The Wireless Constructor

6d

Vol. XIV. AUGUST, 1932. No. 70.

JOHN SCOTT-TAGGART F.Inst.P. ON ARE PENTODES WORTH WHILE?

HOW TO MAKE "S.T.300" COILS AND FROM MY ARMCHAIR

The "ELECTRO-SCREEN" THREE

by VICTOR KING

ALSO THIS MONTH:

VALVE DETECTION MADE READABLE

By Herbert K. Simpson.

RADIO POWER PROBLEMS

"CLEANING UP" THE SUPER-HET.

B.B.C. NEWS ROUND THE DIALS

Etc., Etc., Etc.

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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.

The WIRELESS CONSTRUCTOR

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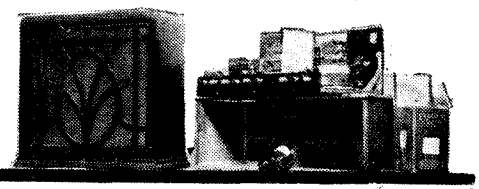
THE EDITOR'S CHAT



"S.T.300" AND GROWING ENTHUSIASM—THE "ELECTRO-SCREEN" THREE—A SUGGESTION FOR BROADCASTING HOUSE—NEARLY A MILLION MORE LICENCES.

"ARE Pentodes Worth While?" is the title of a most interesting and provocative article which is contributed to this issue of THE WIRELESS CONSTRUCTOR by Mr. John Scott-Taggart. In it readers will find discussed from practically every conceivable point of view the merits and demerits of pentode valves, concluding with Mr. Scott-Taggart's considered opinion on this interesting and vitally important topic.

For the "S.T.300"

Mr. Scott-Taggart also tells readers how to make the "S.T.300" coils.

The widespread interest taken in the famous "S.T.300" receiver is well known to every reader, but it is a fact that that interest has been so intense and so maintained that Mr. Scott-Taggart has received during the last few weeks literally hundreds of letters from interested constructors of the "S.T.300" asking for details for the home construction of the coils, and I felt that in inviting Mr. Scott-Taggart to contribute a special article on this subject to THE WIRELESS CONSTRUCTOR I was echoing the wishes of many thousands of readers who have built the "S.T.300" and who wish to indulge their hobby to the further extent of making the coils for themselves.

In this issue is also included an extra specially long instalment of Mr. John Scott-Taggart's monthly feature "From My Armchair," while Victor King describes the "Electro-Screen" Three—a very powerful but most compact receiver employing an S.G. valve and Extenser tuning.

Checking Loudspeaker Response

Reference was made in last month's issue to a contributor to the "Daily Telegraph" who commented on the poor response of broadcast receivers, and who ventured the opinion that the majority of receivers now in use probably fail in their reproduction of sound below 150 and over 4,000 cycles per second.

Pure Note Scale

This contributor went on to say that we have no means of judging how far our receivers are at fault, and this is a point where the B.B.C. could give listeners valuable assistance and, at the same time, give greater impetus to the design of better receivers.

This could be done by the B.B.C. occasionally broadcasting a scale of pure notes, or notes free from harmonics, starting at 30 and rising to 10,000 cycles per second. By listening to this it would be possible to judge what our receivers would and would not do. Broadcasting a series of tones from 30 to 7,000 cycles per second would be a good start, but it is suggested that the B.B.C. should aim at at least 10,000, since the ear is sensitive to between 15 to 20 thousand cycles per second.

We recommend this suggestion very strongly to the B.B.C., and in particular we suggest that the B.B.C. engineers should bear in mind that the majority of listeners do not employ loudspeakers so excellent in quality as those installed for testing purposes in Broadcasting House.

"Effects" in Radio Drama

This point should be particularly borne in mind in connection with "effects" in a broadcast play. In the Control Room there is a first-class loudspeaker whereby the producer of a radio play can gauge the type of effects necessary for any play he is producing, but it should be remembered that although the effects may come through excellently on the loudspeaker in the Control Room, the average listener probably gets something entirely different, and certainly not half so good.

There are many, many thousands of portable sets incorporating loudspeakers in use to-day, and it is inconceivable that the effects obtained by the B.B.C. when judged by their own loudspeakers can be faithfully reproduced to such a high standard by speakers of the portable set type.

"Portable" Test for B.B.C.

In fact, the B.B.C. might achieve a greater effect in certain broadcasts if, instead of judging the effects they aim at by the special loudspeakers in Broadcasting House, they judged them by the reproduction qualities of an average portable loudspeaker set.

Still Growing

The fifth annual report of the British Broadcasting Corporation, presented recently to Parliament, shows that 1931 was a year of "steady and continuous progress."

On December 31st, 1930, the number of licensed listeners was 3,411,910, and on December 31st, 1931, it was 4,330,735, an increase for the year of 918,825. These figures include the licences issued free to blind listeners, which increased by 9,521 during 1930, from 19,460 to 28,981.

The net revenue for the year exceeded the 1930 figure by over £200,000. The greater part of this increase was in licence issues. The revenue from publications also increased considerably during the year. The capital expenditure amounted to over £907,000.

Income totalled £1,425,349. Of this, £1,179,031 was received from licences, while £237,834 was revenue from publications.

LISTENERS' LETTERS

A selection of readers' letters, from our correspondence files, of particular interest to loudspeaker builders and short-wave enthusiasts.

Simplified Cone Cutting

The Editor, WIRELESS CONSTRUCTOR.

Sir,—Referring to Mr. Summerfield's very interesting letter on the above subject, on page 107 of the June number, may I point out that his construction can be simplified by merely drawing the triangle ABC, AB being the radius and AC the height of the cone. After describing the circle GHJ and stepping off six times AB from G to H, add to H the quantity HJ, equal to *one-eighth of the height.* This will approximate much more closely to the truth than the addition of the constant quantity EF.

A still more accurate result is obtained by making HJ equal to one-seventh of the height.

Yours faithfully,
"HOBBY."

Bromley, Kent.

Another Method

The Editor, WIRELESS CONSTRUCTOR.

Sir,—One great difficulty many people seem to come up against is that of making a cone for their L.S. unit.

THE WAY IT'S DONE

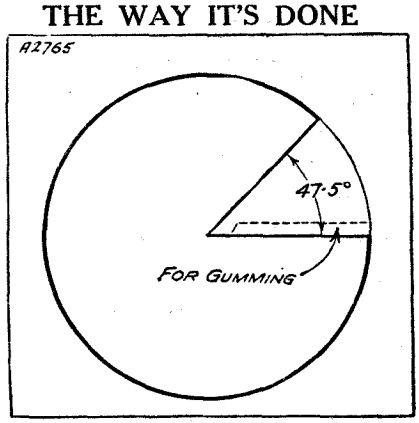


Fig. 1. This shows how much of the circle of cone paper should be cut away for the cone specified in this letter.

Here is the method I employ for making a cone of any specified size.

Perhaps you will think it worth while to publish this idea, as I should like your readers to try it.

Assume we require a cone 4 in. high and 14 in. across the mouth.

First find C thus: $a^2+b^2=c^2$, i.e. $16+49=65$, and $\sqrt{65}=8{\cdot}06$ (radius of circle to be cut out). To find circumference of circle to be cut out:

$2\pi r=16{\cdot}12\times3{\cdot}1416=50{\cdot}7$ in.

To find circumference of mouth of cone (the radius being 7 in.):

$\pi D=14\times3{\cdot}1416=44$ in.

Section to be cut away will be $\frac{(50{\cdot}7-44)\times360}{50{\cdot}7}=47{\cdot}5°$.

This is the arc to be cut out, not forgetting to leave a small strip for gumming. (See Fig. 1.)

Note.—This is only accurate to ·1 in., but greater accuracy can be obtained by using further stages of decimals.

I am, sir, yours truly,
"HELP."

Plymouth.

A "Kelsey" Adaptor in India

The Editor, WIRELESS CONSTRUCTOR.

Sir,—Last year, whilst on leave in England, I purchased a Mullard "Master" Three set. A friend of mine home on leave part of the same time purchased an Osram "Music Magnet," and on his return to India last October took the set along with him. He wrote me saying that broadcast wireless reception was a wash-out as far as India was concerned.

Neither of us knew a thing about wireless, and it looked as though there would be a couple of respectable sets given away.

Just as I was about to return to India I saw the January issue of THE WIRELESS CONSTRUCTOR, and, scenting some sort of salvation, I rushed off to purchase the parts necessary for two "Kelsey" Adaptor sets and got them in the boxes just in time.

Astounding Results

The results obtained have been astounding and give us exiles a new outlook on what was a somewhat dreary life.

My friend is stationed in a heaven-forsaken hole on the southern fringe of the Sind Desert, whilst I am stationed on the northern fringe some 400 miles away.

Have enclosed part of a note received from my friend (my reception has been about the same). No doubt you will find it interesting, and from the strain in which it is written you may be able to conjure up in your imagination how much of the buoyant feeling is due to your adaptor.

It has been mighty difficult to feel cheery at times when alone in a night temperature around 105 degrees, with nothing more exciting to do than swipe mosquitoes, etc., out of existence.

Many thanks for what you have achieved for us and good wishes for the future.

Yours sincerely,
H. ROBERTS.

North Road, Moghalpura,
Punjab, India.

The Enclosed Letter

In Office,
Sweating in the afternoon
of 28th inst.

Dear Joss,—*I had such good results on the Kelsey last night* that I thought I would write you all about the same. I am not yet satisfied that all is yet O.K., as I am still short of H.T.

I have an idea I told you in my last letter that the first station I received was Schenectady, U.S.A.; as I have not heard him since I am beginning to disbelieve myself. Still, as you have no doubt found out for yourself, it's a question of getting in while the station

COLLECTING THE DATA

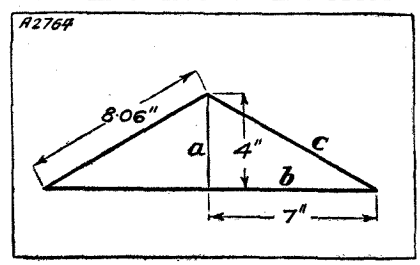


Fig. 2. Here is a side view of the particular type cone required, and it should be drawn first of all to obtain the data for cutting the cone paper.

is actually broadcasting; more often than not the blighter you are after is shut down.

My log so far (I have only had it on two nights) include Rome, Singapore, Paris Colonial, Russia (Moscow), the loudest yet, in addition to the above. Late last night I heard a very interesting English amateur offering the man he was in touch with a present of a model aeroplane he had made providing he had a kid it would interest. I tried to get their call, but it was not repeated.

So you will see *my adaptor is well worth while,* for on the broadcast band I cannot get anything worth having during the summer. The best of the short waves is that they are entirely free from atmospherics—*what a blessing out here.*

John Scott-Taggart ASKS —

Are Pentodes Worth While?

— AND EXPLAINS WHAT THESE VALVES ARE, AND WHAT THEY DO

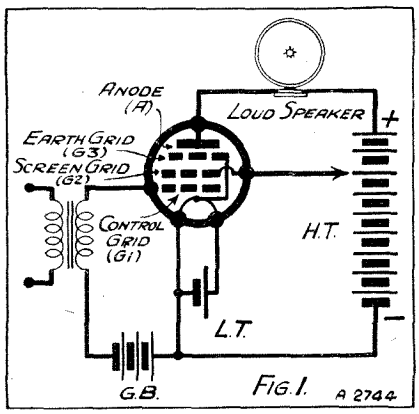
The pentode has been introduced to the public comparatively recently, and below our famous contributor explains in easy-to-understand language the many mysteries of this remarkable member of the valve family. From the facts and information given, the reader should have no difficulty in deciding whether or not the pentode is really worth while for the circuit he has in mind.

IN 1919 I was obsessed by grids. Perhaps every valve and circuit inventor goes through this phase. He dreams of grids within grids during the day, and at night he has nightmares of even more complicated valves.

From the Patent Office files it would seem that I was the first British inventor to be really bitten by the multi-grid germ. Innumerable receiving circuits were evolved, including super-het. bi-grid "mixers," reflex circuits, and other applications which were mostly the result of sleepless nights spent wrestling with all the possible ways one could use extra grids.

Some of these inventions have only recently come into their own. For years after 1919 British valve manufacturers looked with horror upon the idea of making even double-grid valves; whereas now they think nothing of A.C. pentodes with their filaments, cathodes, anodes, and groups of three grids.

FIVE ELECTRODES!



A pentode has five electrodes, comprising cathode, anode, and three grids. The inner grid is used for control purposes, the middle one is the screening electrode which is connected to H.T. positive, while the third, or outer grid, is joined to the cathode, inside the valve.

Germany's Glut of Grids

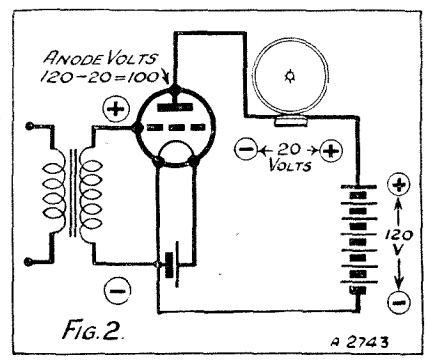
The Germans have always been fond of extra grids. In 1918 I took possession of what seemed to be a complete depot of military wireless gear—a wonderful capture.

Extra grids in their valves were a noticeable feature of their technique, although I found, during the brief time I had for tests, that in spite of these complications their valve apparatus generally was far behind ours in technical efficiency.

But in spite of Germany's backwardness in radio matters during the war, we owe them not a little for their work on multiple grids.

We in this country may be slower starters, but in the matter of valves —whether triodes, tetrodes, or pentodes—we have certainly won the race.

OPPOSING THE OUTPUT



Mr. Scott-Taggart explains that in the case of ordinary three-electrode power valves the actual output obtainable is lessened by a back E.M.F. produced by the inductive effect of the loudspeaker windings. This diagram helps to illustrate the point.

"S.T." Tells Readers All About the Pentode—

What is a pentode? Its name—derived from the Greek—means a five-electrode valve. The five electrodes are the cathode, anode, and three separate grids one inside the other and all situated between cathode and anode. The cathode, in the case of a battery-operated valve, is, of course, the filament.

Meet the "Earth Grid"

The object of the filament and anode will be well known to the reader; while the "control grid"—which is the first of the three—comes next to and surrounds the filament. Its purpose is exactly the same as that of the grid in an ordinary three-electrode valve, namely, to vary the anode current.

The signals to be amplified by the pentode are applied across this grid and the filament.

The next grid is the auxiliary grid (or screening grid, as it is sometimes called), and it is placed round and outside the control grid. This screen grid is given a high positive potential which is usually somewhat less than the full anode voltage.

The last grid comes nearest the anode and is an "earth grid"; it is connected inside the valve itself to the filament, the junction usually being made at the middle support between the two V's of wire which form the filament of the average pentode.

Apart from this last grid, the pentode greatly resembles an ordinary screen-grid valve, and its technical operation also resembles its elder brother.

But whereas the S.G. valve is primarily designed for high-frequency amplification, the pentode (for the present, at any rate) is chiefly used for the output stage of a receiver, and consequently it passes a heavier anode current.

Why is a pentode needed when we have excellent output valves already?

The reply is that, whereas the pentode did not revolutionise technique to the same extent as did the S.G. valve, it was a definite advance in the direction of higher efficiency.

The pentode can be made to give a large output with quite low values of H.T., and its "sensitiveness" can be made higher for a given output. In other words, louder signals are obtainable with a given input voltage; or, putting it the other way, we can get good loudspeaker results with weaker input signals.

A Big Break-Away

The amplification factor of a pentode is higher than that of a comparable triode (three-electrode valve). This makes the pentode particularly useful in portable and other receivers where the number of valves is to be kept down to a minimum and the H.T. current confined to a reasonable figure.

How far the trend towards fewer valves is desirable is a highly debatable point, and I believe there may easily be a big break-away from the magic number "three" in set designs in the near future.

As long as there is a psychological attachment to that mystic figure we are likely to continue with the glut of "threes," and to get better results we shall, no doubt, use pentodes.

To what must we attribute the benefits of the pentode? To understand the action of this valve we can consider the simple circuit of my first diagram.

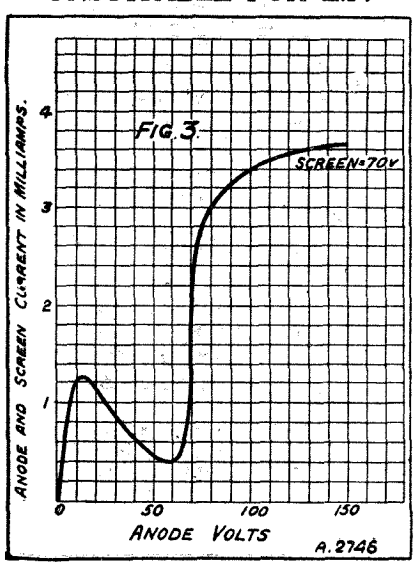
The connections to the three grids are clearly shown, the grid G_3 being connected to the filament inside the valve. The reason for this grid—even though it is the one which turns an S.G. valve into a pentode—we can leave to the last.

How It Differs

The action of the circuit I have given differs from that of an ordinary power valve in the following way: When signals are applied to the grid of a three-electrode valve having a loudspeaker in its anode circuit, the amplified low-frequency currents which pass through the speaker windings will set up back-E.M.F.'s which reduce the amplification obtained.

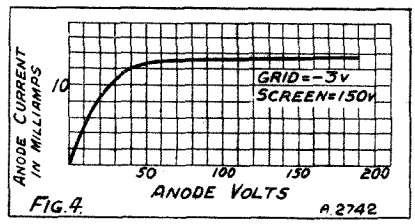
Imagine that we are dealing with a momentary positive impulse to the grid. If we had nothing but the H.T. battery in the anode circuit there would be an increase in anode

UNSUITABLE FOR L.F.



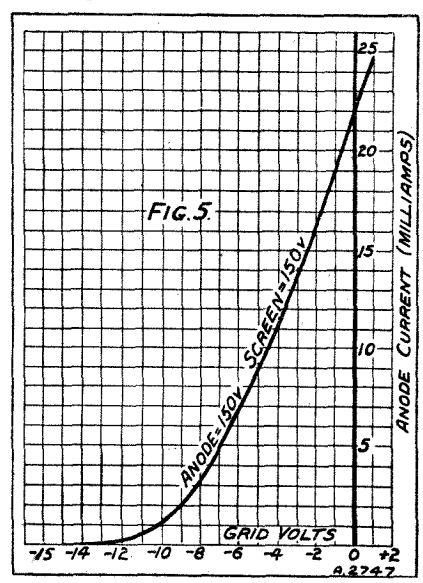
An S.G. valve has a property known as negative resistance, but it is present only when the screen potential is above that of the anode, thus attracting secondary electrons from the anode. It is represented in this diagram by the "kinked" characteristic curve.

NO NEGATIVE RESISTANCE



In a pentode, where negative resistance is undesirable owing to the large voltage variations that are dealt with, an "earthed" grid is interposed between the anode and the screening grid. This keeps back any secondary electrons that may leave the anode during an extra-large voltage variation.

QUITE HARMLESS!



This grid volts–anode current curve represents the characteristic of a popular type pentode. And as you will see, to all appearances it is very much like that of an ordinary power valve.

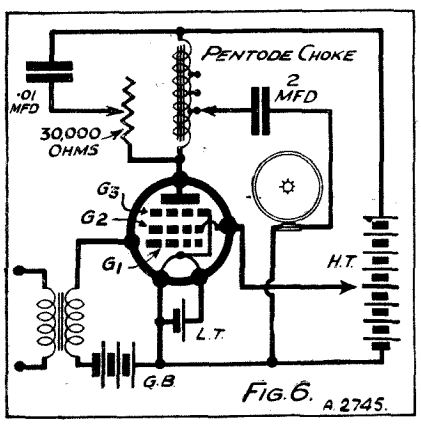
—The Valve that "Revolutionised" L.F. Amplification

current. The anode *voltage* would remain practically unaltered and the full anode current change could be estimated from the published grid volts–anode current characteristic curve of the valve.

When there is a loudspeaker in the anode circuit the sudden increase in anode current will set up an E.M.F. across the speaker, since the latter is a sort of iron-cored inductance coil.

This E.M.F. is such that the anode side of the speaker is negative with

BALANCED OUTPUT



A pentode has a fairly high impedance, and in order to match it up to the loudspeaker it is advisable to use a tapped output choke arrangement as shown here. To reduce the high-note gain, which is rather pronounced in this type of valve, an impedance equaliser, consisting of a condenser and resistance in series, is joined across the choke.

respect to the other side. This E.M.F. will be in opposition to the steady voltage given by the H.T. battery. The result is a reduction in the voltage of the anode.

Anode Current Drop

This, in turn, tends to cause a drop in anode current. The final result is that the anode current change is less than it would have been had there been no loudspeaker in circuit.

Fig. 2 shows a sample case. The grid is made positive by the signals. This causes a rise in anode current. This sets up 20 volts across the inductance of the loudspeaker. This 20 volts acts in opposition to the steady 120 volts of the H.T. battery. The anode voltage is now no longer 120, but 120 minus 20, which equals 100 volts.

Thus the moment the anode current tends to rise the anode voltage begins to drop, and the result is that the full increase of anode current is never obtained.

When the grid is made *negative* and we desire a big *drop* in anode current, the change in current through the speaker sets up a 20-volt E.M.F. across its terminals; this time the 20 volts help the 120 volts of the H.T. and the anode voltage rises to 140 volts. But this rise is a nuisance, because it tends to *increase* the anode current just when we want it to drop.

Thus with an ordinary valve we are partially defeated by the alternating E.M.F.'s set up across the speaker, these always opposing and lessening the big anode *current changes* which we desire.

Quite a Small Voltage

In the case of S.G. valves and pentodes this opposing effect is greatly reduced, because although the anode voltage is changing above and below its normal value of 120 volts, the screen grid prevents these voltage swings from influencing conditions on the other side of it.

The anode current of a pentode is derived from the electrons reaching the screen grid, and quite a small anode voltage (with respect to filament) will collect most of these. With, say, 120 volts on the anode, the latter has more than enough voltage to draw up the greater proportion of electrons reaching the screen grid, so anode voltage fluctuations around this figure will produce no change in the current, which is always more or less at "saturation" value.

Since, in a pentode, a change in anode volts over a wide range produces little change in anode current, we can get big voltage swings on the anode due to the loudspeaker without their making any difference to the anode current. The full effect of grid voltage changes is thus obtained. There is now nothing fighting against their efforts.

Vitally Important

It is important to realise that the control effect of the grid on the anode currents still holds good even though anode voltage changes make no material difference to anode current.

The screen grid (or auxiliary grid) is of vital importance.

If this grid were given zero potential, the full voltage on the anode (say, 150 volts) would produce only the slightest anode current; the screen grid would act as an almost impenetrable barrier to the attractive force of the anode.

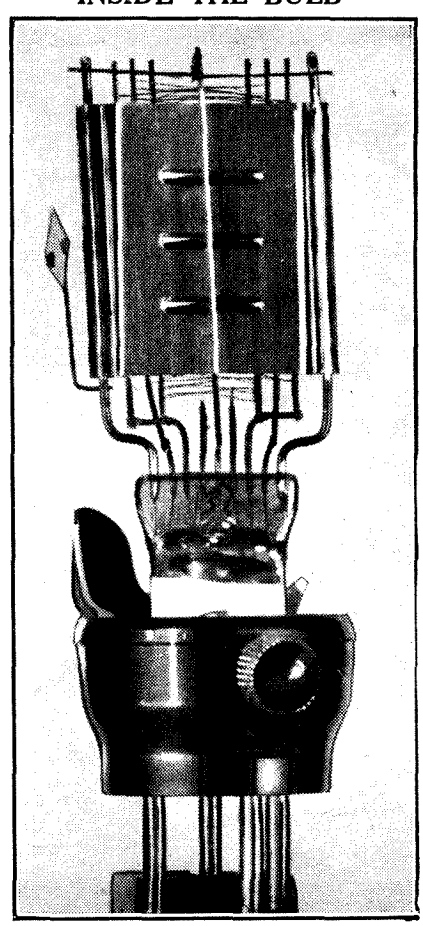
But by giving the screen grid a very high positive potential the electrons are brought right up to the screen grid. Once there, they are readily attracted to the anode. The screen grid, therefore, acts as a "decoy duck" luring on electrons, which then shoot through the open spaces and pass on to the anode.

The Screen-Grid Current

Of course, some of the electrons stay at the screen grid and form a screen-grid current, but this current is not large and nothing is done with it.

Variations in control-grid potential vary the number of electrons going to the screen grid and thus the anode current in turn is varied.

INSIDE THE BULB



A pentode, with its large number of electrodes, is a very complicated structure as this photograph showing the arrangement of the electrodes inside the glass testifies. Note the multiplicity of supports emerging from the "pinch."

Are Pentodes Worth While?—*continued*

We now come to the "earth grid" connected to the filament.

Readers of my articles will be familiar with the characteristic curve of an S.G. valve. It possesses a "negative resistance" part of its curve. This occurs when the anode voltage is less than the S.G. voltage.

Prodigal's Return!

Under these conditions "secondary" electrons which are knocked out of the metal anode by the electrons arriving from the filament decide to leave the anode for the more attractive screen grid, which is at a higher potential. The anode is now losing more secondary electrons than the primary ones it is gaining, and the anode current thus falls as the anode voltage is increased.

As the anode voltage is increased *above* the screen-grid volts, the previous deserters — the secondary electrons —decide that home's best.

This decision is not really from any loyalty to the anode, but simply because the anode is now more positive and therefore more attractive. The secondary electrons are still knocked out of the anode, but return to it, and so can be ignored.

The further increase in anode voltage now causes an increase in anode current until we reach a flattish portion of the curve, which is where we work the S.G. valve for H.F. amplification. The negative resistance part of the S.G. curve is a nuisance for H.F. work, but it does not matter much because the anode voltage swings are small.

Large Anode Swings

In the case of the pentode, however, the anode voltage swings are large, and these E.M.F.'s across the speaker set up large potential differences across the anode and the screen grid, as will be seen from the position of the speaker between these electrodes. (See Fig. 1.)

Now the anode is being bombarded by primary electrons which originated at the filament, and this bombardment sets free secondary electrons from the anode. The anode is therefore also a cathode.

If the screen grid (G_2) ever becomes positive with respect to the anode, as it will when high alternating E.M.F.'s are set up across the speaker, secondary electrons will tend to leave the anode and go to the screen grid. This is highly undesirable, and we stop it happening by putting an "earth grid" between the anode and screen grid.

If you consider the anode acting as a secondary emission cathode and the screen grid as the secondary emission anode, the earth grid (through being connected to the filament) will have become very highly negative with respect to the secondary emission cathode—so much so that even with very high positive swings on the screen grid no secondary electrodes would leave the neighbourhood of their source.

The easiest way to understand these secondary emission effects is to turn Fig. 1 upside down and then A becomes the cathode, G_3 is the "stopping" grid with a high negative potential and G_2 the would-be anode. Thanks to the "stopping" grid (i.e. the earth grid) we can forget the secondary electron effect.

The stoppage of secondary electron currents alters the whole curve of the pentode. The S part of Fig. 3 (an S.G. characteristic curve) disappears and we get the simple type of pentode curve of Fig. 4.

This curve has no negative resistance slope in it, and very wide anode voltage swings are possible.

But just as the S.G. valve when operated with proper voltages possessed a grid volts–anode current curve similar to that of an ordinary three-electrode valve, so is a pentode curve of that type perfectly straightforward.

Study the Working Curves

A sample is given in Fig. 5, which is the curve of a Pen.220A. with 150 volts on the anode and 150 volts on the screen grid. It is quite harmless.

Although such curves showing the effect of grid volts on anode current are simple enough, the merits of the valve in actual operation are only seen by a study of the anode volts–anode current curves under given conditions of screen-grid voltage and control-grid voltage—which latter is biased negatively as in the case of a triode amplifier.

