The Wireless Constructor

6d

INCORPORATING "MODERN WIRELESS"

Vol. XVIII. JUNE, 1934. No. 92.

HOW TO BUILD an A.C. RADIOGRAM

ALSO THIS MONTH:

FROM MY ARMCHAIR

and

QUESTIONS I AM ASKED

by

JOHN SCOTT-TAGGART,

F.Inst.P., A.M.I.E.E.

WHY ARE THOSE STATIONS WEAKER?

by

VICTOR KING

etc., etc., etc.

CONTENTS

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.

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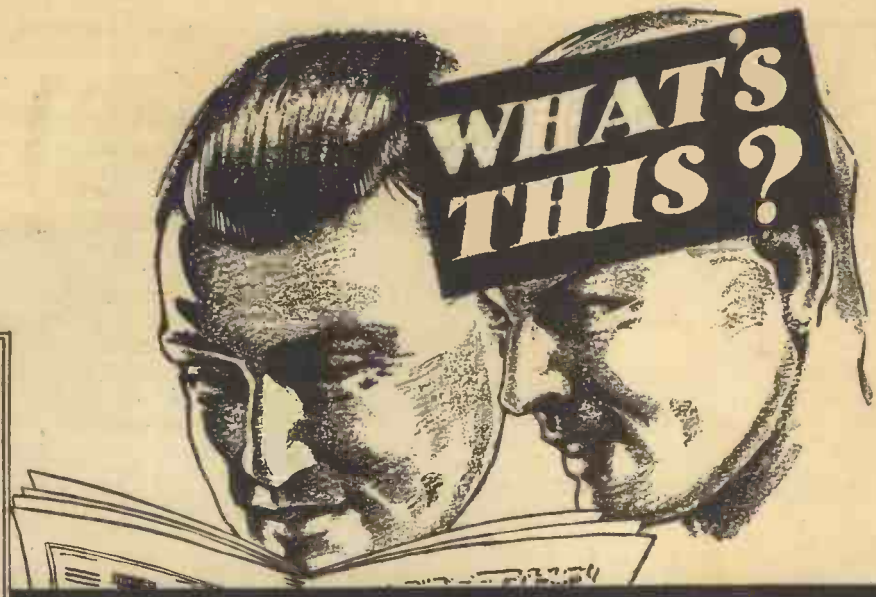

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THE EDITOR'S CHAT • THE WIRELESS CONSTRUCTOR

INCORPORATING MODERN WIRELESS

A Fine Radiogram—Women Announcers Barred—Tracing Echoes—The 24-Hour Clock

NOT so very long ago the term "radiogram" conjured up in one's mind a luxurious and definitely bulky piece of apparatus, rather too complicated and too expensive for home construction, and only obtainable by those who could spend anything between forty and eighty guineas.

But if you glance at some of the photographs illustrating the "A.C. Radiogram" which we are publishing in this issue, and compare them with pictures of radiograms we published a year or more ago, you cannot fail to be struck by the extraordinarily rapid changes which have taken place in the technique of radiogram design.

Recent Advances

The modern radiogram—whether commercial or home built—need no longer rank as a massive piece of furniture; nor need it make you dip your hand too deeply into your pocket.

The present-day radiogram is definitely one of the finest examples of sound and logical progress in radio design; and that is why we feel that, whether you build it or not, you will be particularly interested in reading about the "A.C. Radiogram" described in this issue.

* * *

We are able to announce definitely that the B.B.C. will not engage another woman announcer. Since the departure of Mrs. Borrett, rumours have been rife that the B.B.C. intended repeating the experiment of having a woman announcer; and rumour also suggested that Sir John Reith was not particularly in favour of the idea, but that certain members of the B.B.C. Board of Governors were pressing him hard in this connection.

But the truth of the matter is that the B.B.C.'s first experiment with a woman announcer was not successful—not because of any fault of Mrs. Borrett, but for the simple reason that the experiment was a failure psychologically.

