with it.

A High Tribute

By the way, a high tribute has been paid by the Canadian Prime Minister to the B.B.C. Official Adviser to the Canadian Broadcasting Commission, Major W. E. Gladstone Murray.

Major Murray has done sterling work in Canada, for, as a result of his visit, not only has he planned out a first-rate broadcasting service for Canada, but he has made possible the acceptance of interim proposals on behalf of the B.B.C. for the co-operation of Canadian and British broadcasting.

Although inducements have been held out to Major Murray by Canadian and American interests for him to remain on the other side of the Atlantic, Major Murray is already on his way home, for he has definitely declined all offers to leave the B.B.C.

Great Possibilities

You have no doubt been reading the description of the new Cathode Ray television receiver exclusively described in our contemporary, "Popular Wireless." At a demonstration held recently, many pressmen were present, and everybody agreed that the system has great possibilities.

The "Daily Herald" representative, in his report, said: "The new system rules out all the difficulties of some of the earlier mechanical television receivers and, by harnessing a stream of electrons and guiding them to strike at the right moment and at the right spot on a florescent screen, enables pictures to be received clearly on the demonstration receiver."

Religious Broadcasting

The B.B.C. announces that the Rev. F. A. Iremonger, M.A., has been appointed in charge of the Corporation's religious work in succession to the late Mr. J. C. Stobart.

Mr. Iremonger, who is Chaplain to the King, was for four years Editor of the "Guardian," and his experience of the wider issues of the Church should stand him in excellent stead in his work with the B.B.C.

FROM MY ARMCHAIR

—continued from page 140

A Brixton reader objects to my having said "Righto, old cock!" to a correspondent. Not dignified. Uncouth.

I must admit that when writing it I was not wearing the old school tie. But my correspondent hailed from a distant corner of the greatest Empire the world has ever known, and on which the sun never sets, and had just called me "old lad."

Was I right, or was I right?

Herbert Watson, of Bridlington, writes:—

"You are my wireless father."

After reading your letter carefully, Bertie, I must decline the honour. Try Victor King.

Ideal For Eskimos!

R.L., of Liverpool, writes: "I have your A.C. set but fortunately my mains, although D.C., are 210 volts. I shall connect up the set to-morrow."

Unfortunately, your letter was marked Personal and has been (like all such) considerably delayed. Otherwise I would have sent you a telegram.

Obviously a set for the Eskimos.

* * *

Here's a letter from Axminster. On the carpet again, I suppose. Yes, I'm afraid so.

". . . all these flattering art plates, probably all touched up and nothing like you . . . disgusted with the scores of flattering letters from . . . sick of hearing . . . must you go on . . . a lot of bilge . . . quite agree with . . . want to be perfectly candid . . . why didn't you stay at John o' Groats. . .

One of these days I shall turn.

* * *

"We have no pigs and chickens in the kitchen," writes R. Williams, of Belfast. Yes, we have no pigs and chickens in the kitchen.

* * *

"The variable condenser vanes scrape together every ten degrees or so. Does this matter?"

Well, it will make it harder to turn the dial, of course.

* * *

A Lancashire lad writes: *"Since fitting the new L.F. transformer, results are a sight better."*

I am glad to see the unit called a "sight" coming into its own. The "decibel" has had all its own way lately and I intend to help popularise

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FROM MY ARMCHAIR

—continued from page 151

the "sight" which lends itself to almost every phase of wireless. Thus a four-valve set is probably five or six sights better than a three-valver. The selectivity is probably three or four sights better.

The symbol "st." might be used as an abbreviation. The only danger is that it may become confused with the "street"—another hitherto neglected unit in electrical engineering.

Such, however, is the narrow prejudice which governs our stolid and conservative N.P.L. that I doubt if we will ever hear of a valve's undistorted output as being seven sights better or three streets ahead of another type.

National Institution

I wonder how many readers recognise that the N.P.L. really belongs to them? It is a national institution organised for the benefit of the public and industry as well as for other government departments.

They and the Radio Research Board are a source of most valuable technical information. Sometimes a really useful investigation takes place and the tax-payer receives such a report as that on the Stenode System. Very fine work has been done on direction-finding problems.

Unfortunately, years and much money have been spent on observing atmospherics, and the public—who do not care a row of pins where atmospherics come from—feel that some of the Government research is too academic.

I suppose that the argument is that, as nobody else will do academic research, *they* should (they are now busy studying the reflection of waves from the Heaviside and Appleton layers).