The beginner may imagine that the purpose of the screen grid in a pentode is to stop low-frequency oscillation, just as the screen grid in an S.G. valve does.

But actually this is not so, and even in the case of an S.G. valve the screen grid gives added—and, as it were, accidental—advantages over and beyond the reduction of a tendency to oscillate.

Not Very Popular

In a pentode there is no appreciable change in anode current with anode voltage swings; moreover, the screen grid shields the control grid from the anode voltage swings. This latter advantage prevents the reduction in signals which is caused by the capacity between grid and anode in a three-electrode valve.

Unfortunately, the present construction of pentodes (with leads going out together, etc.) does not make for low capacities.

The pentode has not achieved much popularity amongst home-constructors—partly because of its

(*Please turn to page* 212.)

PENTODE POINTERS FROM THE PEN OF "J. S.-T."

"Apart from the earthed grid, the pentode greatly resembles an ordinary screen-grid valve."

* * *

"The pentode can be made to give a large output with quite low values of H.T., and its 'sensitiveness' can be made higher for a given output."

* * *

"The pentode is particularly useful in portable and other receivers where the number of valves is to be kept down to a minimum."

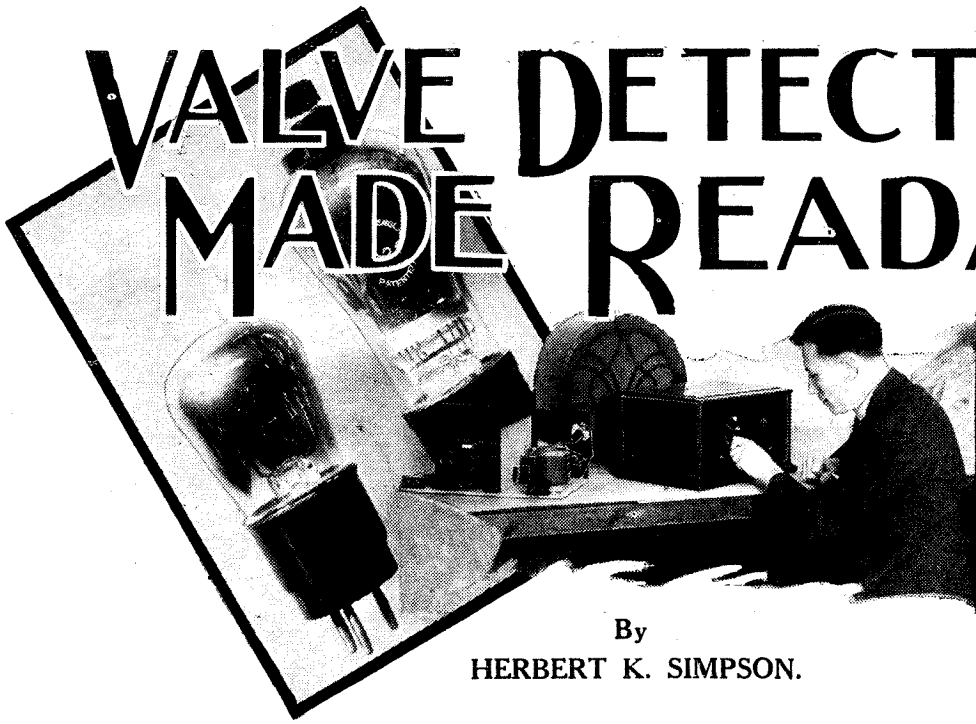
* * *

"The pentode has not achieved much popularity amongst home-constructors—partly because of its price and partly because it accentuates the high notes."

* * *

"The matching of load and valve is of importance, and is effected in practice by a multi-tap choke or transformer."

VALVE DETECTION MADE READABLE



Being an article on "THE DODDERING ARISTOCRAT OF RADIO!".

By
HERBERT K. SIMPSON.

THE heading to this article looks personal; abusive, in fact. But radio is too young, too alive, to have produced any *human* dodderers; and not enough money has yet been made in the industry to produce aristocrats.

No, I am referring to that inanimate part of every wireless set which preens itself as the detector. A great and glorious history has this detector. There was a time when it was the only thing that really mattered, when inventors made their names by merely fiddling with some new bit of mineral, some chip of rock.

Then came the three-electrode valve, which displaced the crystal and the older Fleming valve as detector. But most important of all came the low-frequency amplifier and the high-frequency amplifier.

But the detector—now nearly always a valve—stuck to its premier position. It was the turnstile through which all signals had to pass, and it was the smooth working of that turnstile that decided range and also, largely, quality of reproduction.

The Smug Detector

But high-frequency amplification before the detector, and—to a lesser degree—L.F. amplification after it, have developed and rendered unnecessary (so we vainly think!) any improvement in the valve that turns H.F. into L.F.

Is it any wonder that the detector valve is complacent, smug in its certainty of holding down its job? And aren't *we* self-satisfied and criminally neglectful in not exploring every avenue with the object of developing better and more sensitive detectors?

Screen-grid valves and pentodes rub shoulders with a valve device which hasn't varied for nearly thirty years. Too old at thirty. Definitely so. On its left we have new variable-mu valves, S.G. valves, pentode H.F. valves. On the right—I needn't introduce them to you—pentodes.

But the detector; has *it* tried to better itself? In detail, a little; in principle, not at all. In the homes of the country it hugs its condenser and grid leak with the quiet certainty that it will never have to budge.

Storms have raged around the detector. Mathematicians have gone blue in the face to prove the output quality of a certain arrangement is hopeless; and then gone white in the face on finding they were wrong. Condensers may vary, leaks may change, but the old detector goes on for ever. And nobody cares a row of pins.

An aristocrat? Of course it is! The "grid condenser" valve detector is not only the original De Forest detector of 1907, but in theory is identical with the father of all valve detectors—the 1904 Fleming valve.

"Guinea-Pig Directors"

A dodderer? Well, it works. But so do many guinea-pig directors and senile heads of businesses who ought to make way for younger men.

Age is not a criminal offence, but have we even made an attempt at developing newer and *different* detectors? No. Nor is that the whole indictment. Even the detector valves we use have earned paper reputations which are worthless.

They are reputations that for years have omitted all consideration of input impedances, Miller effects, grid-to-anode capacities; in short, dynamic *working* considerations.

I do not flatter myself that a tidal wave of invention will submerge the laboratories of the country as a result of this article. But in explaining briefly the operation of the valve detector, I want to emphasise its history.

Puffed Up With Pride

As regards detection, we are in a rut, ditched, bogged—and happy! Happy as people are who can say their ancestors came over with the Conqueror, happy as the Spanish

In this instalment of his beginners' series, Mr. Simpson opens with a lively tirade against his subject.

"We have not," says the author of this pungent article, "advanced an inch since valves were first used for detection."

Provocative in manner, lucid in style, Mr. Simpson challenges the complacency of inventors.

It Takes Six Minutes to Explain—

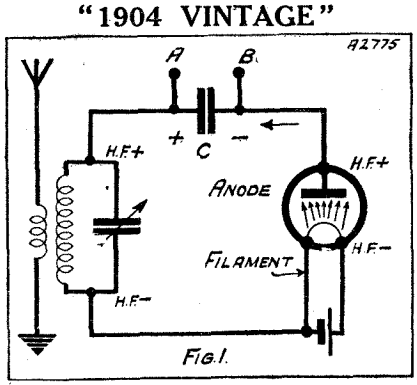
Grandees who—puffed up with pride of ancestry—ruined their country.

Let us examine the pedigree of this valve that never changes.

When Dr. Lee de Forest invented the three-electrode valve he stumbled upon the greatest treasure which radio science has known.

I use the word "stumbled" advisedly, because De Forest at first did not apparently understand what he had

"1904 VINTAGE"



This diagram illustrates how the old Fleming two-electrode valve worked. Music or speech is heard with the 'phones connected across the terminals A B.

done. Later, of course, he realised that he had produced an apparatus having immense possibilities.

But in the earliest days the valve was regarded as just another detector; in other words, simply a device for indicating the presence of signals in a receiving circuit.

Now although I suppose every valve set in the country uses a valve detector, the detecting powers of the valve are the least important. I will go so far as to say that we could easily have forgone the modern valve's detecting abilities, and if we had to jettison them to-day few tears would be shed. And if we put our hands in our pockets, it would not be to draw out a handkerchief, but to pay for a two-electrode valve of 1904 vintage.

No Farther Ahead

All this is very ungrateful to the valve of to-day, which is so docile that it will oblige as a detector, amplifier, or oscillator. But I intend to remain ungrateful. I go farther, and accuse the whole science of radio of having produced a good detector in 1904 and of then resting on its oars.

We are no farther ahead in the art of *detecting* wireless signals than we were nearly thirty years ago. Are we ashamed of the fact? Not at all. We rejoice in our backwardness, rub our hands unctuously over our petty progress, and clap ourselves on the back as each new "detector" valve is produced.

We mouth our satisfaction and smirk complacently as valve manufacturers croon to us about mutual conductance. We are so hypnotised by milliamps. per volt, so worshipful of the twisters of wire and blowers of glass, that we blind ourselves to the obvious defects of our detectors.

A Lovable Mongrel

The modern valve detector is really nothing more than a combination of a Fleming valve and a three-electrode valve acting as a low-frequency amplifier. It is a mongrel, and its birth was probably an accident. But, like most mongrels, it is really quite a lovable creature and a great convenience.

We also bless it because not only does our detector valve detect and amplify, but we can get reaction with it. That was another accidental discovery.

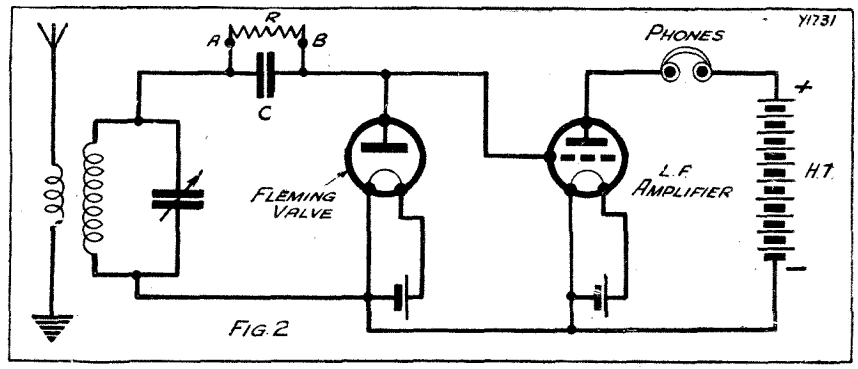
The triple action of the average detector valve, namely—as rectifier, L.F. amplifier and as H.F. amplifier (for reaction)—was not the result of a carefully-thought-out inventive campaign. It just happened. And although it will only take me six minutes to explain the operation, it actually took the inventors six years to understand the process.

Let us go back to 1904 and see how the Fleming two-electrode valve worked. In Fig. 1 I show it in operation; an aerial coil is coupled to an inductance tuned by a variable condenser, and this circuit is connected across the anode and filament of the valve. But notice that I have inserted a condenser C between the anode and the tuned circuit.

Now, when oscillations are produced in the tuned circuit due to the incoming signals, the anode will become alternately positive and negative, the potentials being readily communicated through the condenser C, since condensers pass A.C. As far as the H.F. (high-frequency) currents are concerned the condenser C offers no appreciable obstruction.

But a second effect is to be noticed. When the anode of the valve is made positive it will draw up electrons (which are negative) from the glowing filament. These electrons will flow into the right-hand plate of the condenser C. They will remain there because they represent a flow of "direct current" which cannot bridge the insulation between the condenser plates.

ONE OF THESE VALVES IS UNNECESSARY!



This diagram shows a three-electrode valve used to amplify the rectified currents obtained from the Fleming valve. You will probably notice that the high-frequency E.M.F.'s are applied direct to the grid of the second valve as well as to the anode of the first—thus making the Fleming valve quite unnecessary to the effective working of the circuit! *(See Fig. 3.)*

One-Way Traffic

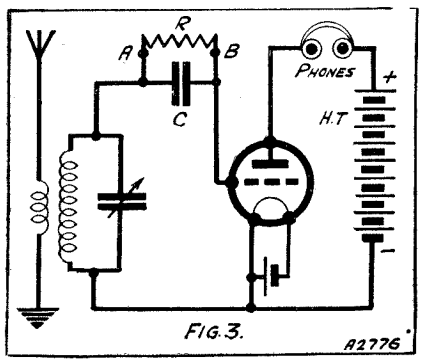
The negative half-cycles of the oscillations in the tuned circuit will make the anode of the valve negative and no electrons will be attracted from the filament, and no electron current can flow through the valve the other way (i.e. from anode to filament), because the anode is cold and a simple vacuum is non-conducting. Only when electrons are emitted is it possible to pass a current through

—But It Took Six Years to Make!

a vacuum, so the valve acts as a rectifier and electrons go on piling up on one side of C, making the terminal B negative with respect to terminal A.

The action of the circuit is exactly the same as that of a mains unit for converting A.C. into D.C. We change the H.F. signals (which are A.C.) into output currents which are D.C. By connecting telephone receivers across the terminals AB we shall hear the "signals," the current through the 'phones being a unidirectional one, which varies in sympathy with the

HOW WE DO IT NOW



This is exactly the same circuit as in Fig. 2—but the unnecessary Fleming valve has been removed. The three-electrode valve is, therefore, doing two jobs in one: detection and L.F. amplification.

music or speech being received. My previous article on the crystal detector will have made it easy for the reader to understand how modulated H.F. currents are converted by rectification into currents varying at low frequency.

The Fleming valve used in this simple way is not as sensitive as a good crystal, but it is very reliable. The next step in our progress towards the 3-electrode valve detector is to amplify the currents obtained from the Fleming valve.

Adding an Amplifier

This could be done by connecting the primary of an intervalve transformer to the terminals AB and applying the secondary across grid and filament of a three-electrode valve used simply as an L.F. amplifier.

There is, however, a simpler method which does not require an intervalve L.F. transformer. The circuit is given in Fig. 2. It will be seen that I have simply connected the anode of the Fleming valve to the grid of the second valve, and the filament of the first valve to the filament of the second.

In the anode circuit of the second valve are the earphones. What now happens is this: The voltages set up across condenser C are applied across grid and filament of the second valve and amplified.

The fact that the oscillating circuit is also across grid and filament circuit of the second valve means that the latter will amplify the H.F. currents, but, as the telephones do not respond to such currents, the currents run to waste and are ignored.

Since the inductance coil of the oscillatory circuit will pass D.C. potentials, the circuit of Fig. 2 is substantially the same as if we connected grid and filament of the second valve directly across the condenser C which supplies the low-frequency E.M.F.'s we really wish to amplify.

Easy To Be Wise

You will notice that a resistance R is connected across the condenser C. This "leak," as it is called, has a value of about 1 megohm (one million ohms), and its purpose is to prevent the condenser from "choking up."

If there were no leak the right-hand side of C would get charged up negatively and the electrons would remain there for ever. The D.C. voltage across C would "remain put" instead of fluctuating with the music and speech received. By letting the electrons leak away at a suitable rate, "choking-up" is avoided.

If it helps you, you can consider the rectified current as passing through the resistance and establishing E.M.F.'s across it, these E.M.F.'s being amplified by the second valve. The condenser C can then be regarded as an easy path for the H.F. currents to get to the anode and as a means of smoothing out the high-frequency unidirectional impulses into L.F. wave-form.

I should like to think that the inventor of the three-electrode valve detector drew out a Fig. 2 circuit and that it suddenly dawned on him that he could disconnect his Fleming valve without affecting the operation of the circuit. Of course, he did not do anything of the kind.

Purely a Passenger

But if you look at Fig. 2 closely again you will see that the H.F. E.M.F.'s are not only applied to the anode of the Fleming valve, but to the grid of the second valve. When this grid is made positive it will draw up electrons from *its* filament, and these electrons will charge up condenser C; when the grid is made negative it will draw up no electrons, and there will be no reverse-direction current, because the grid is cold and does not emit electrons.

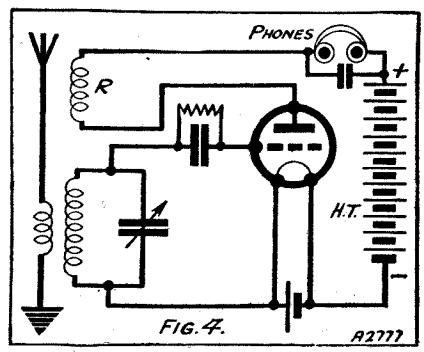
From this you will see that the grid and filament of the second valve act as a little Fleming valve on their own and render the main Fleming valve unnecessary. Nor does the Fleming valve action of the grid prevent it from being the means of amplifying its own L.F. potential variations. Although primarily used for controlling the anode current, the grid is doing a spare-time job which throws the Fleming valve of Fig. 2 out of work.

We thus get the circuit of Fig. 3, but, ingenious as it is, its merit lies chiefly in reducing the number of valves required—and the so-called sensitiveness of a detector valve is due largely to its efficiency as an L.F. amplifier and not as a detector.

Doing Three Jobs

We must always bear in mind that it is a two-in-one valve and that signal strength may be increased by improving rectification *or* amplification. The third function of most detector valves

REACTION AS WELL!



The addition of a reaction coil (seen at R in the diagram) represents the third function of this overworked valve. Mr. Simpson will deal fully with this in another article.

is to supply reaction, and Fig. 4 shows a typical circuit. The valve now not only detects with its grid circuit and amplifies the L.F. E.M.F.'s produced, but the amplified H.F. currents which we have hitherto allowed to run to waste are fed back into the grid oscillatory circuit by means of the

(*Please turn to page* 213.)

THE MONTH ON SHORT-WAVES

All the latest news about this interesting band.

I HAD rather an amusing experience during the last month. I can see the funny side of it now, but I must confess that at the time I felt rather like throwing the set out of the window!

My Mistake!

It happened to be a particularly good night for reception, and after a very promising preliminary "run up the band" I came across a really powerful transmission in the neighbourhood of 50 metres. The set was not my usual one, and in consequence I wasn't too sure of the exact wave, so out came the wavemeter.

I carefully found the absorption point, and then read off the setting on my calibration chart as 48·86 metres. That was where the fun began, because, as I afterwards found out, my eye had changed vertical lines in going up the graph and I was 1·14 metres out!

However, to revert to the story, I had listened to the transmission for quite a while, confident that I had at last found a new world to conquer. Imagine my feelings when I heard an announcement in English to the effect that a certain speech was full of International Proletariat Passion! Moscow, of course, on 50 metres!

Surprising how easy you can slip up with a strange set, isn't it?

A Busy Band

Have you noticed how the number of stations is rapidly growing around the 25-metre part of the dial? I can't say that I am sorry, for there has been rather more static than I care for in the region of 50 metres during the last month.

On one recent occasion I came across no less than six stations all between about 25 and 26 metres, and most of them were pushing out very good signals.

There was the harmonic of Moscow on 25 metres (yes, I knew *that* was Moscow!), Radio Colonial on 25·2 metres, W 8 X K on 25·25 metres, Rome on 25·4, G 5 S W on 25·53, and another station just slightly above G 5 S W which does not appear in my log book, and which I take to be a newcomer.

Lucky Lisbon

Rome is an infinitely better signal than G 5 S W in my part of the world, but since, when I am tuned in to our own station, I can still hear Rome in the background, I am tempted to wonder how listeners fare in other parts of the world where the relative strengths are equal. Perhaps if one of our overseas colleagues spots this he will enlighten us on the matter?

Our old Lisbon friend, C T 1 A A, is putting up an even better performance on his Tuesday and Thursday wave of 31·25 metres than was the case with his 42·9-metre transmission, and that is saying a lot! The quality and strength are excellent, and although he is still only using 2 kilowatts, the 31·25-metre broadcast comes over very much better—at least, that is my experience.

G. T. K.

"ON THE GRID"

Power from the Gas-Main—Short Terminals—Paralleled Accumulators—B.B.C. Mikes.

DOWN in a village in Dorset the other week-end I came across something surprising—a set run off the main. No, not mains; main! In fact, gas-main!

As a matter of fact, I thought all these "somethings" were completely dead a long time ago; but it just shows what goes on in radio which even we at Tallis House never hear of!

Do You Know Them?

For all we know there may be hundreds of the "somethings" in use, and giving satisfaction throughout the country. Perhaps you have not guessed what the "somethings" to which I am referring are. Well, they are known as "thermopiles."

They consist of a number of junctions of different metals joined in series, and each junction heated by a gas-burner. The effect of the heat is to produce a steady D.C. current sufficient for filament-heating, etc., and so the set is run from the (gas) main.

* * *

The saving of material on components, so long as it does not affect their efficiency, is always to be desired, because it helps to keep the prices low. But when it comes to economising by making terminal shanks too short I think it is a little too much of a good thing!

A Ha'p'orth of Tar

On quite a number of present-day components it is impossible to get three connections on to one terminal, and all for the sake of saving an eighth of an inch on the bolt. However, here is a makeshift that will often get you out of the trouble.

Many of the terminal screws are countersunk on their under-sides. So, if they are put on the opposite way round there is more room for the wires, because the terminal screws bite the thread sooner.

Very often when a listener has gone over from 4- or 6-volt valves to 2-volters he uses the cells of his accumulator as independent units. If they are of quite small capacity it would be better to use them permanently in parallel as one large 2-volt accumulator.

In Double Harness

This is because the actual ampere-hour capacity of a battery is dependent on the discharge rate. Two cells in parallel discharged at the same rate as one will most likely provide more than twice the number of working hours per charge.

* * *

What's an average set? It's impossible to say! I don't know. You don't know. But the B.B.C. is beginning to design its mikes with characteristics that dip in the middle so that reception will be nicely balanced on ordinary sets.

That's all very well, but very good receivers with straight-line, or nearly so, response will soon be at a disadvantage. What's more, the designer of a set will be puzzled to know exactly what constitutes a good design!

A. S. C.

The "ELECTRO-SCREEN" THREE

DOES your set kick off with the "det." valve ?

No ; I'm not going to say anything against it, because, as most of you know, there's an awful lot about the Det.-L.F. combination that appeals to me. But this is rather "screen-griddish" weather, isn't it ?

All in Vain

Long summer evenings, hardly dark before it is time to turn in, and quite a number of our old friends overseas speaking to us in far-away whispers instead of in that full-throated winter-time manner that makes distant listening so very much worth while.

And what happens ? People haul down their aerials ; not a few of them "spring clean" their sets ; possibly quite a number even go to the expense of buying new batteries, and then, at the end of it all, they find things are just the same !

It is so, isn't it ? And in ninety-nine cases out of a hundred it is nothing to do with the aerial or the set, or even the batteries. It's just not the weather for all-Europe listening—at least, not with a det.-direct-to-the-aerial arrangement.

I *could* go on and tell you something about these summer fade-out troubles, or, to give it its correct but hard-sounding technical definition, the ionisation of the atmosphere ; but I agree with you, it's not the weather for that either !

There is a Way

In any case, all the talking in the world will not alter the fact of what happens. But in many respects we are fortunate, for unlike that don't - care - if - the - boat - does - sink feeling consequent upon another type of wave-motion upheaval, there *is* a way of overcoming this little difficulty. That is where the screen-grid valve comes into its own.

I expect you are wondering what all this is leading up to ?

Well, I've been spending a lot of time of late in company with screen-grid valves, or, rather, perhaps I should say more accurately, in company with a screen-grid valve, and I've got a scheme for an S.G. three-valver that really does things—lots of things !

Designed to meet summer reception conditions, and to "hand out the goods" under the most adverse circumstances, this splendid long-range three-valve receiver will surprise you with its remarkable capabilities. It is selective, sensitive, and easy to build, and it will supply all normal requirements with ample power in reserve.

Designed and Described by

VICTOR KING.

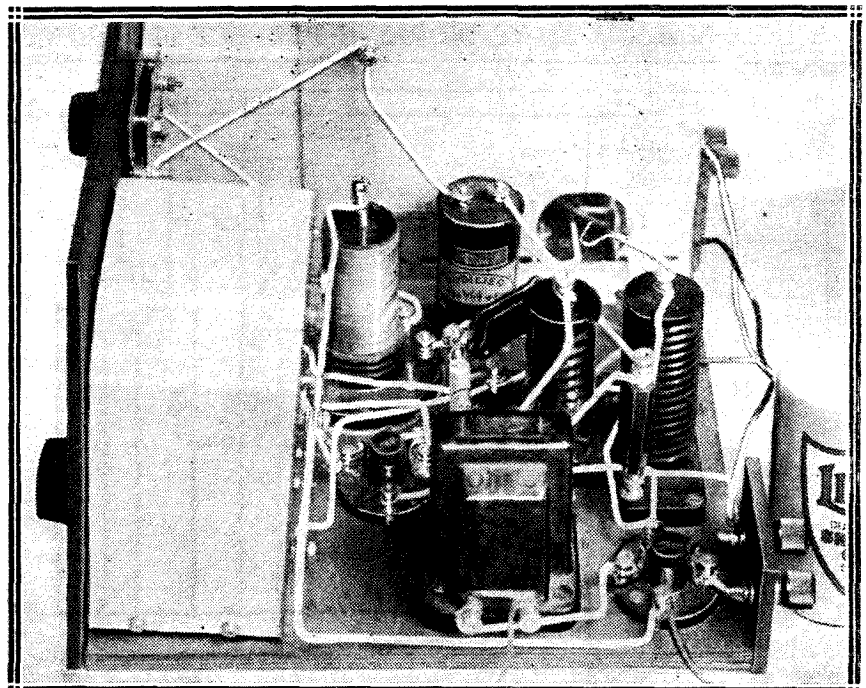
Let me try and be a little more explicit.

The requirements of an up-to-date S.G. three-valver, as I see them, are summarised in those three familiar, but often misused, words—sensitivity, selectivity, and simplicity.

Selectivity Without Loss

In these modern days a set is not an atom of good unless it will say good-bye to the locals in a very few degrees. Well, that in itself is easy enough to achieve, but the trouble is that in saying good-bye to the locals in a matter of a few degrees it isn't altogether uncommon to say good-bye to everything else as well !

IT PROVIDES POWERFUL HIGH-QUALITY PROGRAMMES



The set incorporates many interesting features, and is really delightful to handle. This picture shows the L.F. section that supplies powerful high-quality programmes to your loudspeaker.

The "Electro-Screen" Three—*continued*

That is certainly a tough nut to crack, but it is by no means a new one. It's one of the problems that has been with us ever since high-powered regional broadcasting came into fashion, and it all boils down to the fact that you can't have the jam on both sides.

Very Good Results

But you *can* have the jam in the middle! You *can* compromise in such a way as to obtain an adequate degree of selectivity for your own local requirements, combined with sensitivity sufficient to enable you to globe-trot at will.

And that is precisely what I have set out to achieve in the "Electro-Screen" Three. I have tried not to sacrifice any more of either than is absolutely necessary to achieve the objective.

The results, as you may imagine, are very satisfactory.

You get high-quality reproduction of the local programmes with adequate volume for all normal domestic requirements, and when you do want a change of programme—well, you get it without any tedious searching.

I have just been listening to Rome. But for the language it might have been one of the locals. Then there is Munich, Turin, Vienna, Budapest, all our old friends, they are all there, *and it is still broad daylight!* What further proof of genuine H.F. amplification is necessary?

Apart from the technical considerations, my aim in designing the "Electro-Screen" Three has been two-fold. I have endeavoured to combine compactness with an attractive panel appearance. To what degree I may have succeeded I will leave it to you to decide; but 12 in. by 7 in. for a S.G. three-valver is certainly getting down to midget sizes, isn't it?

As for appearance—well, I think the panel is *very* attractive!