Not a "Fighting Issue"

The majority of listeners in this country definitely prefer men announcers; and although Mrs. Agnes Hamilton, one of the Governors, is personally in favour of repeating the experiment, she has not—as has been alleged in other quarters—made her suggestion a "fighting issue," nor has Sir John Reith threatened to resign if the suggestion is unduly pressed upon him.

In short, another rumour has been blown "sky high," and it is to be hoped that in due course certain newspaper radio gossip writers will realise the futility of exaggerating trivial news items from Broadcasting House.

* * *

The B.B.C. was recently criticised by a London daily for "overlooking" 2,000 wireless amateurs in this country. Briefly, the B.B.C. invited the collaboration of listeners in an experiment aimed at finding a solution to the problem of the causes of fading and of echoes. Consequently, it is rather strange that the B.B.C. should completely ignore the Radio Society of Great Britain.

We should have thought that a reputable and experienced society like the R.S.G.B. could have rendered considerable service to the B.B.C. in such an experiment, for most of the 2,000 members are real experts in short-wave technique. In fact, for some time a special section of the Society has concentrated upon the problems of fading.

If it is not too late, we suggest that the B.B.C. communicate without delay with the Secretary of the R.S.G.B., and take advantage of the highly organised and competent assistance it can render.

* * *

It was only to be expected that the B.B.C.'s attempt to impose the 24-hour clock system on listeners would call forth a storm of criticism. Logically, of course, the 24-hour clock system, like the metric system, is a great improvement on that used in this country to-day.

Doomed to Failure?

Psychologically, however, the B.B.C. is doomed to failure when it makes an attempt to convert the public to an entirely new method of timekeeping.

Although not so dangerous, the attempt to impose the 24-hour clock system is just as ludicrous as if the Ministry of Transport attempted to convert traffic in this country to the American and Continental system of "Keep to the Right," instead of the left. To expect people to accustom themselves to say it is, for example, 19.52 hours will prove to be too much even for the B.B.C.

It is no help, either, when a B.B.C. announcer finds the new method of timekeeping so confusing that he announces "19.50 hours" at 6.50 p.m., or when it is stated that the Director General himself will not use the system in his own home!

54 STATIONS ON THE S.T.300 STAR

[*From C. Lambert, 140, High Street, Poole.*]

This will probably be one of thousands, but I must congratulate you on the S.T.300 Star. I had the S.T.300, but I dismantled it, and at 9 p.m. on the 15th (the day the description appeared) I received the first station on the Star.

Last night I received 54 stations on the speaker on the medium waves alone!—and this district is generally acknowledged as a difficult one at the best of times.

I am using a P.M.202 as output, as the quality is definitely better than with the smaller power valve.

Once again, many thanks and congratulations on the S.T.300 Star.

THIS COPYRIGHT "MUDDLE"

By a Legal Correspondent.

The controversy about the payment of royalties on the reproduction of musical numbers in hotels, dance halls and other places still rages. The legal situation in regard to the use of loudspeakers in these circumstances is clearly defined in this article by an expert on legal matters.

THE reproduction of broadcast programmes—more particularly modern dance music—in hotels, restaurants and other recognised places of entertainment raises a curious problem in copyright law. It may appear strange at first sight that there should be any "legal" difference between listening to the strains of the latest "tango" in a public restaurant and hearing the same tune in the sanctity of your own home. But it is so.

It is Now Settled Law

In point of fact the ordinary B.B.C. —or P.M.G.—licence allows the holder to receive broadcast transmissions only in his own home. That is to say it covers private or domestic reproduction, but does not permit the use of a wireless set for what—by contrast—may be called the entertainment of the public in general.

The point was first decided by Mr. Justice Maugham in the High Courts early in 1933. He held that the owner of a public-house, restaurant, hotel or similar premises was liable to pay copyright fees—in addition to the ordinary B.B.C. licence —if he wished to entertain his clients by reproducing broadcast items. The Court of Appeal has recently confirmed this decision, and it may now be taken as settled law.

Some people, of course, hold strong views as to the "entertainment" value of loudspeaker music either in hotels or restaurants, and at least one man I know rejoiced exceedingly because he thought that the result of Mr. Justice Maugham's decision was to make it definitely criminal.