Of course, one never knows what important developments may arise out of this type of research.

Accurate Measurements

On the whole, the N.P.L. give the impression of aloofness and are thus to be contrasted with the at least equally famous Bureau of Standards of Washington, U.S.A.

General Squiers, who was the wireless head of the American army, told me while showing me round the Bureau of Standards that they wished to be of the greatest service not only to manufacturers but also to the private experimenter.

Of course, our N.P.L. have a deserved reputation—as a measuring institution. Unless they can measure accurately, they refuse to measure at all.

In recent years they have developed methods for measuring the overall performance of broadcast receivers. I was the first to ask them to undertake this work, and provided them with a broadcast receiver (which they may still have).

An Able Leader

They finally decided not to undertake the work, as accurate measurement was then impossible. This was a good many years ago, and things have now changed.

The wireless department of the N.P.L. has as its extremely able head Dr. R. L. Smith-Rose, who has collected at a very early age almost every academic distinction.

I often wish that some of these quiet, retiring physicists would help more in the popular spheres where their judgment and experience would be invaluable. Fortunately some of the N.P.L. staff *do* write articles.

Reader's Reply

In hot water again. Mr. W. T. Palmer, of Clapham, has turned on the tap marked "H."

He refuses to snigger at my suggestion that the reader whose set "went all to pieces on a Sunday" should sell it to a clergyman.

"*It is quite possible*" (says Mr. Palmer) "*to give a sensible scientific answer to the question. My answer would have been. Your aerial is very close to and running parallel with a neighbouring aerial, which is a better aerial in the sense that it is probably higher and in a better situation. Now such an aerial coupled to a fairly powerful set would rob your aerial to a very considerable extent.*

The owner of this aerial is at work all the week and, like many another listener, can operate only on Sundays. Thus on Sundays you get POOR *reception such as would be* NORMAL *if the neighbouring set were used regularly. And on weekdays you get* GOOD *reception such as would be abnormal if the neighbouring set were used regularly.*

The remedy is obvious. Try to improve your aerial by raising it above your neighbour's or by getting it at right angles."

Quite ingenious and technically feasible—except that I don't quite like the bit about a "fairly powerful set." The "power" of the set is not likely to make any difference. The

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FROM MY ARMCHAIR

—*continued from page* 152

set would only affect things in so far as its aerial circuit was different. Thus a reaction-on-the-aerial receiver, which might only be a single-valver, would behave differently from a set without reaction.

Better Results Possible

Other aerials certainly can "suck up the juice," and leave you high and dry; but, on the other hand, many a poor aerial has benefited from "re-radiation" by a better aerial.

Also, if the neighbouring aerial has reaction applied to it, and yours hasn't, you *may* get *better* results when both of you are receiving the same signals. This explains the astonishingly good results obtained on some of the early crystal sets.

Tit for Tat

A Glasgow reader informs me that the gospel according to Ripley states that every inhabitant of the village of Cervera de Buitrago, in the Province of Madrid, has at least six digits on his hands and feet. The number of fingers on each hand is usually seven.

My informant adds: "Just the place for the 'S.T.400.'"

I wish I had him in the Ukraine. I find from Ripley that Wasyl Bezborodny, of Kiev, Russia, had his face slapped by a friend for 36 hours.

NEW TUNING METHODS

—*continued from page* 126

developed commercially One of the bulkiest of the components in the receiving set as we know it is the variable condenser, particularly if ganging is used. The variable condenser disappears altogether with a consequent saving in space and a reduction in expense.

Eliminating Wires

Very few variable-condenser tuned sets incorporate anything bigger than a four-gang condenser, which means that the number of tuned circuits is limited to this number in straight receivers. They may be divided into one band-pass circuit and two inter-valve circuits of the single type, or into one preliminary and one inter-valve circuit, both of the band-pass type, or possibly into four single circuits.

Permeability tuning makes it an easy matter to have band-pass tuning in every signal-frequency stage, if required, and any number of coils within reason can be ganged. The straight set can thus be made as sensitive and as selective as the super-heterodyne.

The elimination of the variable condenser leads to some important results besides the saving in space. If you will look at Figs. 3 (A and B), you will see a comparison between the number of leads needed for two valves coupled by a high-frequency transformer and by an iron-dust coil. Polydoroff coils, by the way, are not made as transformers, but always as single inductances. An examination of Fig. 3 A shows that six leads are required: (1) From the plate of V_1 to transformer primary; (2) from transformer primary to high-tension positive; (3) from transformer secondary to grid of V_2; (4) from transformer secondary to earth; (5) from the grid of V_2 to variable condenser; and (6) from transformer secondary to variable condenser. Some of these leads have necessarily to be rather on the long side and even half an inch in a high-potential lead may make a difference to the performances of a sensitive set.