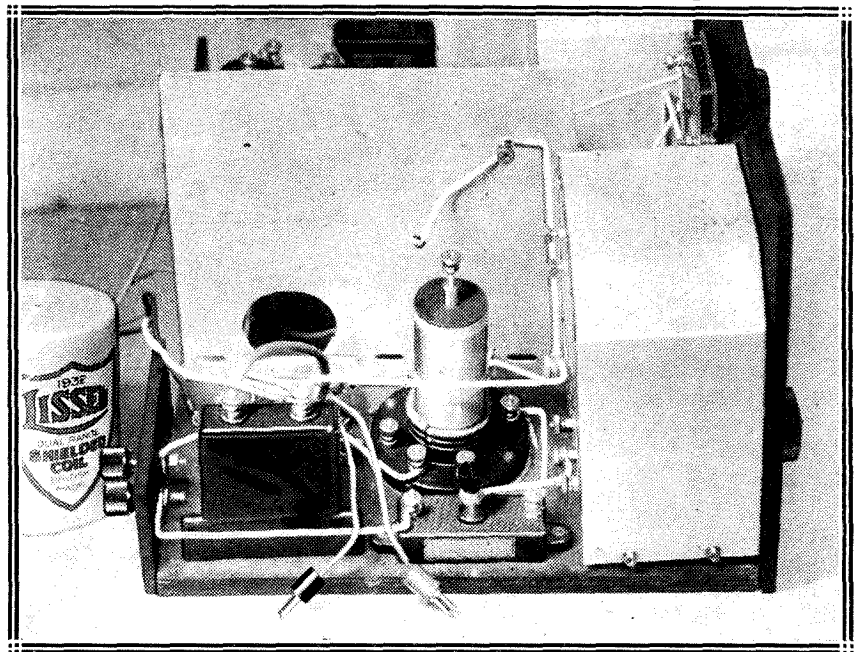
Just have a look at it and see if you don't agree. That is one of the advantages of being able to dispense with orthodox wave-change switches, for it enables the controls to be cut down to the very minimum.

Only Four Controls

In this case, for instance, there are only the two tuning controls (the two outer knobs), the reaction condenser (above), and the on-off switch, and with those four simple controls you can command almost any programme in Europe!

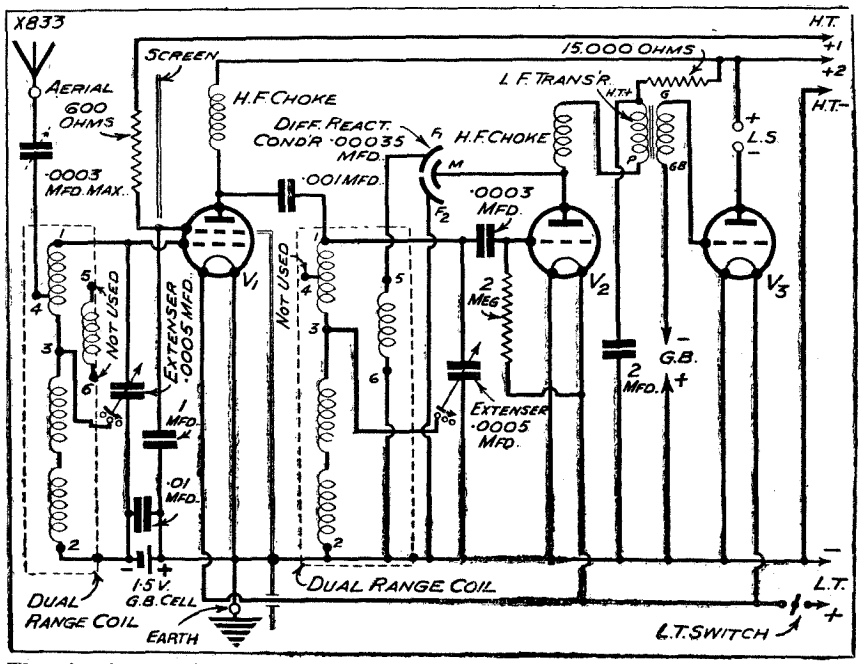
But enough of generalities. I feel sufficiently satisfied with the results to say that the time that has been spent on its development has been very well spent, and with that I am going to leave it to your judgment. You can take it from me that you will not be dissatisfied!

THOROUGHLY SCREENED TO SECURE STABILITY



This is the H.F. end of the receiver and, as you will notice, the screening is very complete. The metal cover on the left belongs to the aerial coil, and the totally enclosed component on the right is a "Telexor" Extenser that makes wave-change switches unnecessary.

THREE VALVES THAT WORK IN PERFECT HARMONY



The circuit comprises an S.G. high-frequency amplifier, a grid-leak detector, and a powerful output stage. The overall voltage amplification obtained from this combination will bring the weakest stations up to full loudspeaker volume.

The "Electro-Screen" Three—*continued*

I mentioned in an earlier paragraph that compactness has been one of the aims in this new design. Synonymous with that, of course, is the fact that rather more care than is usually necessary has been given to the layout of components. It is easy enough to pack a lot of components into a small space, but to obtain compactness with efficiency is quite a different thing!

So when you come to arranging the various components on the baseboard, take my advice and closely follow the diagram in which the most efficient layout has already been worked out for you.

The same thing applies, of course, with the arrangement of the components on the panel, which is really the correct jumping-off point when you start the construction of the set.

Don't Be Afraid

Incidentally, there is rather a tendency to fight shy of panel components for which it is necessary to cut escutcheon holes in the panel, but if you go about it in the right way there is very little more in it than in drilling a hole with an ordinary hand-drill.

Take the present case. The two Telexors require fairly large holes for the escutcheon plates. Let me tell you how I went about making them.

I first obtained a piece of soft tissue paper and placed the panel front downwards on the paper. That is a useful little tip for avoiding scratches on the polished surface which is ultimately to be the front of the set.

Then I marked out three vertical lines, one at the half-way, and one $2\frac{1}{4}$ in. from each end. To get the Telexor escutcheons reasonably symmetrical, I found that it was necessary for the centres of the control knobs to be $1\frac{1}{4}$ in. up from the bottom of the panel, and so accordingly I made another scratch mark parallel with the bottom of the panel and $1\frac{1}{4}$ in. up.

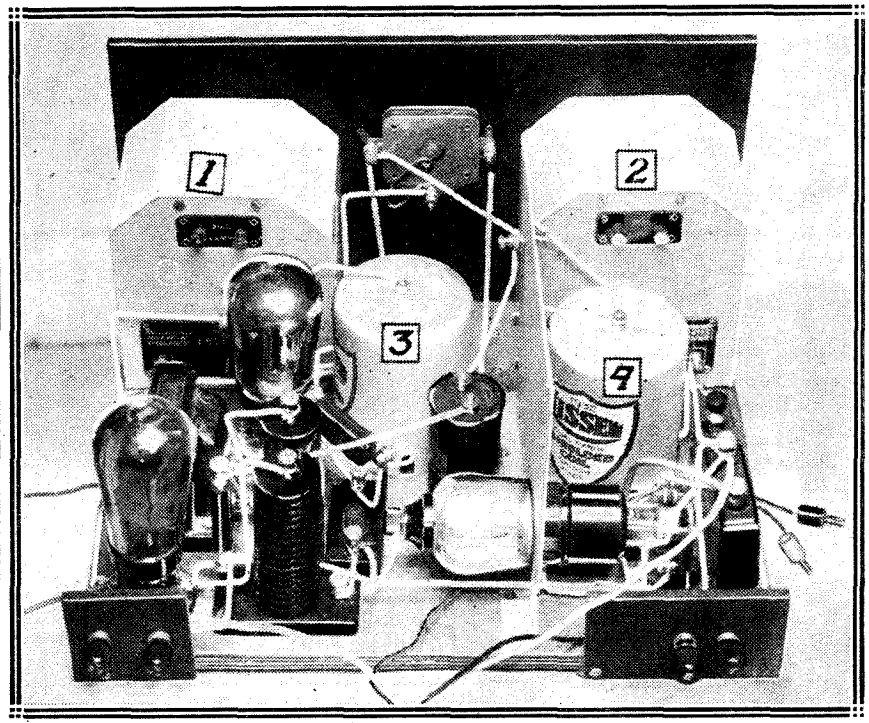
The rest was easy, for a template is provided with the Telexor, and by placing this in the appropriate position on the panel it was only necessary to prick through.

Once the holes were marked out it was quite a simple matter to

ALL THE COMPONENTS YOU REQUIRE ARE CATALOGUED IN THIS COMPREHENSIVE LIST

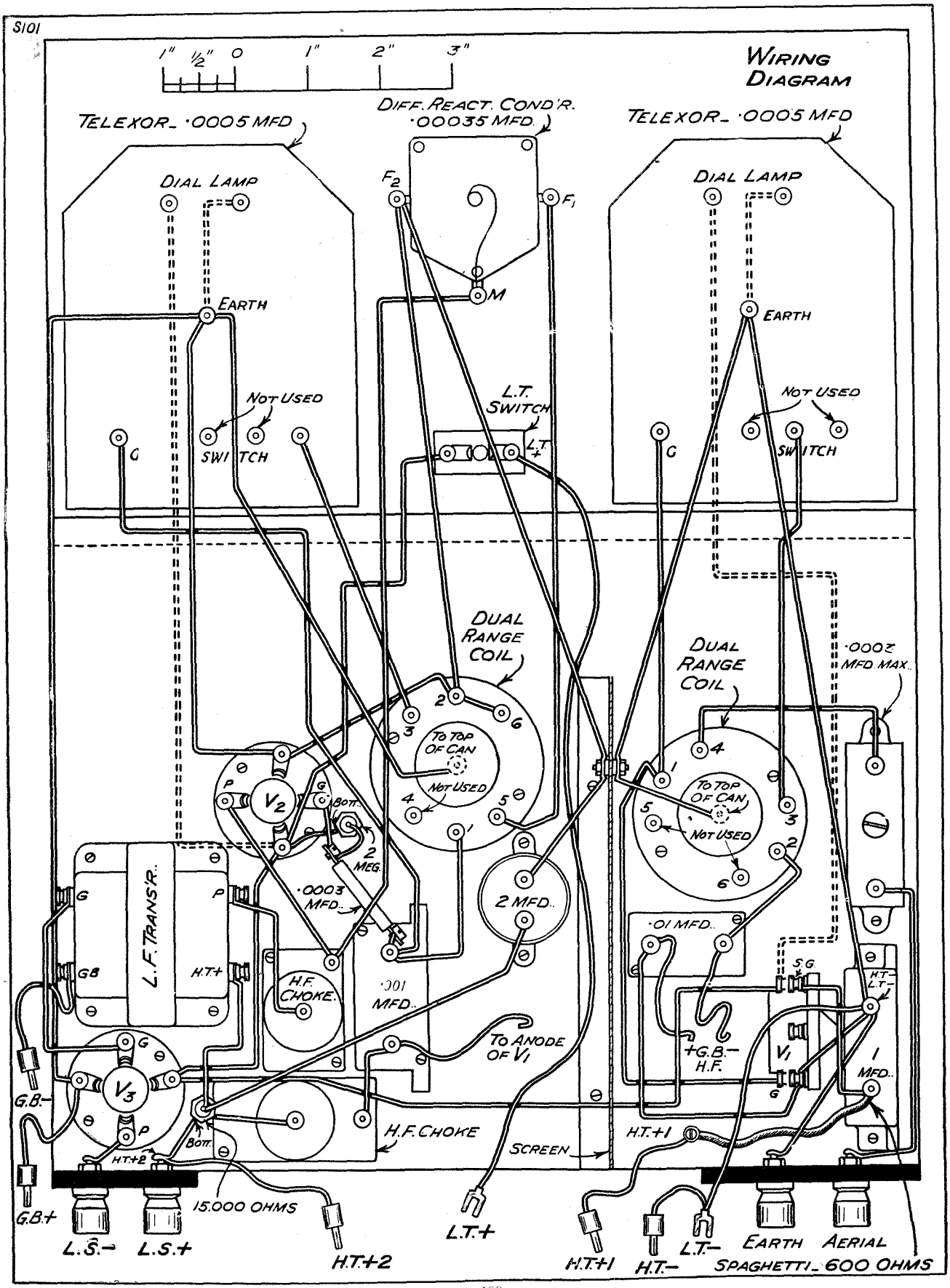
1 Panel, 12 × 7 in. (Peto-Scott, Lissen, Permcol, Becol, Ready Radio, Wearite).
1 Cabinet to fit, with baseboard 9 in. deep (Peto-Scott, Ready Radio, Gilbert, Pickett, Osborn, Smith).
2 ·0005-mfd. Telexors (Telsen).
2 Canned coils (Lissen).
1 Horizontal-mounting valve holder (Lissen, W.B., Telsen).
2 Standard four-pin valve holders (Lissen, W.B., Graham Farish, Wearite, Igranic, Clix, Benjamin, Telsen, Bulgin).
1 ·0003-mfd. max. compression condenser (Sovereign, Telsen, Graham Farish, Polar, Formo, Goltone).
1 ·0003- to ·00035-mfd. differential reaction condenser (Lotus, Telsen, Ready Radio, J.B., Cyldon, Ormond, Polar, Graham Farish).
2 H.F. chokes (Ready Radio "Standard" and Lewcos type 11, Sovereign Super, Tunewell, Peto-Scott, Lissen, Telsen, R.I., Wearite, Varley).
1 1-mfd. fixed condenser (T.C.C., Dubilier, Telsen, Lissen, Peto-Scott, Graham Farish).
1 2-mfd. fixed condenser (Dubilier type 9200).
1 ·001-mfd. fixed condenser (Lissen, Dubilier, T.C.C., Graham Farish, Telsen, Watmel, Ferranti).
1 ·0003-mfd. fixed condenser (Dubilier type 670, or button type T.C.C., Watmel, Formo, etc.).
1 ·01-mfd. fixed condenser (T.C.C. type S, etc.).
1 L.F. transformer of medium ratio (Lissen Hypernik, R.I. Hypermite, Varley Nichoke, Ferranti A.F.10, or small type of Graham Farish Snap, Telsen Ace, Igranic Midget, etc.).
1 Push-pull on-off switch (Ready Radio, Telsen, Lissen, Graham Farish, Bulgin, Wearite, Peto-Scott).
1 Spaghetti resistance, 600 ohms (Bulgin, Varley, Telsen, Lissen, Lewcos, Tunewell).
1 2-meg. grid leak with wire ends or terminals (Lissen, Igranic, Dubilier 1-watt type, Graham Farish Ohmite, Loewe).
1 15,000-ohm resistance (Graham Farish Ohmite, or as above).
1 Metal screen 6 × 6 in., with hole for S.G. valve, (Magnum, Peto-Scott, Ready Radio, Wearite).
2 Terminal strips, about 2 × 2 in.
4 Indicating terminals (Belling-Lee type R, Bulgin, Igranic, Goltone, Clix, Eelex).
Battery plugs (Bulgin, etc.).
Glazite, Quickwyre, or 18 gauge tinned-copper with sleeving.
Flex, screws, etc.

A SPLENDID ASSEMBLY OF GOOD POINTS



As you will notice from this photograph, the screened-grid valve is mounted horizontally. It is arranged in this manner so that the optimum screening effect can be obtained, the valve being fixed in such a position that the vertical screen comes in line with the screen inside the bulb. Referring to the numbered components, those marked (1) and (2) are the tuning Extensers, while (3) and (4) are the screened inductance units.

The "Electro-Screen" Three—*continued*



The "Electro-Screen" Three—*continued*

remove the unwanted pieces by means of a fretsaw. But for easy working, even if it takes a little longer, you will find as I did that it is best to use a fairly fine blade.

The mounting of the various components on the panel is not a difficult job, and it is not a job that will take you very long to do. I think you will probably find it best to mount the panel components after the panel has been secured to the edge of the baseboard, although it doesn't very much matter in which order you carry out these operations.

Follow the Diagram

Concerning the disposition of the parts of the baseboard, as I have already mentioned you will find it best to follow the wiring diagram. If you get one or two of the larger components mounted first of all, it makes it much more simple to locate the positions for the others.

By the way, if you are unable to get a screen with the hole for the S.G. valve already cut in it, it isn't at all a difficult job to do it yourself with a fretsaw, but you *must* use a very fine blade. Otherwise it's like trying to saw through wood with a bread knife!

When you arrive at the wiring stage there is a method of procedure which I always adopt and which I am convinced tends to make the job very much more simple. Furthermore, it reduces the possibility of lead omissions.

Start off with the L.T. negative terminal of the S.G. valve-holder, that is, the filament terminal nearest the back edge of the baseboard, and join it to the ·01 fixed condenser and to the associated 1-mfd. condenser. Then proceed by joining this same terminal of the 1-mfd. condenser to the earth terminal and to the terminal marked earth on the first Telexor.

Repeat Ad Lib.

From the earth terminal of the first Telexor you make a join to the screen, and then from the same side of the screen to the terminal on the top of the first coil can, and so on.

The scheme is to follow out the common circuits progressively. The one that we have just run over is a part of the L.T. negative circuit. It continues, of course, on the other side of the screen, and you just follow it out from point to point until all the connections which are common to L.T. negative have been made.

That finished, you can follow out progressively all the connections that are common to L.T. positive, and so on.

I am afraid this seems rather an obvious sort of procedure, but I have purposely emphasised it because it does enable one to dispense with straggly leads and wrong connections. And that, after all, is the main thing, isn't it?

Dial Lamps Are Useful

Do you notice, by the way, that there are a couple of the leads to each of the Telexors shown by means of broken lines in the wiring diagram? The Telexors incorporate small lamps for illuminating the dials, and it is by means of these leads that the lamps are connected in circuit.

They are purposely shown by means of broken lines because the connections are optional. It is very nice to have the lamps in circuit, especially if the set is to be placed in a dark corner; but you must remember if you do use them that a slight extra load will be placed on your accumulator, and that in consequence it will not last *quite* so long as it would otherwise.

SUITABLE ACCESSORIES

Loudspeaker. Marconiphone, B.T.-H., Epoch, H.M.V., Celestion, Cossor, R. & A., W.B., Ferranti, Blue Spot, Graham Farish.

Valves. S.G.: Mullard P.M.12A., Mazda, Cossor, Marconi, Osram, Six-Sixty, Lissen, Tungsram, Eta.

Det.: Mazda H.L.2, Mullard, Cossor, Osram, Marconi, Six-Sixty, Tungsram, Eta, Lissen.

Power: Marconi P.2 or P.2/B., Mazda, Mullard, Cossor, Osram, Lissen, Six-Sixty, Eta, Tungsram.

NOTE.—If H.T. batteries of small capacity are used the L.P./2 will be advisable.

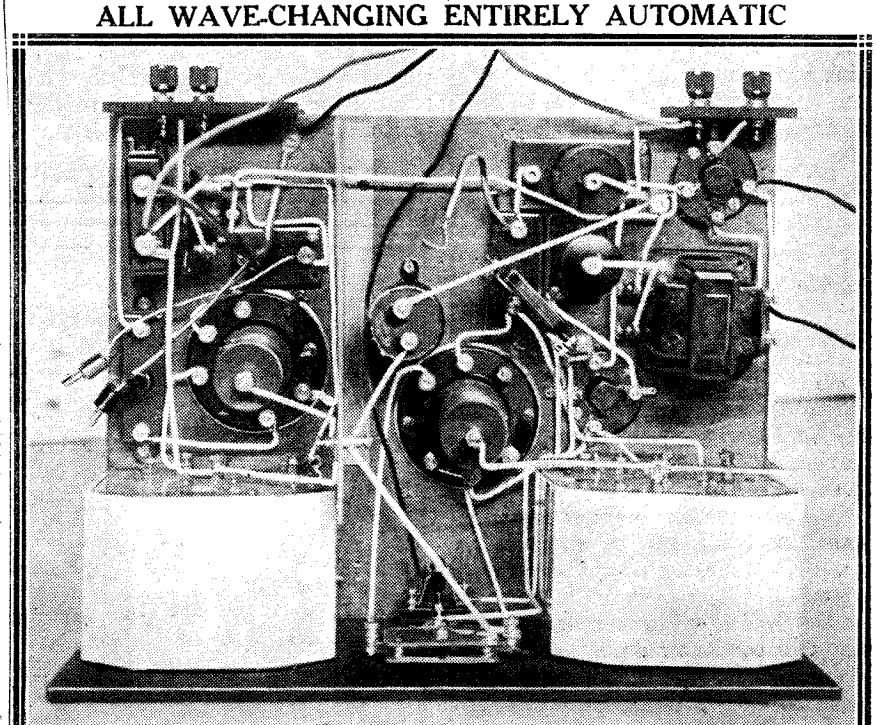
Batteries. H.T.: See above note re valves. If the valves take more than 10 milliamps, the super- or triple-capacity battery is needed. There are many makes of these on the market, such as Lissen, Pertrix, Ever Ready, Siemens, Ediswan, Drydex. 120 to 150 volts max. is required.

G.B.: To suit output valve. Also small 1·5 cell, or tapped 3 or 4·5 battery, for S.G. valve. (See above makes.)

Mains Units. These should be capable of giving 25 milliamps at 150 volts if the full punch of the set is to be obtained using the P.2 valve. If other valves are used, care must be taken to see that the mains unit will give sufficient power.

Good mains units can be obtained from Atlas, Heayberd, Ekco, R.I., Tannoy, Regentone, Tunewell, Lotus.

ALL WAVE-CHANGING ENTIRELY AUTOMATIC



When you have finished wiring up, this is how the set will appear as you look down on to the baseboard. But don't forget to put the "tin hats" on the coils, for these are an important part of the receiver's equipment.

The "Electro-Screen" Three—*continued*

But it is nothing to worry about, and, in my opinion, it is well worth while, for apart from the primary use it does provide a *visual* indication which reduces the possibility of the set being left on all night.

with an adequate measure of selectivity. As a general rule, the maximum setting is obtained by screwing the adjustment down; but you can soon tell whether you are moving it in the right direction, because as you

"THE WIRELESS CONSTRUCTOR" "ELECTRO-SCREEN" THREE

Circuit: S.G. H.F. stage, followed by detector and one transformer-coupled L.F. stage.

VALVES	VOLTAGES	CONTROLS
1st (mounted horizontally): Screened-grid type.	L.T.: 2, 4, or 6 volts, according to voltage of valves used.	Two outer knobs: Tuning controls. (The left-hand one tunes the H.F. circuit, and the right-hand one tunes circuit between H.F. and detector valves.)
2nd (nearest panel): H.' H.L., or similar type.	H.T.+1: 60 to 80 volts.	Upper central knob: Reaction control. (Increase in clockwise direction.)
3rd: Power.	H.T.+2: 100 to 150 volts.	Lower central knob: On-off switch. (Pull out to switch receiver on.)
NOTE.—Valves may be of 2-, 4-, or 6-volt rating.	G.B.—: Dependent on power valve used.	

ADJUSTMENTS

The small compression-type condenser at the screened-grid valve end of the baseboard is a selectivity control. It should be adjusted as near to the maximum as is consistent with adequate selectivity for your own local requirements.

OPERATION

Tune with two outer knobs, keeping circuits in tune. When dials read between 0 and 100 degrees, set is on medium waveband. Long-wavers are tuned in between 100 and 200 degrees.
When searching for distant stations, use reaction control.
NOTE.—This set does not cause interference through radiation when the set is oscillating.

With regard to the various flex connections and battery leads, they are all clearly shown in the wiring diagram, and I do not think that there is anything that requires elucidation in this respect. And when you have done the flex connections your set is finished and ready for testing.

For your convenience, all the necessary details regarding batteries and valves are given in the special operating panel, and you will find it very handy to cut this out and fix it to the inside of the lid of your cabinet.

Selectivity to Choice

It also gives just a brief idea of the general procedure to be adopted when operating the set, but I feel that it will be helpful if I amplify these necessarily condensed instructions before bringing this article to a conclusion.

There is, for instance, the question of aerial coupling, which will largely depend not only upon the size of your aerial, but upon your geographical location with respect to the local broadcast station.

That is where the compression-type condenser inside the set comes into use. It is not a control that requires to be constantly varied, but when you are first testing out the set you should vary this condenser until you arrive at the correct balance between selectivity and sensitivity to suit your own local conditions.

The setting to aim at is as near to the maximum setting as is consistent

increase the coupling the local stations will gradually occupy more and more of the tuning condensers.

Now, with regard to general operating procedure, I am not going to say a lot about it, because I am convinced that there is nothing better than practice for mastering the operation of *any* set. But there are just one or two rules of thumb which will help.

The first one—and it is one with which most of you will probably be familiar—is that the two main tuning dials must be kept in step. It is easy enough to tell when they are in step, for the condition is indicated by general liveliness which is not nearly so marked when they are out of step.

Then there is the question of reaction when searching for distant stations. In this connection, since the set does not radiate even when the set is oscillating, I think it is very helpful, especially for the beginner, to search with the set actually in an oscillating condition.

Getting the Knack

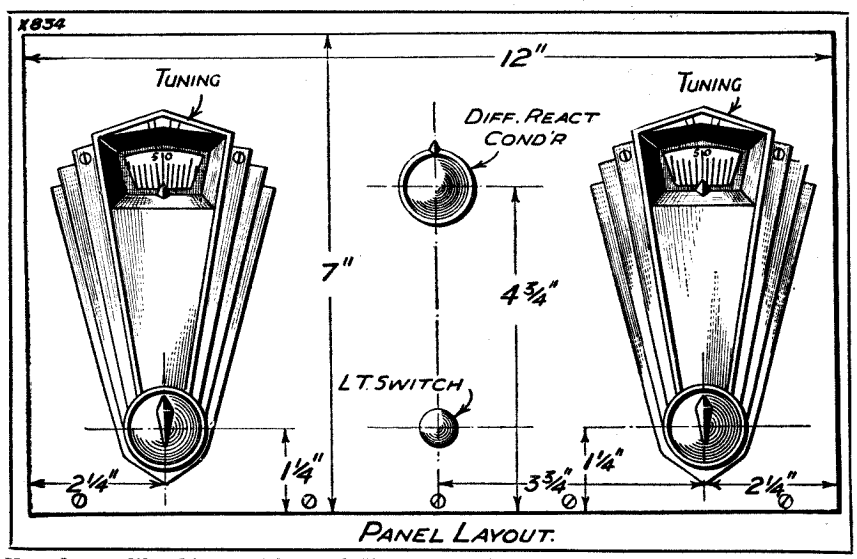
If you do search with the set in this condition, then when you hear a carrier-wave you must, of course, reduce the setting of the reaction control in order to resolve it.

I am only advocating this procedure until you get used to the set, for once you have got the knack it shouldn't be necessary. You should then be able to find all the distant stations you want by searching with the two tuning controls in step and with the reaction control just below the oscillating condition.

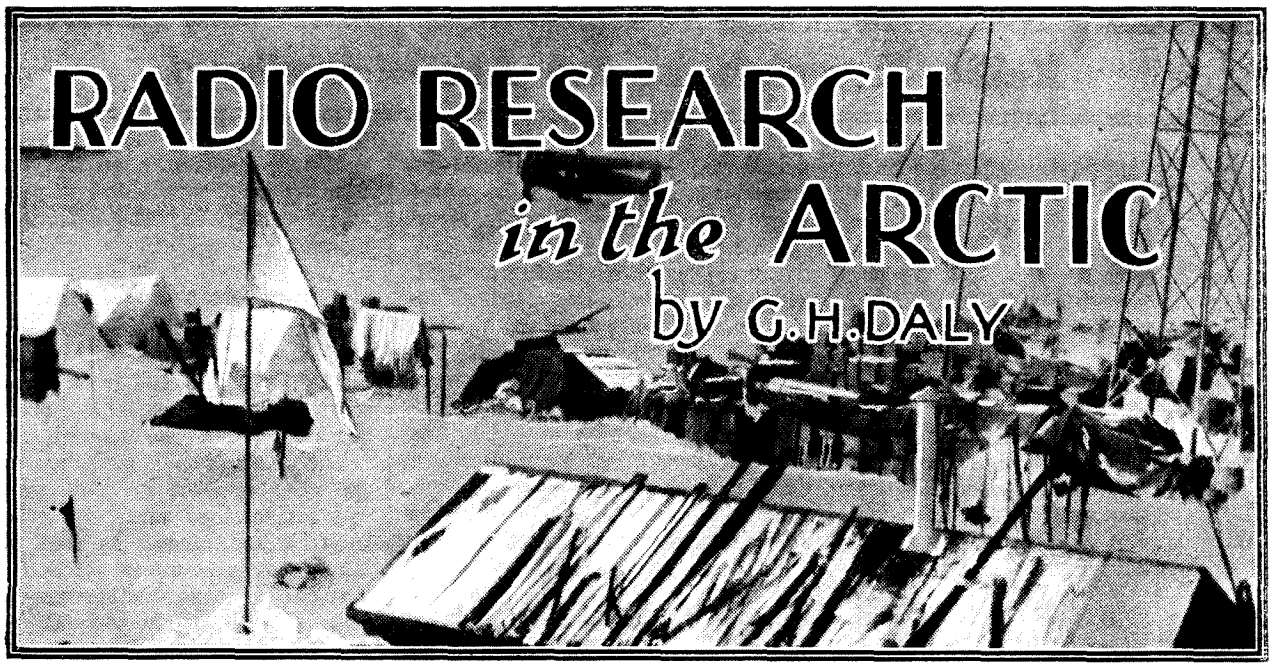
Just as a final note for the benefit of those who may not previously have handled an Extenser-type condenser, may I just remind you that any station received between 0 and 100 degrees is on the medium-wave band, while the long-wavers will all be found between 100 and 200. Very simple, isn't it?

And now it only remains for me to wish you the best of luck with the "Electro-Screen" Three.

A BALANCED LAYOUT OF ATTRACTIVE APPEARANCE



How do you like this panel layout? Very good, isn't it? And the imposing escutcheon plates are not at all difficult to fit, either. The left-hand one belongs to the aerial Extenser, and the one on the right to the tuned grid circuit.



RADIO RESEARCH in the ARCTIC

by G. H. DALY

Leaving our summer behind, a party of scientists has set out for a remote outpost within the Arctic Circle, to carry out some important radio investigations. In the following article our contributor gives readers a few interesting facts about the work that these enthusiastic radio explorers have undertaken.

THAT vast area of frozen waste which lies beyond the Arctic Circle has always been of interest to our scientific civilisation. Adventurers and explorers are for ever setting out on expeditions. Sometimes they come back; sometimes their notes are found decades later, frozen in the snow and ice. Attempts have been made to explore this almost unchartered area with airship and submarine; we can all remember Nobile's famous airship disaster and the no less famous submarine of Nansen.

Completely Cut Off

So this attempt at conquest of the frozen north goes on, and now we learn that the Government has given £10,000 to the National Polar Year Committee towards the cost of another scientific expedition to the Arctic. Observation posts are to be spread round the magnetic pole, and during the winter they will be completely cut off from their fellow men, except, of course, for our great friend—radio.

This expedition is of particular interest to the wireless community, however, for it has as one of its principal objects the investigation of wireless phenomena. Professor E. V. Appleton, of Heaviside layer fame, is the leader of one party which is to make its headquarters at Tromso, in Norway.

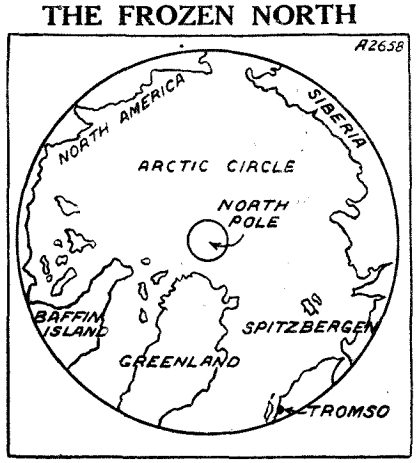
Bouncing Between Layers?

What do these scientists expect to find in the Arctic which will further the progress of wireless communication? We may be sure that Professor Appleton's chief object will be to obtain more definite data concerning the Heaviside layers, for conditions are particularly favourable for investigation in this direction within the Arctic Circle.

We are still puzzled over the wireless echoes which leave the world and, after travelling for about 50 million miles, return to the earth again. Where have they been? Have they been out in the confines of space, or, on the other hand, have they been no farther than the Heaviside layers, wandering about between one layer and another? For there are two Heaviside layers, one about 60 miles above the earth and the other about 70 miles farther on. They may have bounced from one layer to the other before being able to creep back exhausted to earth.

If the waves travel out to space they must be reflected back to us by distant clouds of electrons, and these electron clouds will only occur under certain conditions of the earth and sun. In the clear and almost silent atmosphere of the Arctic it will be possible to study points such as these far more accurately than here in England, with its overcrowded ether.

THE FROZEN NORTH



This map shows the place, Tromso by name, where Professor Appleton and his followers are going to carry out their observations.

A Profound Effect

Then these Heaviside layers may behave differently in the far north. The air over the poles is very different from the air here at home. The belt of air, for instance, which makes it possible for life to exist on the earth is about three miles deep at the Equator and only a few hundred yards deep at the North Pole. Such conditions may be common throughout all the layers of our upper atmosphere, and the distance of the Heaviside layers above the earth may be found to vary with latitude. This, of course, would have a profound effect on wireless communication.

There is also a very peculiar point regarding temperature. For instance, the temperature of the gases ten miles above the Equator is colder than that of the gases ten miles above the

Radio Research in the Arctic—*continued*

Arctic Circle. In the former case it is 110 degrees F. below zero, and in the latter case only 60 degrees F. below zero. Such peculiarities in the temperature of these gases of the upper atmosphere must have some effect on the layers which reflect our wireless signals.

Beautiful Displays

The Arctic Circle is noted for its beautiful auroral displays, and this phenomenon appears to have a very definite effect on wireless transmission. We think that the gorgeous displays of these Northern Lights are due to electron streams from the sun bombarding the gases in the lower Heaviside layer. In some way, possibly by increasing its reflecting properties, the aurora increases the range of a transmitter far beyond the normal. Yet, on the other hand, the aurora coincides with sunspots and magnetic storms, and the latter are sometimes detrimental to short-wave transmissions.

Reflection of wireless waves from the Heaviside layer takes place mainly at night. This is owing to the action of the sun's rays on the lower atmosphere. To be precise, the rays of the sun in the daytime cause the lower atmosphere to become slightly ionised, and the effect of this ionisation is to damp down our wireless waves before they reach the Heaviside layer.

Little interference from Continental stations is experienced in the daytime, and in this respect it is a pity that daylight does not last until the wireless stations close down. Alternatively, we might ionise our atmosphere during the night-time by some artificial means and stop this reflection from the layers, but then, of course, we should cramp the style of short-wave wireless, which depends entirely on the reflection from the heavens.

However, speculation into methods of neutralising the effect of the Heaviside layer is quite another story. And what we are chiefly concerned with here is the fact that the long Arctic night will enable continuous observation to be made into the effect of the upper layers.

The Magnetic Pole

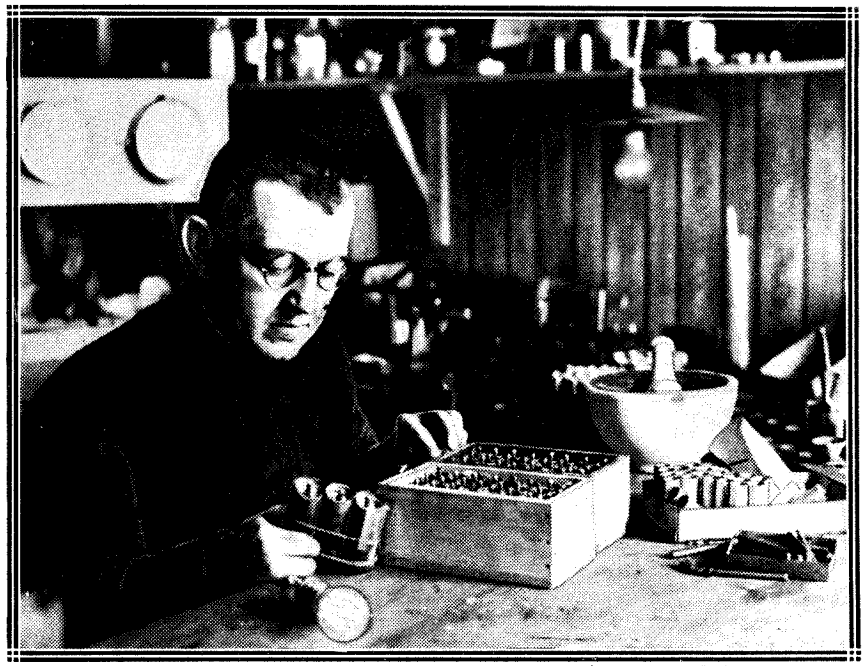
The expedition is also to pay particular attention to certain peculiarities regarding the earth's magnetic pole. Disturbances in the earth's magnetism are continually taking place, and as we know there is close relation between terrestrial magnetism and electro-magnetic phenomena such as wireless waves, some new light may be thrown on this point. Possibly some mysterious vagary of wireless may be explained in this manner.

Wireless and Weather

General meteorological conditions, too, are of great interest to wireless science, for meteorology is but the science of the atmosphere and air generally; and as wireless waves travel through and make so much use of this same air, then wireless and meteorology must have many interests in common. In fact, wireless may help us to forecast the weather, and the weather may give us an inkling of what particular wireless conditions may be expected to prevail at a given time.

It is a clear sign of the times that so much stress has been laid upon the importance of this expedition to wireless research, and it is gratifying to think that in order to further this research men are willing to face the rigour and peril of an Arctic winter.

A NEW ACCUMULATOR DEVELOPMENT



A new accumulator invented by a Franciscan brother in Paris. It is claimed that its main advantage over present types is that it can be charged very rapidly and has a much longer life. This photograph shows the inventor at work in his Paris laboratory.

POINTS TO REMEMBER

When Constructing a Mains Unit.

To enclose the mains unit in a metal box to conform to I.E.E. regulations. Incidentally, this may save you from a nasty shock.

* * *

That whilst automatic bias can be provided by inserting a resistance in the cathode lead of your S.G. valve, or in the case of the power valve by the insertion of a resistance between filament and H.T.—, H.T.— being connected to secondary of L.F. transformer (in both cases shunted by a 1-mfd. condenser), the effective H.T. potential applied to the valve is reduced by the voltage drop so produced.

* * *

To use the "anode-feed" method rather than a potential-divider to obtain different H.T. voltages, and back-coupling will be cut down to a minimum.

* * *

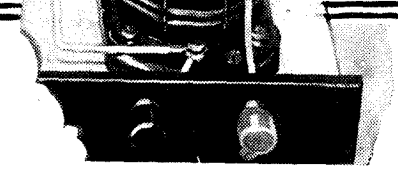
To fit fuses.

* * *

To insert an efficient mica condenser in the earth lead when using D.C. mains.

HOW TO MAKE YOUR-OWN "S.T.300" COILS

BY JOHN SCOTT-TAGGART



In response to many hundreds of requests from readers, Mr. Scott-Taggart is now giving full details for making at home the coils for his famous "S.T.300" receiver. He describes minutely every phase of the construction, and provided you follow his instructions with care, you will have no difficulty in producing coils of 100 per cent efficiency.

THOSE of my readers who were wireless fans in 1912 will remember the huge, long cardboard tube on which we wound miles and miles of wire. Even the rollers from discarded washing mangles were mobilised as "formers."

Rolling Your Own

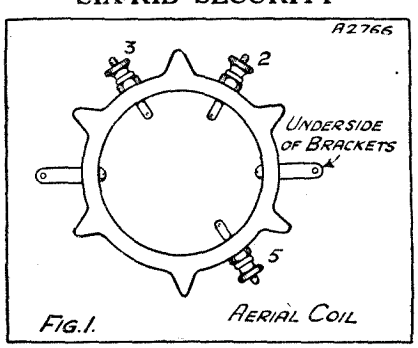
Happily, those days are long past. But there are still many constructors who prefer to "roll their own" when it comes to coils. Personally, I admire them enormously. I know that—except for experimental and design purposes—I should plump for leaving the work to a manufacturer.

Coils—at any rate, "S.T.300" coils—are now made by machinery at a cost which is little if anything greater than that of the raw materials purchased by the amateur.

Different sizes of wire and of formers will alter the wavelength range of the coils, the correctness of the reaction, the selectivity obtainable and the general stability of any set. No two firms manufacturing "S.T.300" coils wanted to use the same wire or formers! The result was that I had to advise each firm individually. In only one case were the originally submitted coils accurate.

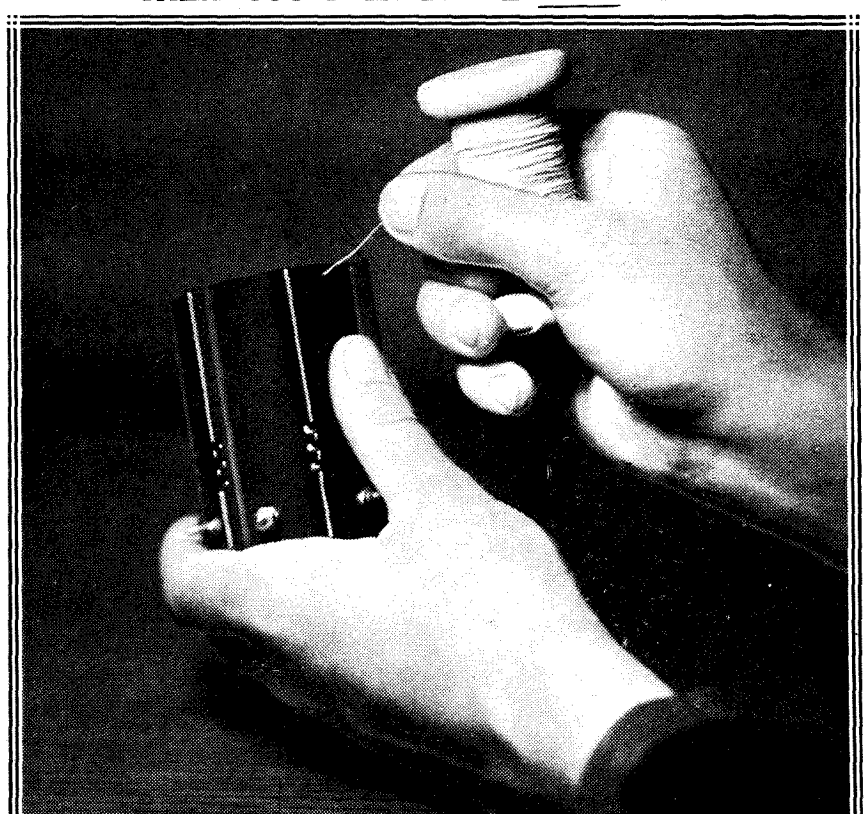
If this is the case with companies having their own laboratories and measuring instruments, it is improbable that the home-constructor will fare much better unless he adheres to a rigid specification. If you use the one I give in this article you are certain of satisfaction. Aching wrists

SIX-RIB SECURITY



The formers on which the coils are wound should be made of high-quality ebonite, and should have six ribs.

THESE COULD EASILY BE YOUR HANDS



Hold the ebonite former in the left hand, and the reel of wire in the right. Pass the end of the wire through the small hole as shown in this photograph, and commence winding on the medium-wave section, taking particular care to keep the wire taut while doing so.

How to Make Your Own "S.T.300" Coils—*continued*

and fingers will soon be forgotten as the stations tumble in.

Happily, "S.T.300" coils present very few snags, as there is no question of ganging and no tappings have to be taken.

How to Start

The two formers used are of Becol 6-ribbed (No. 11) type, $2\frac{1}{2}$ in. diameter and 3 in. long. They are drilled in preparation for the terminals and supports. All these holes are $\frac{3}{8}$ in. from one end of each former, which end will be called "the terminal end." It is a good plan to scratch the numbers (as given in the sketches) next to each terminal hole. Fig. 1 and Fig. 2 show the numbering viewed from the terminal end.

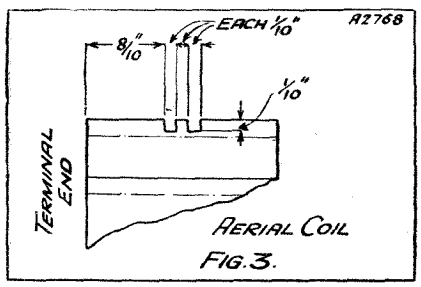
The next job is to mark and cut the slots. You can measure down each rib separately. Fig. 3 shows the number and dimensions of the slots for the aerial coil, while Fig. 4 illustrates the slots for the anode coil. The depth of all the slots is $\frac{1}{10}$th in., and to get the slots all the same depth scratch a line down the side of each rib.

The slots are formed by sawing cuts with a hack-saw on the inside of the marks for each slot, and snapping off the piece left in the middle. Each slot is then smoothed with a narrow file or with emery cloth folded round a strip of wood. To ensure the correct depth of slot, many constructors may prefer to make the slots on the shallow side and then deepen with the file.

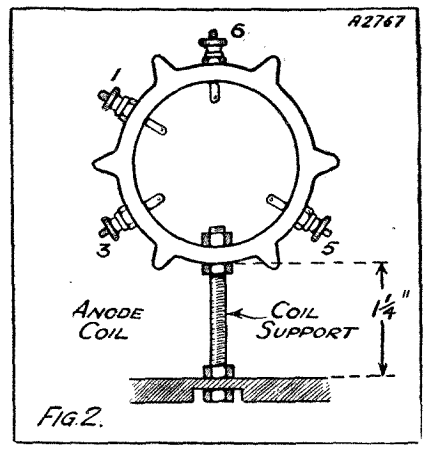
The drilling of the holes for the ends of the windings is now carried out, and the positions are seen in Figs. 5 and 6 for the aerial coil, and Figs. 7 and 8 for the anode coil. The size of the holes is unimportant.

The terminals are now fitted with their soldering tags on the insides of the formers. Soldering is desirable on account of the risk of breakage when fastening No. 36 S.W.G. wire under a terminal nut.

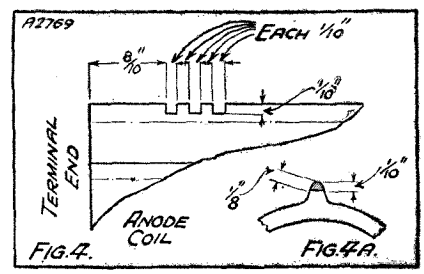
CUTTING THE SLOTS



In the above diagram you will find all the particulars necessary for making the "long-wave" slots in the aerial coil former, while on the right you will see another diagram showing the method of mounting the anode coil.



ROOM FOR REACTION

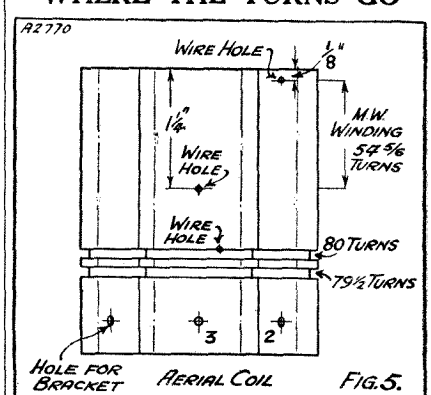


In the case of the anode former you will have to make three slots, the additional one being for the reaction winding. Regarding the little sketch in the right-hand corner (Fig. 4a), this shows that the line you mark along the length of the rib should be a little farther from the top than the depth of the slots.

The terminals should be firmly fixed at this stage to avoid any tightening when the wires are attached to the tags. The tags are most accessible if made to point towards the terminal end of the coil.

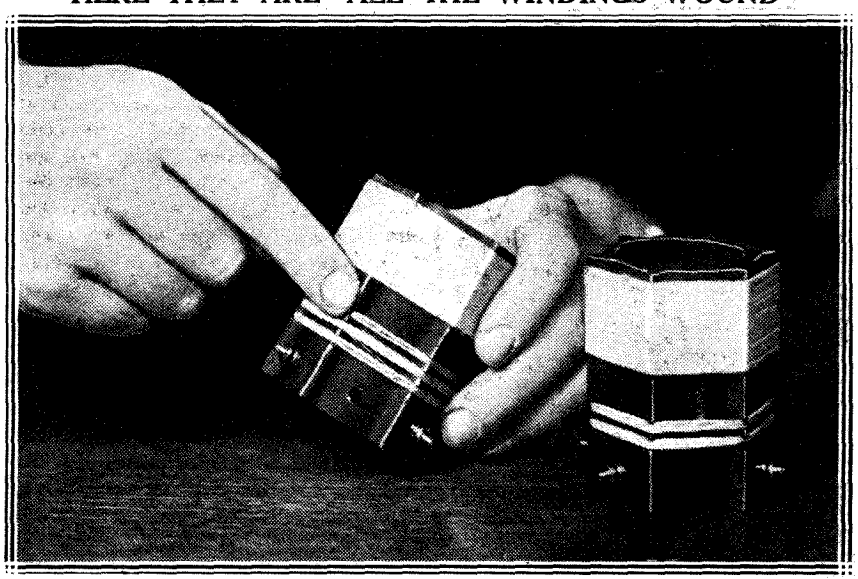
Now for the actual winding. Start with the 26 S.W.G. (double silk-covered) on the medium-wave winding of the aerial coil. Thread the end of the wire through the hole $\frac{1}{8}$ in. from the top and fasten it to the tag under terminal No. 2.

WHERE THE TURNS GO



This diagram will give you most of the information you require for winding the aerial coil. The long-wave section is accommodated in the two slots at the bottom.

HERE THEY ARE—ALL THE WINDINGS WOUND

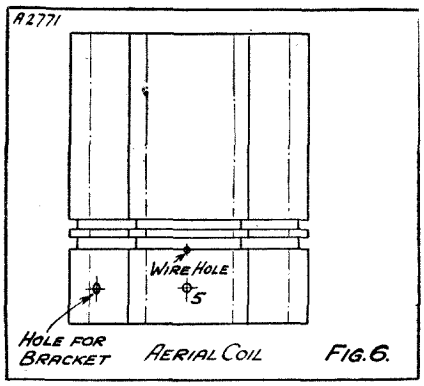


This photograph of the coils shows them after the windings have been completed. The one on the left is the anode coil and the other is for use in the aerial circuit. The next job is to fix the supports.

How to Make Your Own "S.T.300" Coils—*continued*

Hold the former by the terminal end in the left hand, as shown in the photograph, and rotate the former away from you (i.e. in an anti-clockwise direction looking at it from the terminal end), continuing for 54 complete turns, and then do another

TERMINAL NUMBER FIVE



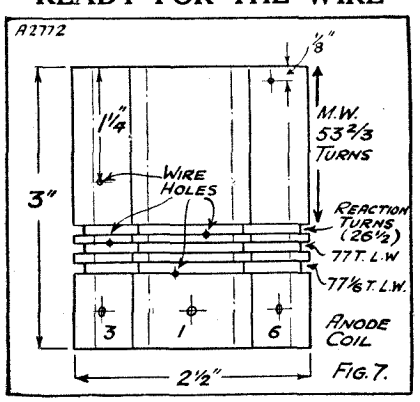
five-sixths of a turn, finishing above terminal No. 3.

Leave ample wire to reach down to the tag, and then cut off, thread through the prepared hole and fasten to the tag.

If the turns have spread out at all, they can be packed together by pushing the end turns.

Now take the 36 S.W.G. (single-silk-covered) wire and thread its end through the other hole above terminal No. 3 and fasten it to the same tag

READY FOR THE WIRE



The reaction winding of the anode coil is contained in the upper slot of the three shown here. In this position it comes between the medium- and long-wave sections, on to both of which it has to react.

where the M.W. (medium-wave) winding has just finished. Wind the long-wave winding in the same direction as the M.W. winding.

The upper set of slots (farthest from terminal end of former) should carry 80 complete turns, and the lower set 79 complete turns—the winding being completed by another half-turn, finishing above terminal No. 5. Leave ample wire to reach the tag of terminal No. 5, cut wire and thread through hole, finishing the job by soldering the end to the tag.

The anode coil is tackled in the same way, except that the turn numbers are different, and that the extra set of notches between the M.W. and L.W. windings is left vacant for the reaction winding, which is put on last.

To avoid any error it would be just as well to run briefly through the procedure:

First put on the M.W. winding (53⅔ turns), the fraction of a turn being accounted for by the position of the two wire holes which is given in Fig. 7. This M.W. winding starts at terminal No. 6 and ends at No. 3.

The long-wave winding (36 S.W.G. single-silk-covered wire) starts at terminal No. 3, and 77 turns are put into the upper L.W. slots; then continue into the lower slots and wind on a further 77⅙ turns, finishing the L.W. winding at terminal No. 1.

The reaction winding starts at terminal No. 1 with 36 S.W.G. single-silk-covered wire, and completes 26½ turns, finishing at terminal No. 5.

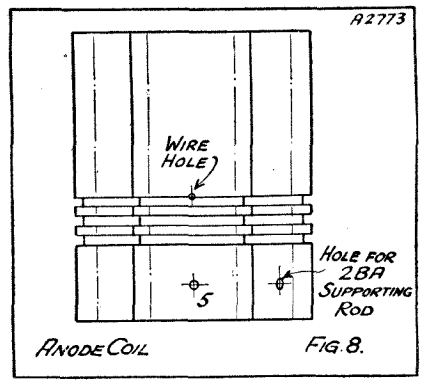
(*Please turn to page* 210.)

THE WIRE YOU NEED

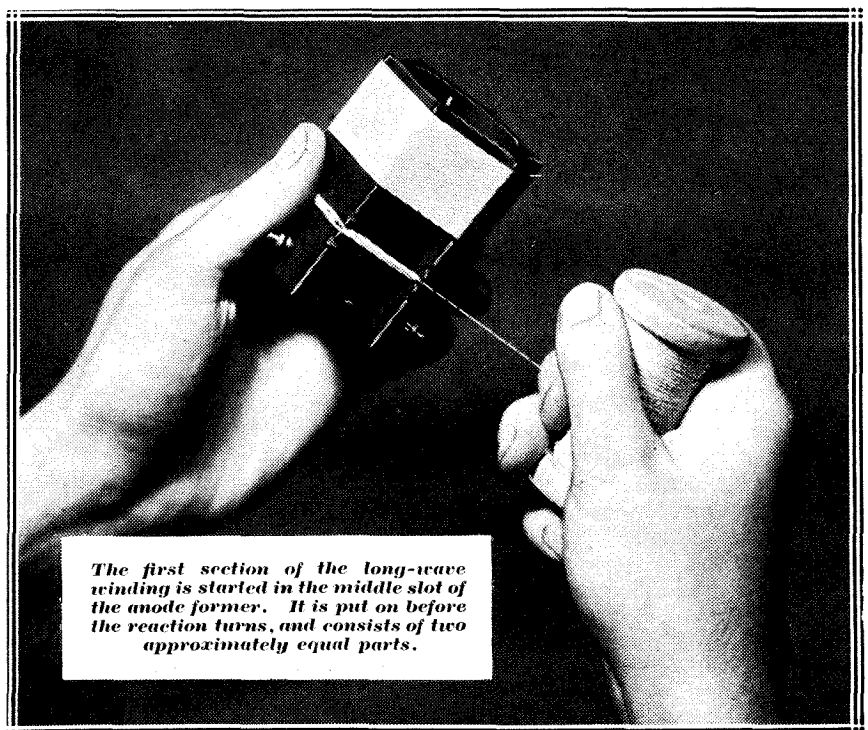
1 oz. of 36 gauge Single-Silk-Covered
and
2 oz. of 26 gauge Double-Silk-Covered

The No. 5 terminals are situated as indicated in Figs. 6 and 8, and the positions for the two terminal holes are clearly shown in these diagrams. You should also note the positions of the other holes; namely, those for the supporting brackets, and for the ends of the windings.