Saving in Cost

The difference in Fig. 3 B is striking. Only three leads are needed: (1) from the plate of V_1 to coil; (2) from coil to high-tension positive; (3) from coil through grid condenser to V_2. The length of Nos. 1 and 3, the high potential leads, can be kept down to the absolute minimum; a postage stamp or cartridge type of condenser, for instance, may itself form the connection between the coil and the grid of V_2.

The cost of iron-dust cored coils with their ganging gear should be considerably less than that of a combination of air-cored coils and

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MAKING SPEECH CLEARER

—continued from page 116

This has the effect of shifting the point of maximum response higher up the frequency scale in the case of speech, but of leaving it more in the lower regions when receiving music. Actual clarity of speech and the faithful reproduction of all those individual details in a voice is possible only if the tonal balance decidedly favours the higher notes.

Only Two Components

In any set, either mains or battery operated, working into a loudspeaker of any type, this desirable end can be attained very satisfactorily and cheaply. It is assumed that either an output transformer or the usual choke-condenser arrangement is employed.

The additional components required are a fixed condenser (try something round about ·5-mfd.) and a push-pull switch. The latter, if possible, should be mounted on the panel of the set, for it is frequently required. But if by so doing the symmetrical appearance of the panel is going to be upset, or if it means dismantling a bought set to get at the back of the panel, which the owner may feel a bit nervous of doing, the better plan is to mount a small tumbler switch on the side of the set in an accessible position.

The condenser can be mounted in any available spot near to the output valve. The connections are made as shown in Fig. 1, if a transformer is in use, and according to Fig. 2 for choke-condenser coupling.

Improving Speech

Normally the switch is put in the position that shorts the condenser. The set is then exactly as it was and music will be reproduced with all the satisfying bass that is usual.

When the News Bulletin is announced or a talk is to be heard, the speech switch is operated, thus bringing the new condenser into circuit.

The effect upon music is to make it too thin, but reproduction of speech alone will be found to be incomparably improved. This simple change does away with all that deep-toned, muddy and gruff speech, and makes the announcer sound "just right."

Finally, do not attempt to apply this expedient with a receiver which has the loudspeaker connected directly in the anode circuit of the power valve.

NEW TUNING METHODS

—continued from page 153

ganged condensers. Further, much closer matching of circuits is possible, and with very little labour. It does not in the least matter if the coils differ slightly from one another in their actual inductance values so long as they are alike in shape and physical size. The process of matching is carried out in the following simple way. To begin with, each coil is adjusted individually to tune to 200 metres with its core fully withdrawn. Then, by means of the ganging gear, all of the cores are gradually inserted and a readjustment is made for each coil at exactly 300 metres. When this has been done it is found that the error of a five-gang circuit over the whole waveband is not more than ·5 per cent—a very remarkable figure.

Experimental work on iron-dust cored coils is proceeding, and we may hope, in time, to see them placed on the market. They will not render existing sets obsolete or anything of that kind, though they will make for greater compactness and more constant performance.

A PRACTICAL MAN'S CORNER

—continued from page 138

Nut Spoilers, Too

Other constructors are very hard on both hexagon and round, milled-headed nuts. Some of them, in fact, rapidly turn hexagon nuts into round ones! Here the trouble is very often due to the use of ordinary flat-nosed pliers for tightening down or loosening nuts. With pliers of this kind you really cannot obtain a proper grip, and if you look at Fig. 5 you will see why.

The jaws of such pliers cannot grasp the flats as they should; they grip them only at their top edges. If any force is used a slip is probable and incidentally a pinched finger is not unlikely. This kind of treatment soon removes the corners of a nut, and then there is little left for anything to grip.

Flat-nosed pliers are also far from ideal for use with milled-headed nuts, for here again the grip is very insecure. If you want to use pliers instead of a box-spanner, a far better tool is that illustrated in Fig. 6. This is the nut plier, to which I referred some time ago in these notes. Its jaws are so shaped that they do obtain a sound grip on either the flats of hexagon nuts or the milled rim of round ones. You can buy nut pliers at any toolshop, and their cost is only a shilling or so.