FINISHING OFF



LAYING ON THE LONG-WAVE SECTION



The first section of the long-wave winding is started in the middle slot of the anode former. It is put on before the reaction turns, and consists of two approximately equal parts.

QUEER QUERIES

Some details about unusual radio faults and some suggestions that may help you to better radio reception.

By P. R. BIRD.

A Bad Time for Batteries

A NUMBER of "unaccountable" H.T. battery failures, which when investigated proved to be due to faulty insulation, remind me that this is the time of the year when the H.T.B. often gets a lot of unwarranted blame. Crackles, for instance, are often put down to a dud battery, when the real trouble is a dud earth connection.

One acquaintance of mine was called in to prescribe for a set that was continually giving battery trouble, and he saw the fault from the other side of the room as soon as his eyes fell on the set. It was a "table" model, and the owner had placed it on a wide window ledge. But what struck the trouble-tracker as soon as he saw the set was the fact that the H.T. was where the sun struck full on it.

Now H.T. batteries—and L.T. batteries, too, for that matter—do need to be kept *cool*. This one was not getting a chance of long life in the full glare of the sun, just as it would not have had a chance in winter if it had been stuck into a chimney cupboard or similar warm quarters.

Long Loudspeaker Leads

From a Gloucestershire correspondent (whose experiences have already provided a "Queer Query" or two) comes an interesting note on the use of milliammeters, to which a reference was made last month.

He wants to know how anyone can be sure that no H.T. is passing when the set is supposed to be "off" unless one uses a milliammeter? And he says: "It is surprising the number of sets I come across which pass two or three milliamps. when turned off, sometimes through a fault in the reservoir condenser across the H.T., but usually through *leakage to earth from loudspeaker extensions*.

They Often Pass Unnoticed

"These faults would pass unnoticed without a meter, except in the case of the loudspeaker leads when the leakage happens to be on the *anode* side of the speaker lead. In this case an occasional crackle or pop is heard in the speaker when the set is not being used, thus drawing the owner's attention to the fact that all is not as it should be."

This latter is a little point which is often overlooked, and any reader who has a loudspeaker which clicks to itself when the set is off, or which shows by little crackles that something is on its mind when "off duty," should not fail to check every inch of loudspeaker lead with the utmost care to discover where the leakage is.

Another Floorboard Mystery

"Mysterious noises in the loudspeaker are always a source of annoyance, but there is always a cause and usually a remedy." So says H.A.S., of Kew Gardens, Surrey, in an unusually interesting letter, in which he proves his point by recounting a recent experience of his own.

"Having recently constructed the 'S.T.300,'" he says, "and incorporated an R. & A. 100 speaker in a transportable cabinet, I was much perturbed by loud crackles and other indescribable noises which periodically emanated from my set. I consoled myself with the thought that it was due to 'atmospherics,' and/or the operation of electric light switches.

"It was several days before I discovered that these noises always occurred when I passed through a certain doorway (as well as at other times), and a closer examination revealed the fact that a particular floorboard when stood upon produced a torrent of abuse from my speaker.

"I promptly hauled up the offending floorboard, half expecting to find an electric light cable with a nail through it, or something equally disturbing. But instead I found a gas-pipe and two electric conduits lying side by side in slots cut in the joists.

"Now the conduits were not earthed (thanks to some shoddy electrician), and one was actually severed at an 'elbow.' The floorboard, when in position, pressed on this elbow, and when the board was stood upon the pressure caused the conduit to move a tiny fraction and rub the gas-pipe, thereby partially earthing the conduit.

The Trouble Has Gone!

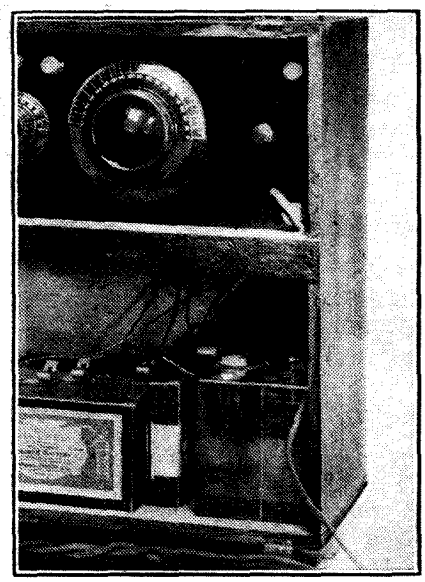
"These disturbances affected my indoor aerial which runs nearby, and the 'S.T.300' magnified and reproduced them most effectively!

"The remedy, of course, consisted in properly earthing the conduits, and this was soon done.

"The 'atmospherics' have since ceased!"

Good business, H.A.S.! It is not everybody who could have "sleuthed" so successfully!

MIND THAT ACID



When using an accumulator in a transportable set, be sure that the acid cannot leak out. If it does so it is likely to penetrate the side of the case, and may damage the frame aerial or other wiring.

HOW IS YOUR SET BEHAVING NOW?

If you are troubled by a radio problem, remember that "The Wireless Constructor" Technical Queries Department is fully equipped to help you.

Full details of the service, including scale of charges, can be obtained on application to the Technical Queries Department, "The Wireless Constructor," Fleetway House, Farringdon Street, London, E.C.4.

SEND A POSTCARD, on receipt of which the necessary application form will be sent by return.

LONDON READERS, PLEASE NOTE. Application should not be made by telephone, or in person at Fleetway House or Tallis House.

WITH PICK-UP AND SPEAKER

by A. JOHNSON-RANDALL

Record reproduction from the "Flexidyne" and details of a new pick-up.

SINCE the publication of the "Flexidyne" in last month's issue, a number of readers have written asking for details of how to use a pick-up with this receiver. Apparently these readers wish to convert the set to a radio-gram, and in order to help them I propose to describe the modifications necessary for adding a radio-gram switch to the equipment in this particular set.

The Best Position

The most convenient position for the switch is immediately preceding the detector valve, because this scheme will give three stages of amplification, and therefore adequate volume for all purposes. At the same time, I would point out that with the pick-ups at present on the market a volume control will be needed across the pick-up itself.

Referring to page 128 of the July issue of THE WIRELESS CONSTRUCTOR, remove the grid condenser and the lead from the 2-megohm grid leak, which at present go to the grid terminal of V_2.

Arrange a short terminal strip on the baseboard immediately behind the H.F. choke and the 1-mfd. condenser.

Fixing the Switch

Upon this new terminal strip place two terminals, and the radio-gram switch, which will be one having three connections, namely, one connection to the arm of the switch, and two to the change-over contacts.

Join a wire from the grid terminal V_2 to the arm of the radio-gram switch.

Join one of the remaining terminals of the switch to the grid-leak connection and the side of the grid condenser which you have just removed from the grid terminal of V_2.

Connect the remaining radio-gram switch terminal to one of the two new terminals on the strip for the pick-up.

Connect the other pick-up terminal to a length of flex terminating in a wander-plug for G.B.—1½ volts. This wander plug is the plug directly into the 1½-volt socket on the existing grid-bias battery.

The connections for the volume control will be:

The two outside terminals on the volume control will be joined directly across the pick-up itself.

The arm of the volume control will go to the pick-up terminal on the terminal strip, which is joined to one of the terminals on the radio-gram switch.

One side of the volume control is then connected to the remaining pick-up terminal on the strip. In making this alteration great care should be taken not to disturb the existing wiring more than is necessary, and all leads should be kept as short as possible.

A Compromise Design

I have recently had the opportunity of trying out a Bulgin pick-up, which the makers describe as a "good compromise" design, and especially designed to suit the "average" amplifier.

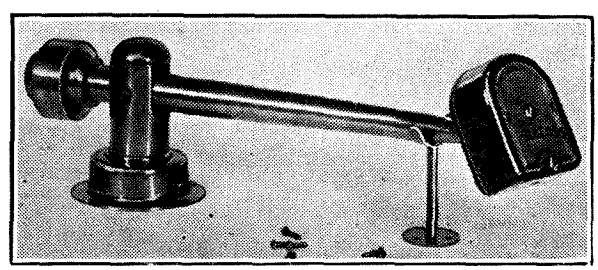
The pick-up does not give a straight line, and, in fact, it is not intended to.

Little Scratch

At the bass end there is a hump to compensate for the rapid falling off of the lower notes on the disc due to recording, and also for the decrease in amplification at this end of the scale in some amplifiers. The pick-up shows a tendency to peak at 3,000 to 4,000 cycles, and above this the response falls away so that there is very little scratch.

MECHANICALLY AND ELECTRICALLY BALANCED

The Bulgin pick-up is designed to compensate for the "failings" of the "average" amplifier and record. It has a counter-balanced arm that is arranged to provide a needle pressure of 4½ ounces on the record.



Personally, I prefer not to have the scratch suppressed in the pick-up itself, but rather to be able to experiment with resistances and things with the object of adjusting it down to suit my own ear. The point is that by suppressing scratch you must cut out some of the higher frequencies, whereas if you eliminate the scratch by suitably designing the pick-up, certain of the top notes are cut out at the source, and nothing you can do to the amplifier will reproduce them.

Messrs. Bulgin have, however, turned out a very good job, and at 30s. it is excellent value.

Practical notes on what stations to look for and how to get the foreigners that are coming over well.

ACCORDING to the calendar, to the barometer, to the eleven-year-cycle experts and to Old Moore we are now right slap bang in the middle of the radio "off" season. Atmospherics are supposed to be at their blackest pitch, and in July and August the long-distance capabilities of our sets are reputed to be nearly negligible. The pessimists are all saying "we must wait for the winter."

But is it as bad as all that?

Plenty of Programmes

Anyone with an ordinarily efficient set can soon decide the matter for himself. But, of course, the set must be in reasonably good condition, and not with a half-run-down H.T.

(It is surprising how often the blame is laid on "the bad conditions of the summer" when the real culprit is a battery that has been exposed to sunshine, or some similar "technical hitch," as the B.B.C. term it.)

* * *

Such a test on a three-valver the other evening revealed that there are plenty of easily captured foreign programmes available. And both the medium and the long wavelengths are packed with interest when a systematic search of them is made.

* * *

Near the zero mark on the medium-wave dial both Cork and Fécamp seemed in good fettle; while higher up and below the London National, Trieste on 247·7 metres and Barcelona Association on 252 metres were fair.

* * *

The patch around 275 metres was very prolific of results, with Turin, Heilsberg and Bratislava all present and correct.

Turin, by the way, seems to have steadied down from those wavelength wandering ways of his that once made him the bad boy of Europe, and the despair of the Prague planners.

* * *

Hilversum, who can always be relied on, on 296 metres, was in tip-top form, and Bordeaux, on 304, and Genoa, on 313 metres, were both worth listening to. In fact, Genoa seemed at first to be quite remarkably strong, but proved to be subject to fast fade-outs during which all trace of him disappeared at times!

* * *

A little higher up the dial, Poste Parisien was kicking up no end of a lively variety programme.

* * *

This new Paris, on 328 metres, is a good station, and those who have not proved that fact are advised to get acquainted.

Higher Up the Band

Above this wavelength there were several really good foreigners, notably Toulouse (385 m.), Katowice (408 m.), Beromunster (459 m.), and Brussels on 509 metres. Special attention was paid on this occasion to the area just above Katowice, in the hope of picking up the new "Dublin," but without success, the weakish carrier heard apparently being the usual transmission from the Free State capital, and not the new transmitter.

* * *

Long waves, too, were full of interest—marred by some eardrum-shattering atmospherics, it is true!—and Radio-Paris and Huizen, near the top of the dial, were specially good. Oslo, usually coy, was strong. In between the stations mentioned there were plenty of others worth nursing, but all the foregoing "stood out" as good entertainments not beyond the scope of an efficient three-valver. Surely not a bad "off season" record!

A Book Worth Having

IT may seem an altruistic thing for a battery manufacturer to give away a book explaining how to make the battery you buy last a long time—and yet it is sound business. "Ediswan's" know that, and their booklet AB767 is a model of good advice to battery users, which should be in the hands of every listener who wonders if he is giving his batteries a fair deal.

The book tells you how to choose a battery, how to look after it, and how to connect it.

It also includes a dozen "Don'ts" which will prove very useful in helping to lengthen the life of your batteries.

There is also a useful station-chart, and any reader of THE WIRELESS CONSTRUCTOR who applies will receive a copy while the supply holds out.

The address is The Edison Swan Electric Co., Ltd., Queen Victoria Street, London, E.C.2.

POINTS FOR PURCHASERS

Interesting details from manufacturers about recent trade activities.

New Metal Rectifiers

The Westinghouse Brake & Saxby Signal Co. signalled their confidence in metal rectifier possibilities by introducing seven new lines a few weeks ago. Three of these are for H.T.: Nos. H.T.9, H.T.10, and H.T.11; the others being L.T.1, L.T.2, L.T.4, and L.T.5.

The respective outputs and prices for the H.T. models are: H.T.9, 300 volts 60 milliamps. (21s.); 200 volts 100 milliamps. (21s.); 500 volts 120 milliamps., or 400 volts and 150 milliamps. (35s.).

Regarding the L.T. models, their outputs and prices are as follow: L.T.1, 6 volts 0·25 amp. (10s. 6d.); L.T.2, 6 volts. 0·5 amp. (11s.); L.T.4, 6 volts 1·0 amp. (13s.); and L.T.5, 12 volts 1·0 amp. (15s.).

Full particulars of these and of their other lines are obtainable from the firm at 82, York Road, King's Cross, London, N.1.

Resistance Alloys

From Wild-Barfield Electric Furnaces, Ltd., of North Road, Holloway, comes the news that the Telegraph Construction and Maintenance Co., Ltd., have entered into an arrangement with them to act as sole wholesale distributors for the following electric resistance alloys:

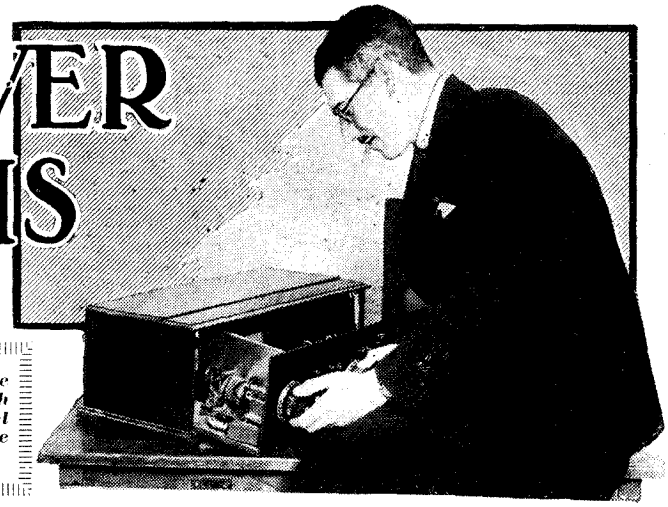
"Pyromic" 80/20 Nickel Chromium.

"Calomic" Nickel Chromium Iron.

Particular care has been paid to the accurate drawing of "Pyromic" wire in fine gauges (down to ·0009 in.!), and this is largely used by manufacturers of valves and other radio apparatus.

RADIO POWER PROBLEMS

by VICTOR KING



A challenging contribution in which Mr. King expresses some very definite views regarding the reception of broadcast speech and music. You may not agree with all he says, but we feel sure you will admire his courage in coming right out into the open with what is a subject of the keenest controversy.

IT has long been generally realised that the H.F. side of a set can considerably influence the quality of the results given. Even the listener who has no technical knowledge at all will quickly discover that he can alter loudspeaker tone by tuning and reaction adjustments.

And very noticeable distortion indeed can occur through instability in the H.F. stage or stages.

But it will be much less widely appreciated that the L.F. end of the set is able to affect selectivity. Perhaps some of you may even consider it absurd that the overall selectivity of a receiver depends almost as much on the loudspeaker used as it does upon, say, the aerial circuit.

Nevertheless, this is a hard fact and one that ought to be remembered.

I recollect a case which proved this to a doubting radio enthusiast in a very striking manner.

Nasty Little Squeak

It happened during that period when Stuttgart first began seriously to interfere with the London Regional programme. Many of you will no doubt remember that nasty little high-pitched squeak which suddenly broke into our 356-metre reception.

The amateur I have just mentioned was very superior in regard to this interference. "No, I don't get it—my set is very selective," he said.

Now, I knew his set and was fully acquainted with its powers and limitations, so I could boldly negative this by observing that I considered that it was his loudspeaker and not his set which was enabling him to claim a high degree of selectivity.

To demonstrate this I took a first-class moving-coil speaker round to his house and connected this in series with his moving-iron instrument. A couple of simple on-off switches were introduced in order to make it possible to switch in either loudspeaker at will.

Free From Interference

With his loudspeaker in circuit the London Regional programme could be heard quite free from interference from Stuttgart, and the reproduction sounded good.

But when we changed over to my moving-coil speaker, a clear, high-pitched whistle could plainly be heard. You see, his speaker had got a sharp cut-off at about 3,000 cycles and was not reproducing anything above that with any practical effectiveness. Therefore, it ignored the Stuttgart heterodyne and led him to credit his radio receiver with a greater degree of selectivity than it actually possessed.

It must also be admitted that quite a few other ether twitterings and squeakings were killed in the process, so that there was justice in his claim that: "Anyway, my outfit as a whole is selective and the programme is much more pleasant to listen to than when your speaker brings in all that rustling background."

Hot Under the Collar

I was reminded of that remark by all the controversy and argument which is at this moment in progress in the advanced technical press. Worthy engineers and scientists are getting very hot under their collars on the subject of high-frequency cut-off.

It would seem to be the opinion of a certain school of thought that one is

UNDOUBTEDLY A MUSICAL INSTRUMENT!

But we do not think Victor King had in mind this combined radio set and piano, which was recently shown at a Surrey exhibition, when he referred to a wireless receiver as "an instrument for the B.B.C. to play upon!"

Radio Power Problems—*continued*

less than the dust" if one does not possess a receiver able to receive and amplify equally a band of frequencies twenty kilocycles wide.

Which seems to me to be quite absurd.

They argue that if you have an output with an upper limit of nothing above five thousand cycles you are missing a whole family of partials, and that your results will be nothing but a mere travesty of the "real thing."

Satisfying the Majority

But my point is what is "the real thing"? And do listeners want it?

I maintain that they do not and that the vast majority would be fully satisfied by a moderately good handling of five thousand cycles.

Against this the radio pundits say that a cut-off at 5,000 cycles means the elimination of important harmonics which are necessary to the building up of true tone colours.

But it has been clearly shown that these harmonics are extremely weak and that many human ears cannot accommodate them at all. Further, the latest investigations would tend to point to the probability that "timbre" (the individual characteristics) of notes is built up more in the middle ranges of the acoustic scale than in the extreme upper limits. If this is true then we shall all have to revise our ideas to some extent.

However, all this is really beside the point, because there can never be a completely so-called "realistic" reproduction of broadcast programmes on a universal basis for various reasons.

A Pretty Problem

The first and most important is that listeners' houses will not permit of it. Just picture the problem. A B.B.C. orchestra is giving a concert in a studio at Broadcasting House. There is a studio audience.

Now a listener could not possibly hear similar sounds to those heard in the studio unless he had his loudspeaker installed in a room as large as and with the same acoustic properties as the broadcasting studio. And that is only an initial requirement.

But it is unnecessary to detail any others, for it is fantastic to suppose that more than a few rich cranks would ever build such a room.

And even if they did they couldn't achieve "perfect realism" for two good reasons. (1) No receiving outfit would be capable of providing a perfectly "straight-line" output over the full acoustic range of frequencies, and (2) the B.B.C. doesn't transmit the electrical duplicate of the studio sounds.

Varying Microphone Energy

In regard to the second point, it should not be forgotten that quite apart from transmitter distortion (and there's plenty of that) the energy from the microphone is controlled so as to bring it within a definite compass of volume variation.

In actual orchestral performances the sounds may vary over a band of intensities as wide as, say, from 1 unit to 100 units. In other words, the loudest sounds may be one hundred times as loud as the softest—or the difference might be even greater than that.

But the B.B.C. has a control panel engineer on duty to compress the compass, as it were, and he expertly handles a volume control so that the loudest sounds shan't be more than, say, ten times the strength of the softest.

Now where is that "realism?"

Careful Control

I am bound to say that the control is always, or nearly always, done with sympathetic discrimination.

By this time I hope you will begin to see what I am driving at. I am attempting to frame a case for free and easy listening as against an endeavour to work to rigid standards.

NO VALVES NEEDED!

Ernest Patrick, a twenty-one-year-old American, and the valveless receiver he has invented. It is said that he obtains excellent results

Perhaps you have met the radio fiend who will have so much wattage in the way of power output from his set, this or that tuning system, L.F. compensation, etc., etc., *and* etc., in order, as he explains, to get perfect realism.

He obviously fails to realise that reception realism is a pure myth and that there can be no such thing. All that can possibly be done is to make the most of the electrical patterning fashioned by the broadcasting stations out of ether vibrations.

The Sane System

And the sane procedure is to adapt these to one's own individual requirements.

I maintain that the criterion that really matters is the listener's satisfaction, and that he should not put up with what he finds is a distressingly loud volume just because it is "the thing" to try and reproduce studio conditions.

You can't do that and I see no harm in not trying, but in setting out to mould the reception to one's own liking. Thus I regard my set not as a producer of imitation concerts, but as an instrument played upon by the B.B.C. And I naturally ensure that it is adequate for its purpose, as far as is possible, practical and desirable.

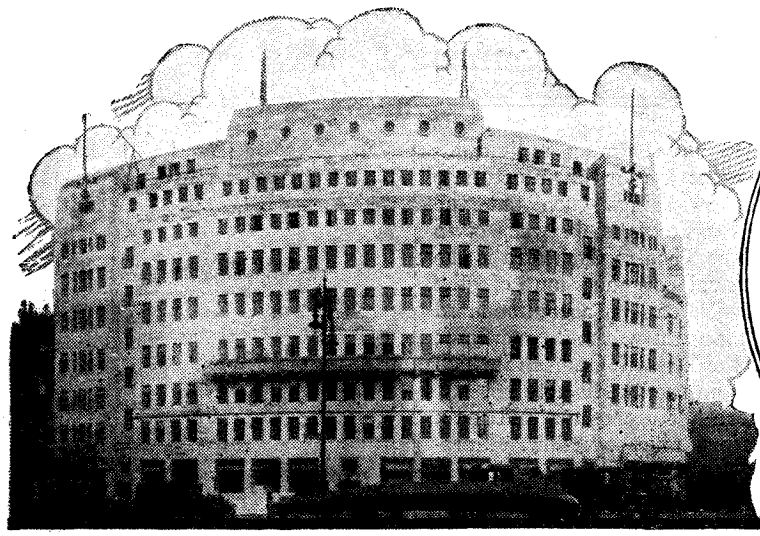
When the B.B.C. plays my set with a Henry Hall combination I get certain results, and these always bear a direct relation to those given when the B.B.C. plays my set with a Boult combination of effects.

I don't expect the B.B.C. to duplicate full concert hall effects on my loudspeaker, and I don't want them to—even if they could do it I wouldn't want it, and I don't suppose many of you would. Fancy having a symphony orchestra blaring away at full strength in the parlour!

Common-Sense Readers

Now don't say the ideal would be a straight-line diminishment of volume, for that would not be even "straight-line distortion," because of such factors as the curve of one's aural sensitivity, etc.

But I must stop now, and I hope some of you will write me concerning the points I have covered in this article, for I would treasure the views of CONSTRUCTOR readers, who, at any rate, are neither pedants nor cranks.



B.B.C. NEWS

Topical notes regarding British Broadcasting Stations and Programmes.

By Our Special Correspondent

Echoes of the Inquisition

I HEAR interesting accounts of the post-mortem on Sir William Beveridge's enquiry into family relations. It seems that the Adult Education Council, under whose auspices this curious series was arranged, is itself hardly happy about the results.

The truth is, of course, as I indicated three months ago, that the whole idea was bound to be repugnant to the healthy British public. In the United States there is a greater public appetite for this kind of inquisition, but it was a fundamental error to try and transplant it to Great Britain.

It has brought the B.B.C. into some measure of ridicule, it has damaged the prestige of the Adult Education Council, and I doubt if it has done any good either to Sir William Beveridge or to the London School of Economics. Anyway, it should be a lesson to the B.B.C. to avoid such entanglements in the future.

That "Opera Subsidy"

My information is that the B.B.C. is taking a more statesmanlike view of the general problem of opera than has been the case in the past. A notable manifestation of the new attitude is found in the practical help which has been afforded the Carl Rosa Company during the more difficult times through which they have been passing.

It seems strange, however, that the authorities at Broadcasting House give no sign as yet of a recognition of the serious disadvantage of the term "Opera Subsidy" as the right description of that part of the licence revenue which the B.B.C. is authorised to spend on opera. The blessed subsidy is a constant source of irritation in the House of Commons, where a harassed Postmaster-General must go on offering ineffectual explanations of a proposal which he, when in Opposition, staunchly resisted.

I suggest seriously that all this Opera Subsidy business should be dropped. It would be better for the B.B.C. to find the comparatively small sum involved out of its already attenuated revenue, rather than to continue to encourage a festering situation.

The B.B.C. Board

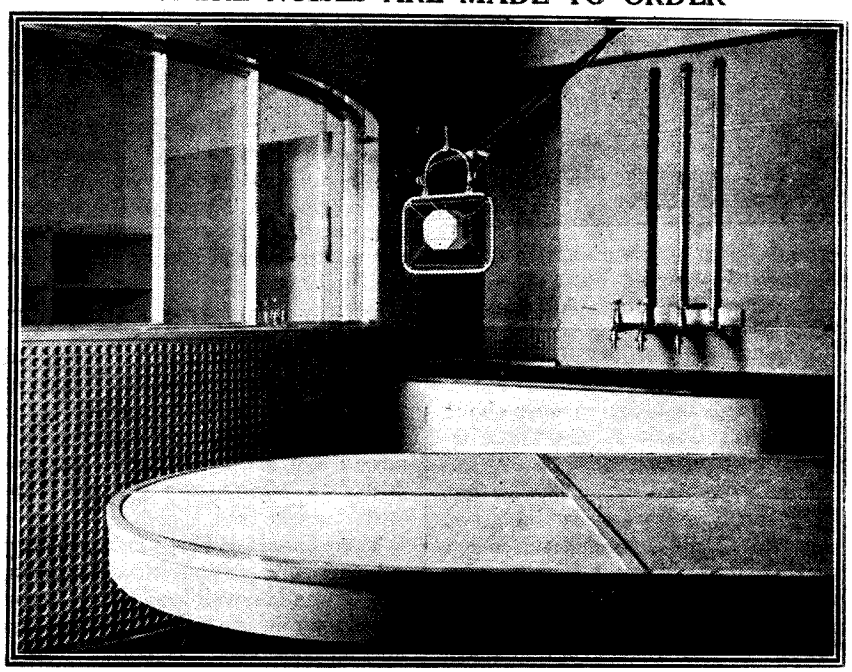
I can say authoritatively that there is no substance in the rumour that the Earl of Clarendon will be invited to resume his post as Chairman of the B.B.C. on completion of his term of office as Governor-General of the Union of South Africa. The idea has been brought forward by Lord Clarendon's friends, some of them inside the B.B.C.

The real reason why it will not become a matter of practical politics is that it is nearly certain that Lord Clarendon will be invited to undertake a second term of office in South Africa.

Unrest in Scotland

A well-known Scottish newspaper completed its first leader the other

WHERE NOISES ARE MADE TO ORDER



A corner of the Effects Studio at Broadcasting House. This studio is known as No. 6D, and in the background you see the water tank which is used for producing splashing noises and sea effects. The table shown in the foreground is also part of the equipment. It is divided into sections, each of which is covered in a different substance for varying tone.

B.B.C. News —*continued*

day with the question: "And who is Mr. Thomson?" Behind this lies an intense drama of personal antagonism and rivalry.

Glasgow not only has not forgotten or forgiven the transfer of B.B.C. headquarters to Edinburgh; Glasgow means to see that the B.B.C. scheme for a Scottish National Orchestra, in which the Glasgow Choral and Orchestral Union would be a minor partner, comes to nothing. Glasgow also remembers the Rev. Dr. George Reith was for nearly half a century its greatest pulpit orator.

Glasgow calls on Sir John Reith, the "Son of the Manse," to see it through, even if this means that Mr. Cleghorn Thomson's head must be produced on the proverbial charger. The crisis develops.

NIGHTINGALE NOTES

The Concert Studio

There is much heart-burning about the Concert Studio at Broadcasting House.

Three years ago, when it was first considered, it was fondly imagined that the biggest orchestra which the B.B.C. would use could be adequately accommodated on a platform such as is now provided in this Concert Studio. It was hoped also that there would be room for seven hundred spectators in the Hall and the Gallery. But many things change in broadcasting.

It is no use blaming individuals or the Corporation for the unfortunate fact that as things turn out the Concert Studio falls between two stools. The Theatre Orchestra is the only musical organisation of the B.B.C. which can be accommodated on the platform without overflow; and it is the Theatre Orchestra which will never be used in this studio.

All the other orchestras and main combinations must overflow. Moreover, if the main orchestra of 118 players is assembled for performance in the Concert Studio, many of the seats have to be removed, and, of course, no audience could tolerate the sound.

Did you hear the Nightingale broadcasts? On the left you see a B.B.C. engineer fixing the microphone in preparation for an attempt to catch the bird's song. This year's broadcasts were relayed from a wood near Pangbourne, in Berkshire.

* * *

The picture on the right was taken inside the radio-equipped van which was attached to the Flying Scotsman when the famous train maintained communication with an aeroplane that accompanied it northward.

The B.B.C., no doubt, will continue to seek elsewhere for an adequate concert hall. Meanwhile, Colonel Val Myer, who takes a particular pride in this studio, need not feel humiliated. It is an excellent creation which does great credit to the specifications and information which he was given. No doubt in due course it will be modified to meet broadcasting requirements without detracting from its inherent symmetry and beauty.

B.B.C. Staff Publicity

I am not surprised to notice signs of growing discontent in the B.B.C. at the new rules restricting publicity for individuals. Photographs of staff are not to appear in the B.B.C. publications, and there is a general "go-easy" order.

There has always been an anonymity rule particularly applied to announcers, and it was believed that the personal popularity of Captain Eckersley did him no good with the B.B.C. Board. There would not be so much feeling about the last ukase if Sir John Reith and Admiral Sir Charles Carpendale got no personal publicity.

But, in the past few months, it is the exception rather than the rule to find a newspaper or journal in which there is no personal reference either to the Director-General or the Controller of the B.B.C.

I do not say that these gentlemen encourage personal publicity; probably they dislike it. But the fact remains that it exists in growing volume, and as long as this is the case attempts to suppress personal publicity for junior members of the B.B.C. staff are bound to be resented.

RAILWAY RADIO

Broadcasting House

Much bitterness has arisen between the various outside interests responsible for Broadcasting House. This development is due to the splitting up of the work into several lots done by competing firms.

Of course, the B.B.C. saw to it that prices were cut to the bone, and those who took on the work expected their real return in prestige and publicity. But the trouble is that the total thunder is not unlimited, and there is a hot scramble for it.

Meanwhile Colonel Val Myer, the real architect, looks on serenely confident of the ultimate recognition of his great success.

From My Armchair

by "S.T."

A GLASGOW reader tells me that he hasn't built the "S.T.300," but he and five friends are waiting for a four-valve set. His reason is that he has an indoor aerial. He writes: "In Glasgow most of us have to use indoor aerials, and although these are as efficient as possible, the earth systems are very bad. Water-pipes are often a hundred yards long before reaching earth, and often six or more sets are 'earthed' to various parts of it."

I am given no reason for this use of indoor aerials. It may be due to the prevalence of flats, or perhaps merely an old Scottish custom! The earth business, however, is bad, and it is quite possible that coupling between sets might occur.

That Bogey Van

As I don't believe—and never have believed—that a P.O. bogey van can normally distinguish the difference between a wireless set and a coal scuttle, the licence department officials must have a difficult time in Glasgow. Perhaps, after reading this, they will give up vans and use plumbers.

Talking of earths, the one at Tallis House (the offices of this paper) is wrapped in mystery. It is alleged to go for miles! A few of the staff have been told in secret where the earth-wire joins a pipe, but even the oldest inhabitant has no idea where the pipe goes to. Curious stories are told in hushed voices, but no one really knows. Personally, I don't even know where the earth-lead joins the pipe.

In some cases it doesn't matter frightfully whether the "earth" is earthed or not. If the earth pipe is long and forms one side of a "condenser," the aerial being the other, you will get good "signals" even if the end is not earthed.

Like a Large Condenser

Frequently a long unearthed water-pipe has a big capacity to earth and you get the same effect as if you had a big condenser in series with your earth lead.

Many people with indoor aerials or poor outside ones squeal about their long earth-leads. Actually, a long earth-lead will often improve signals—e.g. when you are working from a first-floor flat. It acts as an additional aerial, even though on the "wrong" side of the set.

Plenty of Insulation

The whole earth-lead must be of insulated wire to prevent leakages and crackling noises in the set due to intermittent contacts with walls, etc. The chief trouble, however, is that the set, batteries and speaker are at high-frequency potential to earth. There will be an increased tendency to produce hand-capacity effects (e.g. whistles when the hand approaches the set); also the set is usually more unstable when H.F. amplification is in use.

Nevertheless, if I were compelled to have an indoor or very short outdoor aerial I should experiment with a long earth lead and try it in different positions, preferably away from the aerial. Of course, it would be earthed at the far end.

A point for flat-dwellers and others using dubious pipes as earths is that these may pick up all sorts of A.C. due to electrical machinery, electric light, etc. This A.C. or other current of unknown but nevertheless objectionable wave-form can readily produce very bad hum or crackle in a set.

Counterpoise May Help

The parasitic currents picked up by a wandering earth or a badly placed aerial may be of ordinary low-frequency. If so, you will often find that when working a set with an H.F. valve the noise is much louder when a carrier-wave is received—i.e. when receiving a station.

The reason is that the H.F. valve is partially acting as a rectifier and the A.C. on the grid actually modulates the H.F. carrier current of the incoming signal. The modulated H.F. gets rectified by the detector and is ineradicable.

The noise is worst at low values of the first tuning condenser; the A.C. is more "short-circuited" by

There is probably no writer who can deal with so many different subjects in so entertaining a manner as can Mr. John Scott-Taggart, and his notes are bringing more and more letters of appreciation from the hundreds of constructors who follow his advice. This month "S.T." writes about barbers and breweries, about grids and gasometers, and about water-pipes and wavebands! What more could anybody want?

The Brewery That Improved Reception

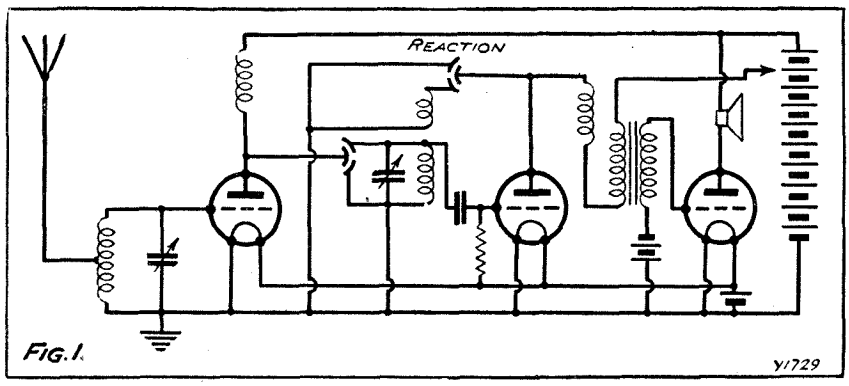
higher values, and therefore the potentials applied to the grid are less. The noise may sometimes be reduced by modifying the H.T. voltage of the H.F valve, and by applying a small negative potential to the grid (e.g. of a S.G. valve) to minimise rectification.

Where an earth is suspected of picking up "noises," try a counterpoise "earth"—i.e. an insulated wire or system of wires not connected to earth at all, but spread out—preferably under the aerial.

* * *

To come back to my Glasgow friend's demand for a more-valves' set, I must say that I sympathise with him. Personally, I shouldn't think of using an "S.T.300" on a small indoor aerial. Neither would I scrap a six-valve super-het. But plenty of readers are doing both and seem jubilant about it!

A SUCCESSFUL SUGGESTION FROM SOUTHEND



Here is a diagram which "S.T." has prepared to show how a correspondent has obtained greater selectivity by adapting the differential anode system of the "S.T.300" to ordinary triode working.

Curious Aerial Position

There is no doubt that there are fewer facilities for good aerials than I thought. Out of all my mail, there are only two readers, I think, who speak of a full 100-ft. aerial. But the fact remains that I cannot at present see how one can theoretically get more out of three valves than with the "S.T.300." Give me another valve and I feel I could do wonders with it.

I have recently been trying out a circuit which is very effective. But it is too effective! I have not the slightest intention of designing a set using it. It is one of those tricky arrangements which requires a real circuit-monger to handle—one of those men who have the patience to titivate things up until the maximum result is obtained from a station.

Anything to Oblige

I like my results quickly when it comes to tuning, but I wonder how many readers these days are interested in playing about with new circuits? I could keep a battalion of them supplied with ideas. I feel, however, that readers prefer a finished practical product rather than fascinating experimental "hook-ups." However, remember that I'll write about anything or design anything if enough readers write in about it.

You can rest assured that every single letter of praise, criticism or suggestion relating to my work for this paper is read by me personally. One of my correspondents complains that I adopt too personal an attitude for a technical writer. But by the same mail comes a letter from a reader who says: "This is the first letter I have written to a wireless journal, but it seems like writing to an old friend when I address you." Another says: "I hope you don't think this letter familiar, but I feel familiar!"

Those Welcome Letters

Of course, it is for readers to say how they like me to write. If they want an austere, highly-professional attitude I can easily revert to it. After twenty years of wireless, however, it is a relaxation to write naturally. To aim at soundness, but to avoid stiffness, has always been my ambition. And if ever I begin to feel too pleased with myself or too superior I have only to gather round me half a dozen amateurs and I am restored to a healthy limpness and humility!

A "follower" of my armchair chats says he has an excellent aerial, but gets poor results on his set. He says: "The fly in the ointment is a gasometer in front of my house."

Healthy Humility

This massive metal structure damps his signals, but excites his argumentativeness. In fact, it is not only a fly in the ointment, but a bone of contention. He and his neighbours apparently spend hours arguing whether the gasometer really can interfere with all "signals," or will merely obstruct those in whose path it lies. I am asked to give an opinion.

It is always a good plan when asked an awkward question on wireless to ask the other man one. So I shall have to know exactly how far off is this gasometer and what is its size. The metal masts of 2 L O, when on the roof of what newspapers (anxious to avoid giving free publicity) called "a well-known store in Oxford Street," threw very pronounced "shadows"; "signals" being considerably poorer if you lived in these shadowed areas.

I should imagine a gasometer would adversely affect all "signals," with a little extra weakening of "signals" coming from the direction of the monster. But that's largely guesswork.

Good for Strength!

I have never tested an aerial under such conditions, although I must have put up hundreds. A school, a row of trees and a railway station have, in my experience, made no noticeable difference; a brewery even seemed to improve the strength of "signals" from its direction!

This is just a case where readers can write to me and give valuable information. There must be some within easy scent-range of a gasworks. Remember, the question is not only to what extent "signals" are effected, but whether the structure acts as a definite screen in a certain direction. If there is a very decided effect, I should imagine we might see advertisements of houses "shielded from Brookmans Park," "Slowit," or Falkirk. (I hope the B.B.C will not be offended by the suggestion.)

What about readers in Southall? Many an evening I have flown home to London to find the City

—and the Bloodthirsty Doctor of Kent!

hidden by a misty, smoky haze. But above these white filmy layers I have seen poking the welcome top of the Southall gasometer and known at once that exactly 2,000 yards to the south I should find Heston Aerodrome.

This one is the tallest, fattest and most overwhelming gasometer in all England. Let me hear from anyone who suffers from pronounced shielding, but above all from neighbours of this monument to the Gas, Light and Coke Company.

Since I mentioned the man at Chorlton-cum-Hardy who wanted to get me by myself, local enthusiasts have rallied to my support. Mr. Leonard Norman, of Caldervale Avenue, Barlow-Moor-East, Chorlton-cum-Hardy, writes a typical letter, but goes one better than most. Not only is he willing to demonstrate his own "S.T.300," which he says is the best set he has ever built, but to put my complaining friend's set right for him!

Many Interesting Reports

My return to radio journalism has brought me many interesting letters from readers in every walk of life, and some from acquaintances I have not met for years. One letter from a builder of the "S.T.300" ends: "I don't suppose you would remember, but I used to cut your hair when you were a schoolboy."

Another letter from J.W.S., of Henrietta Street, Old Trafford, shows what vast possibilities of radio propaganda are latent in the hairdressing industry. For J.W.S. has built three "S.T.300's" (one of which is "doing fine work at Firswood, Chorlton-cum-Hardy"!). The other is at Higher Broughton, and the third—his own—brings in more stations than a previous "four."

Coil—or Shingle?

He writes: "I am a hairdresser by trade, and there are plenty of my customers with 'S.T.300' sets since I told them about it, and only one had trouble. He lives at Warrington; he wrote to you, and now he tells me it is great. I make so many different sets that my customers ask me: 'What have you got working now?' My replies are still: 'The "S.T.300"; there is nothing better.'"

Obviously, the best thing I could do with my next set would be to demonstrate it to meetings of hairdressers up and down the country. But J. W. S. must be unique. How many barbers would discuss "razor-sharp tuning" and "cutting off 'top'"? It must be a relief for denizens of Old Trafford to go to a hairdresser who thinks of continuous rather than permanent waves, and of transformers instead of transformations.

When next I go to watch Lancashire play cricket I shall feel safe in submitting myself to the razor of J. W. S. And as he lathers my face we shall discuss the dynamic mutual conductance of the latest H.F. pentode.

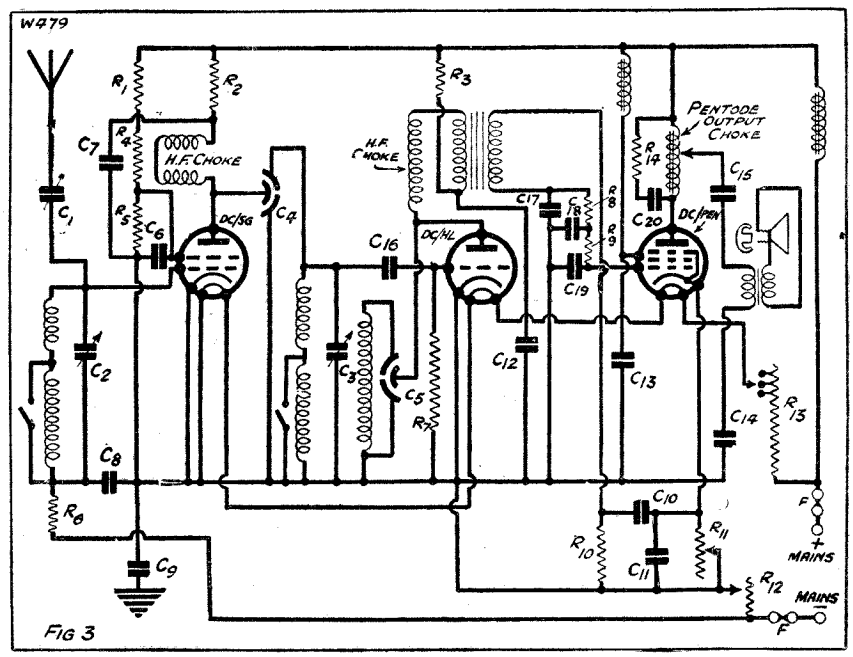
I should feel less safe with Dr. B., of Canterbury, who has had trouble with his "S.T.300," and would be glad of a visit. He writes: "If you let me know in advance, I could arrange for my brother-in-law to be present as well. I could then kill two birds with one stone."

From the symptoms you relate in your letter, doctor, I should diagnose that you were suffering from an unhealthy spaghetti. I should advise you to try replacing it by a plain wire connection. If this improves matters, buy a new 20,000-ohm spaghetti *of the best make*. And when you get it, do not see how many knots you can tie in it. Playing cat's-cradle with spaghettis is a favourite hobby of wireless constructors. The things, of course, simply ask to be twisted—and then crackle about it afterwards.

Sources of Trouble

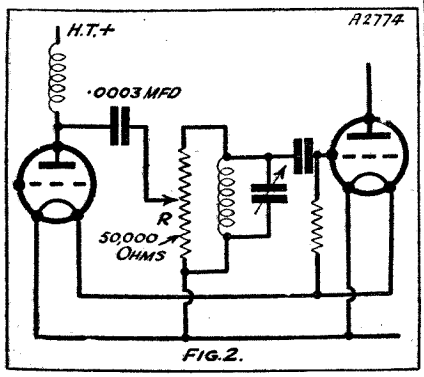
The possible sources of trouble in the "S.T.300" are: (1) faulty sphaghetti; (2) unsuitable or faulty valves; (3) "dry joint" on one of the coils; (4) L.F. transformer inferior to the one I used; (5) faulty differential anode coupler; possible short, perhaps due to dirt or filings;

YOU'VE BEEN LOOKING FOR THIS!



Here is the circuit diagram which shows how a Hull reader has adapted the "S.T.300" as a D.C. mains receiver. "This arrangement," says "S.T.," "has been carefully worked out and should prove highly useful to D.C. users."

FOR GREATER STABILITY



Another useful idea which the correspondent from Southend has tried out with success. With the aid of a 50,000-ohm resistance and a potentiometer slider across the tuned circuit, volume control and increased stability are achieved.

From My Armchair—*continued*

(6) departure from wave-change switch specified—this will cause instability on the long waves; (7) departure from wave-change switch position; (8) unsuitable S.G. choke; (9) unsuitable aerial coupler—only Peto-Scott, Wavemaster, Ready Radio and J.B. are approved; (10) earthing point or contact between vertical and horizontal screens defective; (11) faulty coils; (12) bad contact on either switch—this is worth checking on *all* sets; (13) connections not tightened up; (14) wrong connections to anode coupler; (15) valve pins not making proper contact; (16) wrong connections to S.G. valve holder; (17) faulty grid leak.

It's a Partnership

The above list will cover most faults—manufacturers' or readers'. The list would apply to practically all types of sets, except in the case of (5), (6), (7) and (9). Many of the faults will merely cause a reduction in the performance of the receiver and the reader may not be conscious of it.

The Editor informs me that the "kit" people have had fewer complaints of non-operation with this set than with any in the last two or three years. This, however, does not make me feel at all self-complacent. No matter how few sets are not working, I recognise an obligation to help. After all, the only proper way to look at the relationship of designer and constructor is to regard it as a partnership.

Using the Triode

I have had a most interesting letter from the Rev. B. S. Mercer, of Little Wakering Vicarage, Southend. He has adapted my differential anode coupling system to ordinary three-electrode valves and says he gets very good results. The accompanying Fig. 1 shows how increased selectivity is obtainable on a simple tuned-anode set, or "tuned-grid" set, as most people would call it.

Parallel Fed

A parallel-feed system is used, an H.F. choke being connected in the anode circuit of the H.F. amplifying valve. Of course, there is no real difference between a "tuned-anode" and a "tuned-grid" coupling. In both cases there is only one tuned circuit which is connected to the anode circuit of the valve.

My correspondent also mentions that he has tried out with useful results the scheme I have sketched out in skeleton form in Fig. 2. He now uses a resistance of 50,000 ohms across the tuned circuit and by means of a potentiometer slider he is able to vary the "coupling."

A Permanent Load

The chief disadvantage of this scheme is that there is a permanent "load" on the tuned circuit, reducing its selectivity and damping down signals. But the load of the anode circuit of the H.F. amplifying valve is reducible by moving the slider down, and the damping effect of a three-electrode valve anode circuit is so considerable that the circuit has some merit. Volume control and increased stability is capable of achievement with the arrangement, which could be applied also to an S.G. valve, but with less advantage.

* * *

A Dutch reader, H. Van Doorne, of Rotterdam—apparently wanting more than Huizen (or Hilversum) and Hilversum (or Huizen)—has built the "S.T.300." He has used plug-in coils and is very pleased with results. I am not surprised. Just when plug-in coils were going out of fashion they had reached a high state of efficiency. The necessity for compactness and for dual-range operation rang the death-knell of the "plug-in" coil for the ordinary wave-bands. But it must have been buried alive, because it still pops up every now and again.

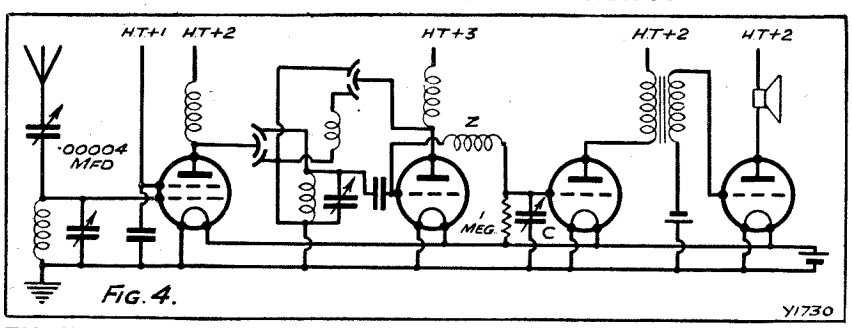
For D.C. Mains

Mr. Van Doorne had at first trouble with selectivity, but it turned out that he had reversed the connections to his differential anode coupler. The aerial and anode couplers worked in opposition as regards giving selectivity. There have been a number of readers who desire a D.C. version of the "S.T.300" for mains. I have not designed such a set myself, but a correspondent, Mr. W. H. Chapman, of Hull, has sent the following details of a set.

Fig. 3 illustrates the circuit, and he writes: "Mazda D.C. ·5-amp. valves are used. Auto-bias is obtained by means of R_{11} and R_{12}, both of which are variable resistances, and are mounted on the panel. In the pentode grid circuit, R_8 and R_9 with C_{17}, C_{18} and C_{19} have the effect of eliminating background noises and render the set stable. The output of the set is matched to a B.T.-H. Minor permanent-magnet "R.K." speaker. The layout can be arranged in a similar manner to the "S.T.300," and the eliminator section, including the decoupling condensers, etc., can either be housed separately or the panel and baseboard extended six to nine inches and then built in, with a screen incorporated between the

(*Please turn to page* 211.)

DIODE DETECTION IN THE "S.T.300"



This diagram shows a reader's "special" all-mains "S.T.300" circuit adapted for battery work, using "Diode" detection. "Fortunately," "S.T." remarks, "the prejudice against more than three valves is dying down."

WRITE TO "S.T." ABOUT IT!

"You can rest assured that every single letter of praise, criticism or suggestion is read by me personally.

"Remember—I'll write about anything or design anything if enough readers write in about it."

J. S.-T.

PICK-UP HINTS AND TIPS

Some interesting notes on various practical aspects of radio-gram reproduction.

By A. BOSWELL

Lubricating Aluminium Discs—Broken Needle Points—A Switching Suggestion—Emptying-out Used Needles—Why We Use Large Power Valves.

I EXPECT many of the readers of this page go in for home-recording, and that they all make use of aluminium discs. One of the most common troubles met with in making records of this type is lack of power in the gramophone motor.

Plenty of Power Required

It is unable to turn the disc fast enough for proper recording, and usually the motor that gives this trouble is a single-spring one of the type commonly used in portable gramophones. If you are faced with this problem, it should be worth while to experiment with a little more lubrication of the aluminium discs.

I say " more " because, as you have no doubt noticed, the discs are sent out smeared with a thin layer of grease. (Its object is to keep down friction between the needle and the surface of the disc, in much the same way as a lubricant is used when drilling or cutting a piece of hard metal.)

It is quite likely that more lubricant, such as vaseline melted down and poured over the disc, would prove beneficial. Also, ordinary oil lubricants might be experimented with, and might lead to some interesting discoveries.

A Needle "Point"

Writing of needle friction reminds me of another needle " point." Have you ever had the very tip of a needle break off while a record was being played ? It has happened to me twice, and I was *not* using cheap needles at the time !

In such a case, unless the needle is removed from the record immediately, the record will be completely spoiled. In any case, it won't " do the record much good."

And to help you recognise the trouble as quickly as possible, should it happen to you, I will tell you how it sounded in the two cases that I experienced. In the first, reproduction almost completely stopped. All that remained was a very thin and very distorted fantasy of the tune being played.

The second case was not so definite, and at first sounded just like a badly scratched or cracked record. Due probably to the record being slightly warped, the reproduction, much distorted, kept rising almost to maximum value and then fading right away again to practically nothing as the record revolved.

TWELVE OF THE BEST

Vocal.

Somebody Loves You.
Singing Sam .. .. .. Broadcast

I Lost My Heart to a Melody.
Peter Dawson .. .. H.M.V.

Humorous.

Mrs. Blumberg's Boarding-House.
Julian Rose .. .. .. Broadcast

Oi !
Flanagan and Allen .. .. ..Columbia

Dance.

Can't We Talk It Over ?
The Blue Mountaineers .. Broadcast

Auf Wiedersehen.
Savoy Hotel Orpheans .. Columbia

Round the Marble Arch.
Ambrose and his Orchestra .. H.M.V.

I Got Rhythm.
The Victor Arden - Phil Olman Orchestra H.M.V.

What Would You Do ?
Rhythmic Eight.. .. .. Zonophone

I Lost My Heart in Heidelberg.
The Blue Lyres .. .. Zonophone

Piano.

By the Fireside.
Billy Mayerl .. .. .. Columbia

Novelty.

Imitations of English and Australian Birds.
" Imito " .. .. Zonophone

Better Switching

Turning now to something a little more cheerful. Most of you will be familiar with the connections for a single-pole change-over switch for record or radio that is connected to the grid of the detector valve. The common point of the switch goes to the grid, one outside contact to one pick-up input lead, and the other outside contact to the grid leak and the grid condenser.

Cutting Out the Clicks

When the switch is in the intermediate position, namely, when going from radio to record or vice versa, the grid is left " up in the air," and the result is often a very loud double click as the change-over is made. There is a simple way in which this clicking can be entirely avoided.

The idea is to connect up the switch so that the grid leak is always across the grid and filament of the valve, thus preventing the sudden breaking of the grid circuit. The grid-leak's resistance is so high that the amount of current that it draws from the G.B. battery is extremely small, as also is its effect on the pick-up across which it is shunted.

So that the tiny current from the G.B. battery is not always being drawn when the set is not in use, it should never be left set to the " record " position. This would not apply, though, to a mains receiver using automatic grid-bias, and, as a matter of fact, it is particularly with this type of set that the scheme is useful.

Room for Improvement

Do you enjoy emptying used needles out of a needle cup ? I don't, particularly when the cup is one of those which you cannot remove from the motor-board.

Why does not someone start fitting a needle box in the form of a shoot ending in a small trap door at the side of the cabinet, so that emptying can be done in a couple of seconds ? Perhaps there is such a thing, but so far I have not come across it.

Readers are sometimes led to wonder why valves capable of handling much more volume than is ever likely to be wanted for ordinary home use are so often used in radio-gram work. The reason is, of course, the provision of a really useful safety margin to avoid overload distortion.

Screeching Sopranos !

Such a safety margin enables one to put on a record of, say, a powerful soprano with the greatest ease of mind. There is none of that worried anticipation of a top note in case it should come out as a cracked shriek, or sound like some broken-down factory siren !