For Panel-Mounting Components

Rather a problem is sometimes presented by the fixing nuts of those components which are mounted by means of a $\frac{1}{4}$-in., $\frac{5}{16}$-in., or $\frac{3}{8}$-in. bush inserted through a hole in the panel and locked by means of a fixing nut. These nuts are occasionally of rather large diameter, and often they are somewhat thin.

Ordinary pliers are almost hopeless for the job, and even nut pliers are not too satisfactory. The other day I found at Woolworth's a tool which offers an excellent solution of the problem. This is a set of two double-ended box spanners with a small tommy-bar. One of the spanners fits inside the other, so that they take up very little room in the tool drawer.

They are sold, by the way, in sets of various sizes, but if you have in your pocket one or two samples of panel bush nuts you will easily be able to select the appropriate set for wireless constructional purposes.

IN LIGHTER VEIN

—continued from page 148

Report on the Goop-Wayfarer "Sandhopper" Six

IT is always a real pleasure to test out a first-rate wireless set, but I cannot say the same of one such as your "Sandhopper" Six. Mercifully, such extraordinary productions come one's way but seldom. It is an outstanding example of all that is bad in both design and construction. Owing to the utter lack of care taken over the wiring, connections are remarkably full of short circuits, some of which are masterpieces of folly, demanding all one's ingenuity to see how they could have been perpetrated. Rectification of these faults proved a perfect nightmare. Tuning is flat, falling lamentably short of the knife-edge sharpness called for by present-day conditions. In point of sheer appalling quality the set is the most amazing that I have ever handled. Its notable lack of sensitiveness is fully in keeping with the rest of the set's performances.

S. O. HIGH.

Practical notes on possible wavelength changes and how the various foreign programmes are coming over.

THE likelihood that Europe's wavelengths will be reshuffled and dealt out anew in the autumn (as a result of the Lucerne Conference) lends a special interest just now to the behaviour of foreign stations. Many of them have held their present dial-positions for so long that any change-round seems a very revolutionary proceeding; and certainly the owner of a set with station-names instead of wavelengths engraved on its dial would appear to be in an unenviable position if the old favourites are to be suddenly shifted to new dial readings.

* * *

Such a change, however, would probably settle some much-disputed questions—such as whether the good reception of Budapest is due to the station or to the wavelength it employs, for example. And any wide changes in wavelength allotment might have the effect of relegating some of the best-liked stations to secondary places, and bringing forward new favourites in their stead.

* * *

Quite apart from such upheavals, there is much of interest for the long-distance listener to look for. By the time these lines appear the new Vienna station will probably be going strong, at the top of the dial.

On long waves Kalundborg's new transmitter should be enlivening 1,153 metres. Nearer home, on medium waves, the B.B.C. has come forward with the West Regional "twins," and the question of whether London's 261·6 metres will be affected by the West National has to be decided.

* * *

Russia continues to put her spoke in the wheel by introducing new stations on both long and medium waves. One new Moscow station has been experimenting on a wavelength just above that of Eiffel Tower; whilst another Russian—or possibly the same station on an altered wavelength—has been interfering with Huizen to some extent.

It is evident that the success of any new wavelength distribution must take account of the Soviet stations, for although it was not necessary to pay much attention to them when they worked on lower power, the new 500 kilowatters will be easily receivable over quite a good proportion of Europe next winter.

* * *

Despite several bad bouts of atmospherics, the after-dark reception of dozens of foreigners has not been at all difficult on good three-valvers. Poste Parisien, Breslau, Katowice, Rome and Brussels No. 2 have been specially good; whilst Florence, Prague, Vienna and Budapest have vied for prior place near the top of the dial.

Langenberg, on 473 metres, has been providing some remarkably consistent breakfast-time programmes; but Hilversum, which was for long a favourite at that hour, seems to have fallen off rather badly.

* * *

On long waves Warsaw has been outstanding, and the fact that this is an unusually good summer for long-distance reception is now well established. Even on the brightest days there is quite a good bag of foreign programmes awaiting the keen searcher at all hours of the day.

INDEX TO ADVERTISERS

All communications concerning advertising in "Wireless Constructor" must be made to John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. Telephone: City 7261.

Printed and published on the 15th of each month by the Proprietors, The Amalgamated Press, Ltd., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices only: Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. Registered for transmission by Canadian Magazine Post. Subscription rates: Inland and Abroad, 8/6 per annum. Canada only, 7/6 per annum. Sole Agents for South Africa: Central News Agency, Ltd. Sole Agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd. S.S.

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