AS WE FIND THEM

NEW APPARATUS TESTED

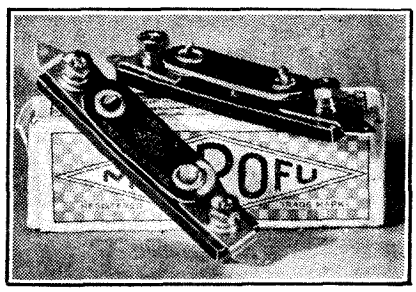
Under this heading we publish reviews of apparatus submitted by radio manufacturers and traders for examination and test in "The Wireless Constructor" laboratories.

Snap Switches

MESSRS. GEORGE BECKER, LTD., of Wembley Park, Middlesex, have sent us in two samples of their single-hole-fixing snap switches.

An important point regarding the design of these switches is that the casing and the operating lever are of moulded bakelite construction, thereby giving very high insulation and rendering the switch suitable for use in connection with mains designs.

EASILY FITTED



Two examples of "Microfuses," which are available in a number of current ratings. The blown fuses can be replaced in a second.

The workmanship throughout is of very high quality and the make-and-break action is positive and instantaneous. Various types are available, those submitted being a one-way and a two-way respectively. These switches are excellent in every way, and we can recommend them.

"Microfuses"

The insertion of a fuse in the circuit of a set, whether mains or battery operated, is always a useful protection in the event of an accidental "short."

Its cost is small, but it may save pounds in the end.

The "Microfuse" is a particularly neat component and comprises two parts, viz., an ebonite holder for base-board-mounting equipped with terminals and soldering tags, and the fuse itself, which is a quickly detachable metal strip with an insulating backing.

The "Microfuse" blows in 1/1,000th of a second, and is available in various ratings. The two samples submitted were designed to "blow" at 100 m.a. and 500 m.a. respectively, and on test we found them to be very effective.

The makers are Microfuses, Ltd., 36, Clerkenwell Road, London, E.C.1.

Loewe Resistances

Messrs. Loewe Radio Co., Ltd., of Fountayne Road, Tottenham, N.15, are marketing a new type of high ohmic resistance which is priced at 6d. These resistances are obtainable either with caps for clips, or with caps together with wire ends, so that clips or soldered connections can be used as desired.

The resistances are available in values ranging from 1,000 ohms to 10 megohms, and are manufactured with a tolerance of 15 per cent of the rated value. The power dissipation is up to ·5 watt, and the construction of the resistances is such that the self-capacity is negligible.

We found the sample resistance to be well up to its rating of 60,000 ohms, and although we deliberately gave it a fair amount of rough handling to test its mechanical strength, we were unable to damage it.

A Useful Screwdriver

Every constructor has a screwdriver, but how many possess one which can cope with some of those awkward places we sometimes meet with when building a radio set?

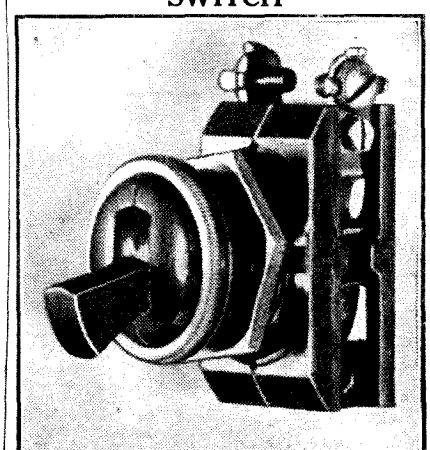
Yet for the sum of one shilling there is an ingenious screwdriver which easily overcomes the difficulty of inserting screws in places inaccessible by the fingers.

It is a dual-purpose tool. One end of the spindle is "pronged" so that it holds the screw in position until the initial task of "getting a start" has successfully been accomplished.

The other end of the spindle is shaped as an ordinary screwdriver, and is instantly reversible in the handle, which incidentally has a rubber insulated grip.

This attractive little tool is called the "Peerless," and the makers are The Peerless Productions Co., 274, Deansgate, Manchester.

BAKELITE-INSULATED SWITCH



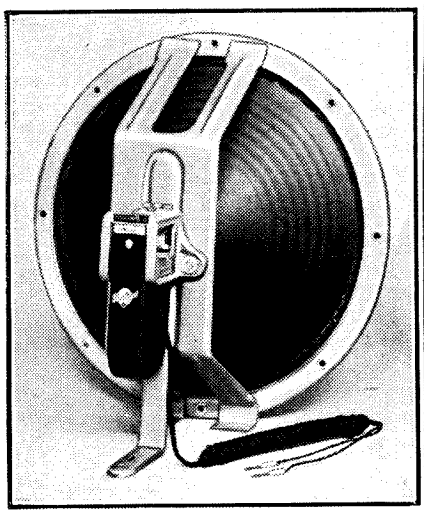
An all-bakelite single-hole-fixing switch made by George Becker, Ltd. The design provides for a rapid and positive make-and-break, and all the usual types of switches used in radio work are available.

As We Find Them—*continued*

Lotus Components

Messrs. Lotus Radio, Ltd., are well known as makers of quality components, and we have had one of their two-gang drum-drive condenser assemblies in use for some time. This particular unit is a thoroughly well-made component and is sound both electrically and mechanically.

BRINGS OUT THE BASS



The Blue Spot inductor type unit combines an excellent low-note response with a good overall balance of tone. The chassis can be mounted on a wooden baffle or screwed directly in a cabinet.

The vanes are of heavy-gauge metal, and each condenser section is screened. The units are matched up to within 1 per cent, and are provided with accessible trimmers which can be easily adjusted either with the fingers or a screwdriver.

In spite of the rigid construction and shielding, the assembly is by no means bulky. The drum-drive is very effective and smooth in working. Moreover, a lamp is fitted for illuminating the dial.

The two other components sent in were a dual-wave aerial coil and an output choke.

The aerial coil covers both medium and long wavebands, wave-changing being carried out by means of an external switch. The makers have paid special attention to the elimination of break-through at the bottom end of the long-wave scale, and a different aerial winding is employed on each waveband.

We found the coil to be effective both on the medium and long waves, there being no noticeable falling-off in volume when the coil was switched over to the long waves.

With regard to the choke, this is a very moderately priced component retailing at 5s. 6d., and is rated at 20 henries when the anode current of the last valve does not exceed 10 to 12 milliamps. It is certainly an efficient little component in its class, and its D.C. resistance is comparatively low, namely, 720 ohms.

A Blue Spot "Inductor"

The British Blue Spot Company have for a long time been associated with "class" loudspeaker units.

Recently we have had the opportunity of conducting an extended test of the 100U inductor type unit and chassis.

This particular model is a worthy representative of the Blue Spot range, and still further enhances the makers' reputation.

The 100U possesses a high overall sensitivity, and will handle undistorted outputs up to just over a watt.

Given an effective baffle, it does full justice to the bass notes, while at the same time retaining a good tonal balance over the middle and upper musical register.

The unit can be used either with ordinary power valves or pentodes, and is equally suitable for small or large sets.

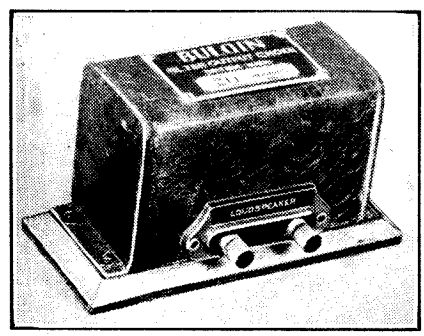
The makers are the British Blue Spot Company, Ltd., Rosoman Street, Rosebery Avenue, London, E.C.1, and the chassis price is 39s. 6d.

Output Filter Unit

An output filter consisting of a choke and condenser connected in the anode circuit of an output valve is beneficial in two ways. First, it isolates the loudspeaker from the high-tension supply, thus protecting the speaker windings, and, secondly, a filter tends to improve the stability of the L.F. amplifier by acting as a decoupling device.

Messrs. A. F. Bulgin have sent us a

PROTECTS THE SPEAKER



A complete output filter unit which can be connected externally between the speaker terminals on the set and the loudspeaker, or alternatively placed in the receiver itself.

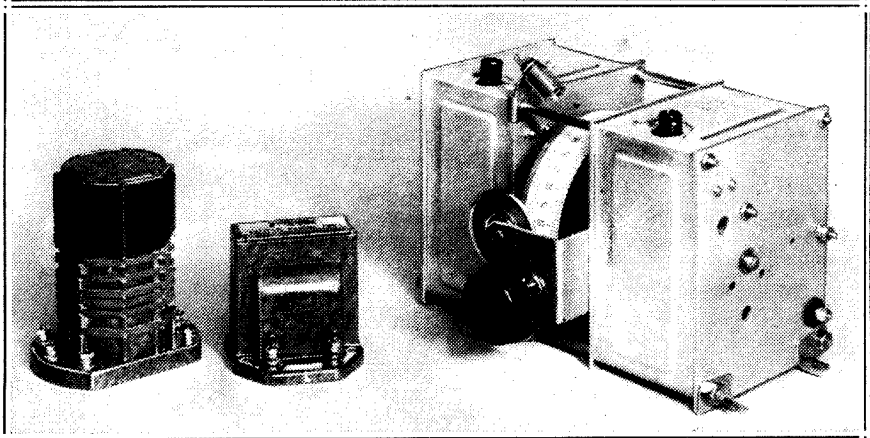
compact output filter for use with any receiver by connecting it to the loudspeaker terminals.

The unit contains a 20-henry choke having a handling capacity up to 50 milliamps. (maximum) D.C., and a 2-mfd. condenser with a working voltage rating of 250.

This unit is particularly well finished and should prove a boon to those who wish to incorporate an output filter without the necessity for altering their existing receivers.

The price is 17s. 6d.

THREE HIGH-GRADE COMPONENTS FOR THE CONSTRUCTOR



The Lotus two-gang condenser unit shown on the right has a slow-motion illuminated drum-drive. Easily adjusted trimmers are provided for each section. In the centre is a 20-henry iron-cored choke, and on the left a dual-wave aerial coil.

The "Hiker" Pushable Radiogram

By Wireless Wayfarer

I DON'T mind telling the reader in the strictest confidence, feeling sure that he will keep it entirely to himself, that Professor Goop is going to provide one of the biggest surprises of this year's Motor Show. You will see how necessary it is for me to ask you to say nothing about it when I mention that it is one of the most closely-guarded secrets of the motor trade.

Here, however, for your own information (copyright by Wireless Wayfarer, the Press Association, Central News, Reuter and the B.B.C., and not to be communicated to the public by loudspeaker, lantern slide, printed slip, or other device), is something about the BIG IDEA. Professor Goop is bringing out a home-constructor's baby-car kit!

On the Kitchen Table

So simple is the construction that the little bus can be put together by anyone on the kitchen table or in the potting-shed, with no more elaborate tools than a turret lathe, a steam hammer, a milling machine and a stamping plant.

ABSENT-MINDED!

"Flung his sandwiches to the fish."

The engine is a four-cylindnder, a if I know anything of constructors every post will bring a sheaf of letters asking how to add a couple. This is one of the beauties of the design; and it is purely on account of his long association with wireless that the Professor has been able to evolve the wonderful Goop Expansible Engine. It is the easiest thing in the world to convert it into a six-, eight-, or twelve-cylinder.

When I called round the other day to discuss with him the final details of the Kit Baby (or Kitten, as it will probably be called), I found the Professor in a somewhat absent-minded mood. I realised that such was probably the case when I entered his den at the "Microfarads" and found him trying to put his gloves on to his feet.

This, of course, was a mere trifle; it is nothing to what the Professor can do in moments of real absent-mindedness. Why, I have known him put the cat into his bed and turn himself out for the night. And there was the memorable occasion when on the canal bank he devoured a whole can full of ground bait and flung his sandwiches to the fish.

The ever-active and versatile brain of Prof. Goop turns from the design of a home-constructor's motor-car to providing radio amenities for another large group of road users—the hikers, but we are forced to doubt its practicability!

The Professor slowly emerged from the reverie in which he had been plunged; but, taking no notice of the question about the Kit Baby which I fired at him, he plunged straight away into a new idea.

"Has it occurred to you," he asked, "that there is one great section of our population for whose summer-time enjoyment of wireless nothing has so far been done?"

Chestnuts and Winkles

This seemed to require a little thought. What could the Professor mean? Unemployed snow-shifters? Vendors of roast chestnuts? Or did he mean devotees of summer pursuits? Winkle eaters? Women cricketers? No, it is too difficult. I told him that I gave it up.

"Why, hikers!" he cried. "Do you know what a hiker is?"

"Why, of course!" I smiled. "One who tours the country on foot; a pedestrian, in short."

"In shorts," corrected the Professor. "Now why shouldn't hikers be able to add to the enjoyment of their country rambles by having wireless or gramophone entertainment always available?"

"They have only to carry portable sets," I suggested.

"Have *you* ever carried a portable set fifty miles?" roared the Professor. "No, the hiker is already sufficiently burdened."

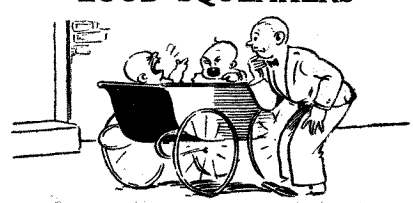
A great light flashed upon me.

"Why, of course!" I cried. "Let us design at once a little unit set specially for him. First will come the H.F. section on four little wheels, then the detector with its wheels, then the note-magnifier also on wheels, and lastly a little truck containing the loudspeaker. The whole lot will be coupled together, and he will be able to pull it after him with a string just like a toy train."

An Epoch-Making Set

The Professor can be very rude at times, and at such moments he is apt to lapse into one of those foreign languages in which extensive use of his short-wave set has given him considerable fluency.

LOUD SQUEAKERS



"See no second-hand babies have been included."

"Can it, you big stiff!" he bellowed. "Say, big boy, put a sock in it!"

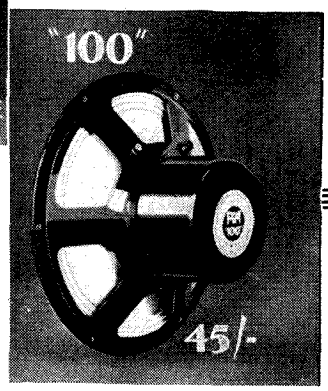
This, in case my readers do not know, is Yugotoblazian for "Please excuse my saying so, but I am not greatly enamoured of your idea."

"No," continued the Professor, "what the hiker wants and what the hiker shall have is a pushable radio-gramophone, which we will here and now proceed to design for him."

This was the beginning of that long series of experiments which culminated in the epoch-making "Hiker" Pushable.

R&A

Permanent Magnet MOVING COIL REPRODUCERS



The R. & A. "Challenger" P.M.M.C. Reproducer is beyond question an outstanding achievement. The WIRELESS WORLD states:—

"Performance is such that it *merits discussion from an absolute standpoint* . . . overall sensitivity slightly better than average . . . reproduction of bass below 100 cycles quite definitely above average . . . full-bodied bass without boom . . . speech natural . . . *balance in music exceptionally good.*"

The "Challenger" will operate perfectly with any set, from a 2-valve to a power amplifier, and will accept up to 3 watts undistorted A.C.

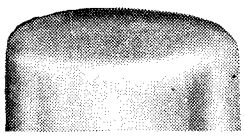
Of the R. & A. "100" P.M.M.C. Reproducer, the WIRELESS TRADER states:—

"In power-handling capabilities above the average . . . will deal with 5 watts undistorted A.C. . . . *reproduction is very good* . . . response rich and full-bodied. Tone will appeal to a wide public . . . plenty of bass . . . *excellent value for money* . . . will work well with quite a modest output valve."

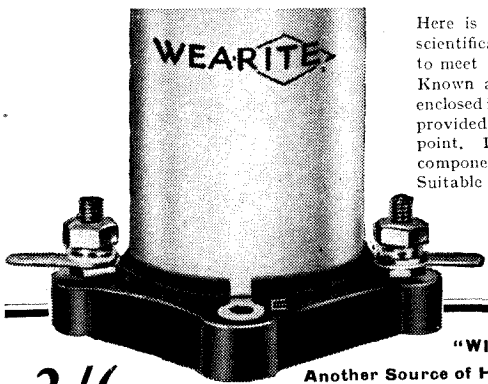
A 3-ratio transformer for use with the R. & A. "100" is supplied at 12/6 extra.

Your dealer can supply. Refuse a substitute.

REPRODUCERS & AMPLIFIERS, Ltd., Wolverhampton.



Now! a *SCREENED* H.F. CHOKE



Here is the new H.F. Choke, scientifically designed and built to meet a long-standing need. Known as the "H.F.P.," it is enclosed in an aluminium "pot" provided with an earthing point. Interaction with other components is thus eliminated. Suitable for wavelengths from 15-2,500 metres, it is free from marked resonance peaks. A sound component at the right price.

3/6

Write for special leaflet.—If you have any technical query, let our Technical Dept. know.

Extract from the "WIRELESS WORLD."

Another Source of Hum—

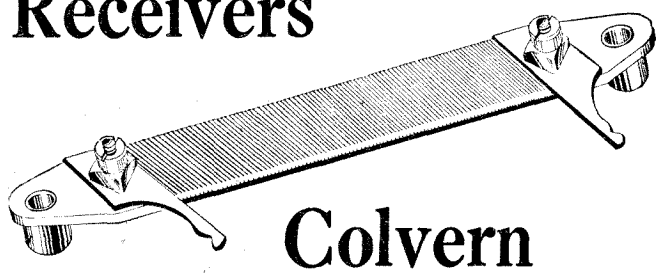
"Interaction between an H.F. Choke in the detector anode circuit and the power transformer is a possible source of hum. A.C. voltage induced into the circuit will be communicated to the grid of the succeeding L.F. valve."

THE NEW WEARITE CHOKE SOLVES THIS PROBLEM.

WEARITE

WRIGHT & WEAIRE, LTD., 740, High Road, Tottenham, N.17.
Telephone: TOTTENHAM 3847/8/9. 684

For All Mains Receivers



Colvern Strip Resistance

(Wire-Wound)

● Colvern Wire-Wound Strip Resistances are constructed to meet the requirements of modern all-mains receivers.

They occupy small space in the set, and can, if necessary, be assembled side by side in the form of a pack.

They are made in such a way as to allow for generous heat dissipation, and are fitted with terminals and soldering tags. Rating, 5 watts.

Prices: 10-25,000 ohms **1/9**

26,000-50,000 ohms **2/3**

Send for the Colvern Booklet

COLVERN

LIMITED, MAWNEYS RD., ROMFORD

In Lighter Vein—*continued*

a set which will be as common in our beauty spots this year as empty bottles and discarded paper bags.

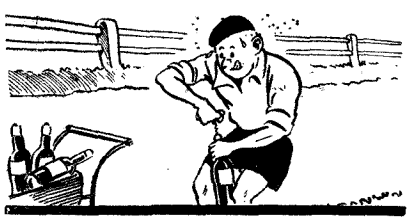
Visit Their Garages

A drawing of this wonderful set accompanies the present description, and I feel that both readers who hike and hikers who read will be ardently desirous of learning full details in order that they may construct their pushables whilst the present season is still at its hike—that is to say, at its height.

It is first necessary to acquire a second-hand bassinet. And here a word of warning. Be careful to see that no second-hand babies have been included in the bassinet. If any are found when a search is made they should be returned to the vendor with a polite explanatory note.

The next process is to fit a pulley to each of the near-side wheels. Excellent pulleys can be obtained from the motor-cycles of friends who

THE ACCELERATOR



"It requires a clockwise twisting motion!"

happen to be out when you visit their garages.

In the bows of the bassinet is mounted the gramophone unit, complete with turntable, tone-arm and pick-up. We decided, after many experiments, that clockwork motors were not suitable, owing to the frequency with which they have to be wound up; and electric motors were discarded owing to the enormous length of flexible wire that might be required in order to keep contact with the nearest plug point.

Singing a Serenade

The turntable is rotated through a bevel gear (easily obtainable from the differential of a friend's car), provided with a sprocket or a pulley and chain, or belt-driven from the near-side front wheel.

Amidships is placed the wireless unit with its neat frame aerial. A hole for the spout of a moving-coil loudspeaker is cut in one side of the bassinet, and covered with a chaste design in fretwork.

At the rear of the wireless unit is mounted a dynamo, driven from the near-side hind wheel of the bassinet. I can state, from personal experience, that dynamos can be picked up for an old song. It was, in fact, by means of an old song that I picked mine up, for I was actually singing a serenade outside his house when Captain Buckett threw it at me.

Failing an old song, much can be done by a visit to a power plant or to the nearest B.B.C. transmitting station.

An Automatic Guide-Post

The stern of the bassinet is fitted up as a luggage compartment. After long experiments, the Professor and I discovered that the best way of insuring against breaking or spilling the luggage was to divide the compartment by means of partitions into a number of sub-compartments, each about two and a half inches square.

The accelerator may be carried in the luggage compartment, but the most convenient position is probably that shown in the drawing, where it is seen attached by means of a quick-release buffle knot to the propelling handle of the Pushable.

One of the most delightful features of the "Hiker" Pushable Radio-gram is that its wireless section serves as an automatic guide-post for the owner. Having decided upon the direction in which he wishes to proceed, he turns the frame towards the nearest broadcasting station and tunes in.

A Halt for Repairs

He then notes the reading of the milliammeter in the detector circuit, which is mounted in a convenient position. Owing to the directional properties of the frame, he cannot now go wrong.

Should he deviate, say, towards the right, a higher reading, accompanied by greater signal strength, is an immediate warning that he is off his course. Again, should he stray towards, say, the left, a lower reading with a corresponding fall in signal strength would tell him at once to starboard his helm.

The ratio between the driving and the driven pulleys should be so adjusted that when the speed of the pusher is six miles an hour, seventy-eight revolutions a minute are obtained from the turntable, whilst a full output of amps. and volts and things is provided by the dynamo. This is most important, for it enables the hiker to keep his own speed constant.

Ghastly Groans

If, for instance, he absent-mindedly works up to eight or nine miles an hour (thus taking far too much out of himself and unconsciously spoiling his enjoyment of the beauties of the countryside), he receives an immediate warning from the rising pitch of the reproduction if a gramophone record is being played.

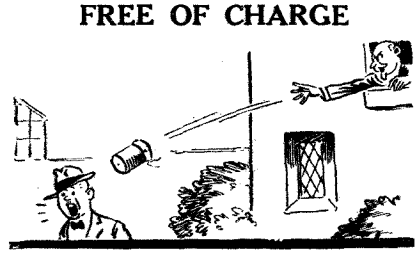
On the other hand, should his footsteps lag so that his speed is below that maintained by self-respecting hikers, the pitch of the gramophone reproduction falls to a mere ghastly groan, and so small is the output from the dynamo that horrible distortion in the reproduction is evident, whether the radio or the gramophone units are in use.

A Supply of Peas

There are some, of course, who will find it difficult, despite the warnings already described, to maintain an even hiking speed. But these need not despair, for there are still other methods at their disposal.

For the sluggard there is always the accelerator, which should be carefully applied with a gentle clockwise twisting motion. This is followed

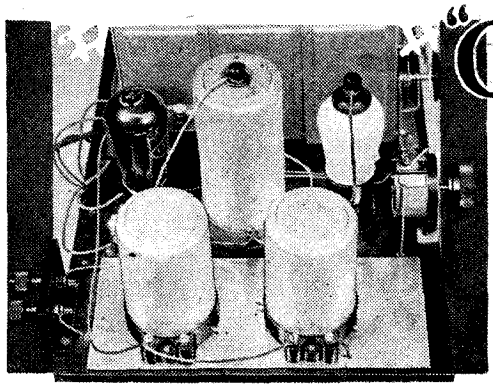
FREE OF CHARGE



"Dynamos can be picked up for a mere song."

by a sharp pulling movement. When the evolution is properly carried out, the latter is accompanied by a loud pop and followed shortly afterwards by a gentle gurgling sound.

The speed hog who finds that even the rising of the pitch to a scream and the burning out of fuses do not suffice to curb his wayward feet should always carry a supply of peas in the luggage compartment. A few of these inserted into each shoe will have the desired effect.



"CLEANING UP" THE SUPER-HET

An ingenious suggestion for overcoming super-het. troubles due to H.F. currents getting through to the L.F. stages.

By A. S. CLARK.

PUSH-PULL detection is certainly by no means new, but a fresh aspect of it has cropped up in connection with a recent patent that concerns a unique scheme for obtaining selectivity. This selectivity scheme has nothing whatever to do with what I am going to write about, but the fresh aspect of push-pull detection has.

So it will be taking things in the correct order if I describe the fresh aspect first. Perhaps it is not entirely new, but it certainly has not been brought out so definitely previously.

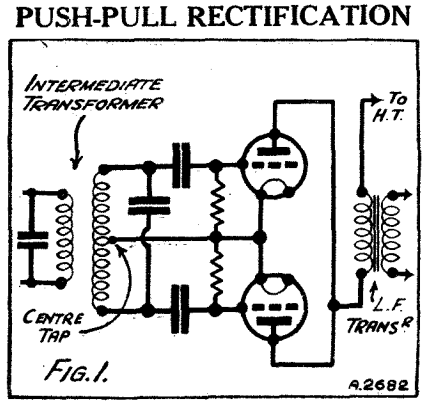
Just a word or two to start with on the subject of push-pull in general. The principle is briefly this.

Currents Out of Phase

In Fig. 1 the opposite ends of the coil that is supplying H.F. to the grids of the two detector valves are out of phase at any moment of time. When the top end is positive, the lower end is negative, and vice versa.

The result, so far as the H.F. component in the anode current is concerned, is that when the current increases from one valve, it decreases in the other. If the two anodes were joined to the ends of a centre-tapped primary of an H.F. transformer they would act on the secondary in the same direction, thus producing a double effect.

PUSH-PULL RECTIFICATION



A point to note here is that, although the grids are connected in "push-pull," the anodes are connected in parallel.

If, on the other hand, the anodes are joined in parallel as in the diagram, then the H.F. components will oppose one another the whole time. The result so far as H.F. is concerned will then be nil in the anode circuit, the H.F. component being cancelled out due to the push-pull input, but parallel output circuits.

H.F. Cancelled Out

Now for the interesting point. Since the valves are wired up as grid detectors, the low-frequency modulations on the H.F. will also be applied to the grids of the two detector valves.

But so far as these low-frequency currents are concerned, the valves are not provided with push-pull input circuits, but with a parallel input scheme. This is because, so far as L.F. is concerned, the inductance coil is a dead short, and so the two grids are to all intents and purposes in parallel.

When we come to the output circuit the valves are still in parallel, so far as L.F. is concerned, and, since the L.F. is applied in phase to the grids of the valves, it does not cancel itself out in the anode circuit like the H.F. We therefore have low-frequency currents after detection that have no high-frequency component on them. This would naturally not be very helpful where ordinary circuits were concerned, because in nearly all such cases reaction is obtained by feeding back H.F. from the anode circuit of the detector.

The Second Detector

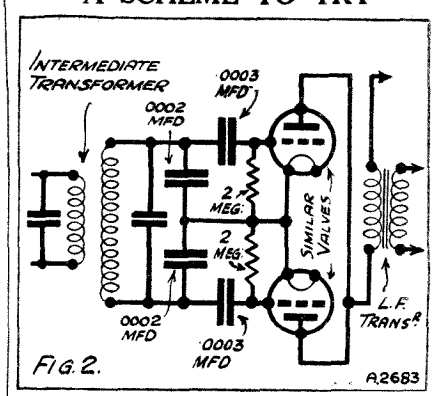
But when we come to consider the detector (usually termed second detector) of a super-het., we have a different proposition. We do not want to get reaction, rather we want to be completely rid of H.F. after the detector. The H.F. in this case being, of course, the intermediate frequency of our "super."

As a matter of fact, in many of the modern super-hets. special H.F. stopping devices and by-pass schemes have to be incorporated to keep this H.F. out of the L.F. stages. Also, it is quite often noticed that output valves do not seem to handle so much power in a super-het. before they overload as they do in a straight circuit.

It is quite feasible that this is due to the loading produced by H.F. getting to the grid of the output valve. With the aid of the circuits shown it should be quite an easy matter for anyone with a super-het. to experiment with push-pull detection. Fig. 1 shows the theoretically best way to go about the matter.

Not everyone will be able to try it though, because it requires a centre-tapped secondary to the intermediate

A SCHEME TO TRY



As most intermediate transformers have no tap, an artificial tap can be provided by series-connected condensers.

transformer, and I do not know of an intermediate on the market with such a tap. Some may care to take a transformer to pieces and try making a tap, but this would certainly be a doubtful proposition.

A suggested solution to the matter is seen in Fig. 2. Here the H.F. potentials from the secondary circuit are applied across two fixed condensers in series, a centre-tapped potentiometer effect thus being obtained. The value indicated for these condensers should be about right, but remember that, like the remainder of the scheme, anything may prove to be the case, because it is entirely experimental. But it shows a lot of promise!

RAPID REPAIRS

A reader sets out some helpful hints on renovating old ebonite panels.

WHEN converting a friend's set into a different model it is very rarely that the same holes in the panel will all be used. It is a very simple matter boring a hole in a piece of ebonite; the problem only becomes acute when you want to fill it up again. Chatterton's compound is quite useful, but is rather difficult to work with, being very sticky. The best plan I have found is to fill up the hole at the rear with a layer of Plasticine, then melt in the Chatterton's till it overflows. Wait till it is thoroughly hard and brittle, then, with a flat piece of wood, plane off the excess level with the panel.

Inclined To Be Brittle

A good substance to use is "heel-ball," the stuff with which the shoemaker puts such a fine gloss on the heels of repaired shoes. Its only drawback is that it is rather of a candle-wax texture, and brittle when cool. For filling up old bolt holes it is ideal, but for large holes there is the risk of chipping, if it gets an accidental knock. The above, of course, only applies to black panels. Plastic wood is excellent if you have a flair for painting, and can finish off the outside to match the particular panel you are dealing with. If you have not, your friend will willingly sacrifice the extra few shillings for a new panel, rather than have your "chef-d'œuvre" continually before his eyes.

Sockets Save Time

Panel sockets for aerial and earth, in place of the usual terminals, are very useful if you do a lot of set testing and building. The ease with which you can whip off your aerial and earth will compensate you time and again for the little extra trouble involved.

The aerial and earth leads will be fitted with plugs to fit the sockets, and to adapt them for ordinary terminals solder a couple of spade terminals to the ends of two extra sockets into which the leads can be plugged. In addition, if you are in the habit of connecting your aerial and earth together at night, a further pair of sockets, soldered end to end, will enable you to do so with the minimum of trouble.

FROM FAR AND NEAR

READERS' APPRECIATIONS OF THE "S.T.300."

A small selection of extracts from some of the many hundreds of letters which keep pouring in from all over the country giving delighted users' opinions of this remarkable and popular receiver.

EAST HAM : "I have made the 'S.T.300' and am delighted with it. The tone and selectivity is all you claim. Several of my friends have also had the same results and are very pleased."—E. G. MIDDLETON, Welbeck Road, East Ham, E.6.

BOGNOR REGIS : "My friend and I both have 'S.T.300's,' and great sets they are. I have mine on a fifty-foot long aerial, and his on an indoor aerial inside the roof. We use 'Atlas' A.C.244 eliminators."—W. E. CHANDLER, Barnham, Bognor Regis.

ORMSKIRK : "I made the 'S.T.300' a week after the February CONSTRUCTOR came out, and all I can say is that, with ten years' experience of wireless, it is very good. Reception of foreign stations here is great."—G. FOSTER, Thomson Avenue, Ormskirk.

SOUTHAMPTON : "It is the best set I have made up yet."—F. WALES, Calshot, Southampton.

"I get so many stations, I am darned if I know where to begin on the task of logging them!"—N. YORK, Butterfield, Southampton.

DARTMOUTH : "I have built two of your 'S.T.300's,' one for a friend of mine and one for my brother-in-law, and the results have been wonderful indeed."—L. R. SHAPLEY, Ford Valley, Dartmouth, Devon.

SHREWSBURY : "I have had remarkable results on a very poor aerial."—G. WILLIAMS, Dorrington, Shrewsbury.

NEWTOWN : "I am one of the very many who have built your wonderful set, the 'S.T.300,' with which I am more than satisfied."—A. S. MORRIS, Park Street, Newtown, Montg.

NEWPORT : "The set is all you claim."—D. WATKINS, Corelli Street, Newport.

CANNING TOWN : "I am using the 'S.T.300,' and I think it a very fine set; the selectivity is very good."—J. BIRCH, Ravenscroft Road, Canning Town, E.16.

BURTON-ON-TRENT : "My friend made the set up and was amazed at the knife-edged selectivity. My idea in writing is to say, no matter what the set is, if you want improvement, follow 'S.T.' and get the CONSTRUCTOR."—G. R. ORTON, Eldon Street, Winshill, Burton-on-Trent.

CAMBRIDGE : "With your set there is almost too much variety of programmes to choose from!"—V. P. WILLIAMS, M.A., Hurst Park Avenue, Cambridge.

OTLEY : "The best set I have made, and I have made fifteen or more!"—K. DODGSON, Carr Bank, Otley, Yorks.

FOLKESTONE : "I have just built your wonderful set, it being my first. I hardly knew a thing about radio before. Really, I am surprised at its performance as against other people's I have heard here in Folkestone."—P. E. DEAL, Sidney Street, Folkestone.

BIRMINGHAM : "I had an ——, but got very indifferent reception. A friend advised me to convert my set to an 'S.T.300,' and the results have been wonderful. Already two friends have asked me to make them up similar sets. Everyone who has heard it says it is the sweetest tone they have heard, and we got tired of logging stations."—C. E. HODGSON, Alum Rock, Birmingham.

HOXTON, N.1 : "I may add that I have constructed your set and I am obtaining wonderful results."—W. ROSINDELL, Hoxton Street, Hoxton, N.1.

NORTHAMPTON : "I have built the 'S.T.300'—a very remarkable set—far better than any three-valver I have ever heard. Really extraordinarily good."—A. MATLEY, Church Brampton, Northampton.

HINCHLEY : "I have built the 'S.T.300,' and find it the best yet and I've built a few. Radio-Paris is obtainable quite clear of Daventry, which doesn't apply to ninety-five per cent of the sets in this district."—H. R. BENNETT, Hurst Road, Hinchley, Leicestershire.

BURNLEY : "I have built your wonderful 'S.T.300' and am delighted with it. Very hearty, sincere congratulations to you on what I will call my finest hook-up."—J. W. BIRD, Cardinal Street, Burnley, Lancs.

FIFE : "It is a sure winner. The listener who builds the 'S.T.300' will have a very faithful friend indeed."—R. O. SCOTT, Cupar, Fife.

SHEPHERD'S BUSH, W.12 : "I feel I must write a few lines in praise of your very efficient receiver. The cleanness of design and the superb quality of reception are indeed tributes to your skill. My particular locality is considered not too good for long-distance reception, and that pleases me all the more."—P. C. SUMPSION, Wormhalt Estate, Shepherd's Bush, W.12.

CUMBERLAND : "Others here have built your 'S.T.300' and are getting very satisfactory results."—W. WANNOP, Longtown, Cumberland.

MUCH HADHAM : "Although I have not an ideal site for my aerial, being rather badly screened by trees, yet it is possible to tune in sixty stations."—D. BURKE, Much Hadham, Herts.

STAFFORD : "After reading the February WIRELESS CONSTRUCTOR, I decided to assemble the 'S.T.300.' This was my first attempt at set building, and after receiving the parts I managed the construction in about five hours, and on test reception came at once. The stations I have received at full loudspeaker strength prove everything you say as to its capabilities, and I am sure anyone can build this set."—C. F. ROBERTS, Oxford Gardens, Stafford.

MELTON MOWBRAY : "I have never had anything to do with wireless before—never owned or tuned one in, yet I had this finished in three evenings, and with a R. & A. 100 speaker it fills the house and the one next door! All my friends who have heard it say: 'Beautiful! Grand!' etc. One who has a four-valve all-electric is altering it to copy mine. It really is a topper."—T. G. BRIGGS, Somerby, Melton Mowbray, Leicestershire.

COLCHESTER : "I have built your 'S.T.300.' It is certainly the goods. I give you credit for a fine set."—W. MATHEWS, Nayland, Colchester.

NORTHANTS : "I have built up your 'S.T.300' and it does all you claim. I have had over seventy stations on the loudspeaker. It is simply great."—F. PERCIVAL, Trafford Road, Rushden, Northants.

HOW TO MAKE YOUR OWN "S.T.300" COILS

—continued from page 187

In this, as in all cases, the direction of the winding is as indicated originally.

It will usually be best to bare and clean the ends of the wires and wrap round the tags, leaving the soldering to the last. The mechanical supporting of the coils may be left to the reader, but my own tested suggestions are given in the illustrations to this article.

Mounting the Coils

The aerial coil is mounted vertically, two small brackets being fixed to the former. The anode coil must be supported in a horizontal position, and a length of 2 B.A. rod will serve as a pillar. The rod is secured to the ebonite former by one pair of nuts, and to the baseboard by another pair.

The coils are now ready for use. The only thing that worries me is that you may use the wrong wire, or make the slots the wrong depth. If so, the wavelength range of the coils may be slightly altered.

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HOW TO MAKE YOUR OWN "S.T.300" COILS

—*continued from page* 210

If you have formers and wire, there is no harm in trying out what you have got, but you should remember the remarks about "modifications" at the beginning of this article.

I strongly advise against cotton-covered wire, as it is hygroscopic and the moisture it absorbs adds to the H.F. resistance of the coils. The wire specified is obtainable through your dealer or direct from the makers. Do not use "the nearest to it."

Although making your own coils is hardly an economy, there is a good deal of personal satisfaction in having done so. Coil winding will always provide both fun and frenzy. My last message to you is that I hope you will not forget the number of turns you have put on, just as you are completing the long-wave windings.

FROM MY ARMCHAIR

—*continued from page* 198

set and the mains unit. The performance of this set has been rated by all who have heard it as extraordinarily good, and would prove a blessing in large D.C. areas where at present only the very wealthy can afford a 'selectivity-quality' receiver.

Here Are the Values

I append below the values of resistances and capacities, which have been arrived at after careful calculation followed by trial and error tests:

C_1 = ·00004-mfd. variable.
C_2 and C_3 = ·0005-mfd. variable.
C_4, C_5 = ·0001-mfd. differential.
C_6, C_7 = 1 mfd.
C_8, C_9, C_{10}, C_{11}, C_{12}, C_{13}, C_{14}, C_{15} = 2 mfd.
C_{16} = ·0001-mfd. fixed.
C_{17}, C_{18}, C_{19} = ·0005-mfd. fixed.
C_{20} = ·01-mfd. fixed.
R_1 = 25,000 ohms.
R_2 = 5,000 ohms.
R_3 = 25,000 ohms.
R_4 = 10,000 ohms.
R_5 = 20,000 ohms.
R_6, R_{10} = 50/100,000 ohms.
R_7 = 1 megohm.
R_8, R_9 = 10,000 ohms.
R_{11} = 400 ohms variable.
R_{12} = 6 ohms variable (must carry ·5 amp.).
R_{13} = 440 ohms approximately, with tappings (must carry ·5 amp.).
R_{14} =10,000 ohms."

I am exceedingly obliged to Mr. Chapman for the circuit and data.

Meanwhile, let us assure readers who experiment or feel that they have obtained particularly good results by special means that their letters will be warmly welcomed. A typical letter is one I have received from J. A. Hathaway, of Great Yarmouth, who sends me a circuit diagram of an all-mains "S.T.300" of modified form, in which the detector valve works with very low H.T. so as to give very smooth reaction. I have adapted the arrangement to a battery "S.T.300" in Fig. 4. You will see that an extra valve is now used.

Three Functions

The detector valve in the ordinary "S.T.300" carries out three functions: It acts as a detector in its grid circuit, the grid to filament path being similar to that of the two-electrode (diode) valve rectifier first used by Fleming nearly thirty years ago. The second action consists in the L.F. fluctuations produced on the grid being amplified by the valve. The third operation has nothing to do with rectification; it is simply a high-frequency amplification of the H.F. currents applied to the grid of the detector. These amplified currents are fed back to the grid circuit, and thus reaction is obtained.

Now, instead of carrying out all three operations with one valve we can separate them. In the Fig. 4 circuit we use the second valve as a diode detector and as a means of applying smooth reaction to the tuned circuit preceding it. The L.F. fluctuations on the grid of this valve are not amplified by that valve, but are applied to the grid of the third valve, which acts purely as an L.F. amplifier. The H.F. choke Z and the condenser C (say, ·00004 mfd.) are merely to prevent H.F. currents getting into the L.F. part of the circuit.

Very Low Voltage

The H.T.3 voltage may be very small—say, 10 or 15 volts—and smooth reaction is obtainable. The circuit may interest experiments, who could also try using the second valve only as a reaction-producing valve and employing the third valve as a grid condenser rectifier with normal anode voltage. I will give this further circuit if readers would like it.

There is a definite trend towards separating the three-in-one functions of a detector valve, and prejudice against more than three valves is fortunately dying down. This should open the way for bigger and better circuits.

ARE PENTODES WORTH WHILE?

—continued from page 172

price and partly because it accentuates the high notes of music and speech.

The power output of a valve depends on the suiting of the output circuit (the loudspeaker) to the valve impedance. Since the loudspeaker (or its transformer, etc.) is inductive, the output impedance will rise with the frequency; and with a pentode these high output impedances get the most out of this high-impedance valve whose anode current tends to remain constant whatever the external anode impedance may be.

The result is that the high notes are reproduced much louder than the low ones. We therefore tone them down.

Shunting the Speaker

The most usual way—as shown in Fig. 6—is to shunt the speaker (or its transformer or choke) by a resistance of, say, 15,000 ohms (preferably 30,000 ohms variable) in series with a condenser of, say, ·01 mfd. A resistance *alone* would help, because as the speaker impedance rose with the frequency the current would tend more and more to go through the resistance—the easier path. The resistance, however, acts also as a shunt to the lower notes; these are more or less kept out of the shunt path by the condenser (which, however, will pass the higher frequencies).

There are several points regarding pentodes which may be mentioned here.

Disconnect the H.T.!

To get the maximum power output a step-down transformer (or tapped choke) is usually connected in the anode circuit of the valve. To avoid the setting up of high voltages which may injure the valve, condensers, etc., the loudspeaker should not be disconnected while the H.T. is on. Nor should you merely take out the anode H.T. plug, leaving in the screen-grid plug. And certainly don't change the grid-bias voltage while the H.T. is on!

The object of the step-down transformer or tapped choke is to ensure a high average impedance of the anode circuit load, and thus—by suiting the load to the valve impedance—obtaining a maximum of output noise from the speaker.

The matching of load and valve is of importance, and is effected in practice by a multi-tap choke or transformer.

Since the high-velocity electrons from the filament short through the screen grid for the most part, and are absorbed by the anode with even small anode voltages (relative to the filament), it is common practice to give anode and screen grid the same voltage. As will be seen from Fig. 4, an anode voltage swing of —100 volts would still leave +50 volts on the anode, and there would be no appreciable drop in anode current.

Ask the Makers

Since secondary electrons from the anode are prevented by the earth- or "stopper"-grid from going to the screen grid, there is not the need (as in an S.G. valve) for keeping the anode at a higher potential than the screen grid; but with some pentodes operating at certain voltages the makers recommend that the screen-grid potential should be less than that of the anode.

A voltage-dropping resistance is sometimes used for this purpose, the resistor being connected between screen grid and H.T. positive; a large-capacity condenser should be connected across screen grid and filament to keep the screen-grid potential constant.

Whether the pentode is worth while is ultimately a matter for the constructor's own judgment. He will get more out of a pentode, but at greater cost. Nearly all our apparatus is designed to work with triodes, and tone-correcting devices are an expense and trouble. The question arises: Will it not pay me better to use two stages of ordinary L.F. amplification?

I am inclined to think that, unless you are limited as regards space, more satisfaction will be obtained by the use of a resistance-coupled stage of L.F. followed by a transformer than by the use of a pentode. Certainly, the two valves will give you louder signals on weak stations.

Neverthless, it is not only possible, but quite likely, that all the valves in our sets will ultimately be pentodes of different kinds—for H.F. amplification, detection, and L.F. amplification.

VALVE DETECTION MADE READABLE

—continued from page 175

reaction coil R and so strengthen the H.F. currents in that circuit. The valve, therefore, is acting in a triple capacity, but detailed consideration of " reaction " must be left to another article.

Before closing it should be pointed out that the Fleming valve rectification effect (as described or in a modified form) is not the only one used. Anode-bend rectification works on a different and newer principle. The action now depends on rectification in the anode circuit, not the grid circuit.

Working on the Bend

The valve characteristic curve illustrating the effect of grid voltage on anode current is never wholly straight. If we operate at a bend—there is always a clearly defined one at the bottom—in the curve, the average anode current will change when H.F. potentials are applied to the grid. Thus at the bottom bend positive half-cycles produce an increase of anode current which is greater than the decrease produced by an equal negative half-cycle. The average effect is therefore a rise in anode current, and the fluctuating rises operate the 'phones.

The leaky-grid condenser method of detection was, however, the first ever employed, and is still the most popular in use to-day. Will it soon be pensioned off? Or will it cling, limpet-like, to office? Nobody knows. And, unfortunately, nobody cares.

A PRACTICAL MAN'S CORNER

Using Twist Drills — Staining Made Easy.

WHEN you use twist drills for making holes in certain kinds of wood it is almost impossible to make the entrance perfectly clean-cut, particularly if the drill is not of the cheapest. When, for example, you try to make holes in a piece of plywood with a thin oak veneer you will nearly always find that the surface tears a little, and that certain ragged-looking fibres are left.

What actually happens is that the pressure of the point of the drill pushes the fibres of the grain outwards and makes its way in between them. The cutting edge is then unable to get to work properly, and the result is a ragged edge to the hole. Whatever you do, do not try to clean it up by tearing off the rags, for this will result in a horrid mess. Nor do I advise you to attempt to trim them up with a sharp knife.

Here is what I have found to be the best way of all. After making your holes, put a small, sharp countersinker of the rose-head type into your hand drill. Instead of trying to pull the ragged pieces away, tuck them into the hole. Now insert the point of the countersinker and give the handle of the drill about two quick turns.

You will find that all the ragged bits are trimmed off in this way, and that a perfectly clean hole results. Remember, though, that it must be a rose-head countersinker, and it must be sharp. One of the best tools that I have come across for the purpose is a little tool that I bought from Woolworths' some time ago for sixpence.

Improving Appearance

It is surprising what a good job you can make of cabinets, baffle boards and so on by using white wood, and afterwards finishing it up and treating it with varnish stain. White wood is a good deal cheaper than more ornamental kinds, and it is also very much easier to work with.

One difficulty that the amateur often finds when he tries his prenticed hand at varnish staining is that, do what he will, he cannot help putting it on unevenly.

The result is that the wood is too dark in some places and not dark enough in others.

A Useful Tip

Here is a tip that I discovered the other day when doing rather a good job with varnish stain. Don't use one brush, use two. Have in your left-hand a small stiffish brush, and in your right a rather bigger one. The left-hand brush is used for taking the stain from the pot, whilst the right one does the work of applying it evenly to the panel.

Start near one corner of the work. With your left-hand brush put a small blob of the stain on to the wood. The right hand-brush now comes into vigorous action, spreading the blob thinly and evenly over as much of the surface as it will cover. Next apply another small blob, an inch or so away from the place reached by the stain, and work it as before, drawing it to meet the part already stained.

DANIELL CELLS

Some practical information on upkeep and use.

A PARAGRAPH that I read recently opened the floodgates of memory and took me back five or six years to a time when we flirted with the idea of Daniell cells as a means of charging our accumulators. In the hands of the expert, no doubt, they are as easy to make up and maintain satisfactorily as any other form of chemical battery.

But in case any of your readers rush to the conclusion that it is always just a matter of sitting back in an armchair and throwing them a few grains of copper sulphate occasionally, to keep them employed, let them read on, and they will see what a really dirty trick the cells played on two unsuspecting amateurs.

In theory, the process is absurdly simple, and if theory always went hand in hand with practice we should probably still be patting ourselves on the back at an absolute brain-wave. But, alas, we made the cell up in its cheapest and apparently most unreliable form!

This consisted of a glass jar half filled with a saturated solution of copper sulphate, and a handful or two of the crystals resting on the bottom to keep up the strength of the solution. Into the crystals a sheet of copper foil, standing edgewise, was placed, to which was soldered a length of insulated copper wire, forming one pole of the battery.

The solution was covered with a sheet of stout porous paper, and on this was carefully poured enough dilute sulphuric acid to fill the jar to within an inch of the top. Into the top solution dipped an alleged amalgamated zinc rod, and the cell was complete.

A Ha'p'orth of Tar!

However, there is such a thing as overdoing the economy side of the business, and porous paper and cheap zincs should be avoided like poison. We made up four of these cells, and decided to try them out before using them for charging purposes. They gave a dazzling light from a flashlamp bulb, so things seemed promising.

To all intents they looked just as we imagined a Daniell cell ought to look.

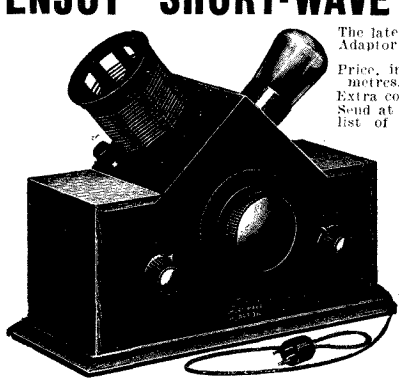
As a precaution, we left them disconnected overnight to see if they would retain their energy for any length of time. Next day, when we came to examine them, we really had to laugh. The stout zinc rods had dwindled to the merest shadows; in one case only half an inch remained, and that tapered to a fine point.

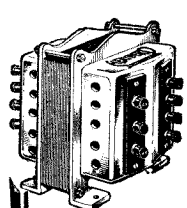
The wretched cells, bubbling over with energy, had spent the night in the particularly senseless process of giving the copper foil an additional coating of copper.

The moral of this little episode is obvious. If you want the results you must pay the price. It costs a bit more at the start, but is economical in the long run.

Should anyone be dubious as to the running cost, it is pretty clear that our experience was quite abnormal and due to badly amalgamated zincs, as the Daniell cell when not on circuit should show no action whatever.

B. C. D.





OUR NEWS BULLETIN

ACCORDING to the "Daily Herald," withing a few months many leading cinemas in the country, besides having an ordinary cinematograph screen, will install a smaller television screen on which national events will be seen as they are actually occurring.

It is suggested that with the new development it should be possible for cinema audiences to see the Centre Court at Wimbledon, a boxing match, the Trooping of the Colours, etc.

Face Up To Facts

We have been hearing suggestions like this for many years past, but isn't it time responsible daily newspapers looked the facts squarely in the face? Television has not yet reached a standard of public entertainment service which will in any way live up to the above forecast.

Such forecasts are, indeed, unnecessarily optimistic, and we think the day has come now when they might justifiably be dropped, and the true facts concentrated upon.

Unjustified Optimism

Television has made many strides on the road of progress during the last few years, and much credit is due to Mr. Baird and his fellow workers in particular for the development of the British television system. But it is unfair to Mr. Baird and his co-operators to excite the curiosity and interest of the lay public with optimistic forecasts concerning television.

As an experimental entertainment television is undoubtedly of the greatest interest, but so far it has not reached the necessary standard which would entitle it to be regarded as capable of giving satisfactory public service entertainment.

Seven-Metre Broadcasting Experiments

We learn that a new transmitter has been built by the Marconi Company engineers on the roof of Broadcasting House, for the purpose of conducting important experiments in broadcasting on a low wave. The B.B.C. intends to make an intensive study of low-wave transmission in cities notable for modern steel structures. These experimental transmissions will probably take place on a wavelength of 7 metres. A number of low-wave sets will be placed in steel frame buildings in various parts of London, and engineers will check up every phase of reception.

A New Radio-Telephone Service

A few weeks ago Big Ben was heard in Cairo. The broadcast was to inaugurate the Anglo-Egyptian Radio Telephone Service. Over 200 miles of land-line and 2,200 miles of wireless are involved in the circuit. The transmitting stations are at Rugby and, in Egypt, at Abu Zabal, roughly 18 miles from Cairo. The receiving stations are at Baldock (England) and at Mahadi, 8 miles from Cairo.

It is understood that a similar service to India will be opened very shortly, and will be followed by a direct service between London and Canada. By that time the whole of the British Empire will be linked together by 'phone.

The Autumn "Proms."

The thirty-eighth series of the Queen's Hall Promenade Concerts will begin this year, on August 6th, under the auspices of the B.B.C.

Programmes are on much the same lines as in past years, Mondays being devoted to Wagner, and Fridays to Beethoven. Bach and Brahms will share Wednesdays, while British composers will be included in Tuesday and Thursday programmes.

Sir Henry Wood in the "Rostrum"

On October 19th the first of a series of eighteen B.B.C. Symphony Concerts will be given at the Queen's

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OUR NEWS BULLETIN

—*continued from page 215*

Hall, while a new series of Promenade Concerts is announced from December 31st to January 14th. These winter Proms. will be on the same lines as the summer concerts directed by Sir Henry Wood at the Queen's Hall.

A Loss to Broadcasting

Listeners will learn with regret that after nearly ten years' service, Mr. Bertram Fryer, the B.B.C. vaudeville director, has resigned his position.

In an interview with a reporter the other day he said: "My parting with the B.B.C. has been perfectly friendly. There has been no difference of opinion. My resignation has been based mainly on the fact that I want to get back to the flesh and blood business. I have been connected with the stage in the past," said Mr. Fryer, "and I shall either return to it, or go into films."

B.B.C. "Private View" for the King

As stated exclusively in THE WIRELESS CONSTRUCTOR some months ago, His Majesty the King will pay a visit to Broadcasting House. It is understood that his visit will probably take place at the end of July, and the B.B.C. is making special arrangements so that His Majesty may inspect Broadcasting House at his leisure.

A Rare Occurrence

A curious case was reported in the "Star" the other day of lightning striking a wireless aerial.

The wireless set in a room was hurled out of its cabinet across the floor and completely smashed, while an insulator from the aerial was found a hundred yards away. Luckily the owner was not seriously injured, but only suffered from shock.

Broadcasting in Norway

Norwegian broadcasting has been reorganised as a Government service from July 1st. Under a new Bill the Government will receive about £10,000 from the service, while any surplus after this payment will be utilised for the extension and improvement of the system.

The Norwegian Ministry of Education and Ecclesiastical Affairs will exercise control of the programmes. It is estimated that at present there are about 110,000 registered listeners in Norway.

TWO NOVEL CABINET FINISHES

Described by W. WYMER.

How long will it be before Britain is affected with the craze for luminous cabinet paint?

It is made by mixing one part luminous sulphide, one calcium carbonate well together with a knife, then mix to thickness of cream in varnish or polish. Commercial gum may be used, but it is not advisable where the work is of any quantity or size. This preparation absorbs light and gives a luminary effect when the body treated is in the dark.

Many amateurs have sought the right method of doing just the opposite, namely, ebonising common deal cabinets, but in vain.

Common lead paint is the answer to the oft-repeated prayer. Several undercoatings of dark colour, each respectively and lightly sand-papered down with grade 00 paper. The final two coats should be of intense black, and brought to a smooth finish with the bare fingers. Polish can then be used in the conventional way.

INDEX TO ADVERTISERS

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