Cramping Business

There are cases, no doubt, where the quality of the music provided is such as to make it more a source of torture than of pleasure. But luckily these are few and far between. If the proprietor of a restaurant or hotel is foolish enough to install a set of the cheap and nasty type, he is simply asking for trouble and is bound to lose customers in the long run.

On the other hand, if he invests in a really first-class equipment, it will usually not only pay for its cost and upkeep, but will bring in a lot more grist to the mill.

And this is just the point. The B.B.C. licence is based on the principle of providing entertainment in the home. It is not intended to be used as a means of making money.

One might, perhaps, argue that this is merely a dog-in-the-manger policy. If hotel-keepers and the managers of restaurants and dance-halls can make use of the wireless to attract customers and increase their business, why shouldn't they be allowed to do so? It shows definite business enterprise, which should be allowed to reap its natural reward.

The Composer's View

At this point, however, it is necessary to consider the question of copyright. The composer, say, of a popular dance number does not work only for the love of his art. He naturally wants to make as much money as he can out of his music, and from this point of view he is very dependent upon the law of copyright.

In the first place, copyright protects him from the pirate "printer," who could produce and sell the printed sheets of music for a few pence—and make a large profit for himself, though none for the composer.

Similarly, an orchestra is not allowed to play the piece in public simply because it has paid a few shillings for copies of the printed music.

When a private individual pays the recognised shop price for the latest tango, he is quite entitled to take it home and play it on the piano for his own amusement or for the entertainment of private visitors.

Entitled to Some Reward

But to play in public is a very different thing. The public is the composer's only market, and he naturally tries to get as much profit from them as he can. And so, before the piece can be performed publicly—before people who either directly or indirectly pay for admission to hear it —the composer is entitled to get some reward in the form of copyright fees.

It is, perhaps, unnecessary to labour the point any farther. The situation amounts to this: Before the B.B.C. can transmit any copyright piece of music, it must first get permission to do so from the Performing Right Society, who are the accepted guardians of composers' copyright in this country.

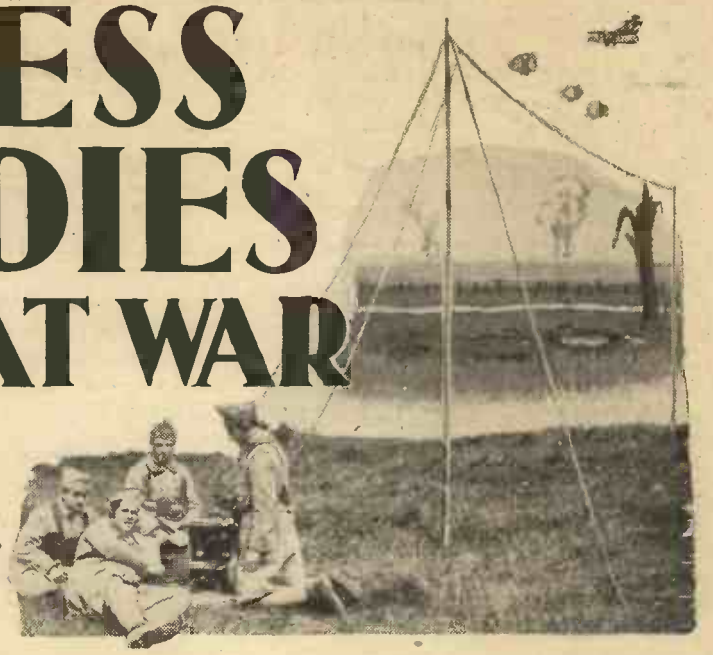
The B.B.C. must, of course, pay a fee for this permission, but the figure is calculated strictly on the basis that the transmissions are intended only for "domestic consumption," i.e. for reproduction in the private homes of

(*Please turn to page* 95)

THE P.M.G. LICENCE COVERS ONLY PRIVATE LISTENING

If the owner of an hotel, restaurant or other place of public entertainment wishes to include wireless as one of the attractions offered to his clients, then he is quite entitled to do so. But he must, in addition to taking out a P.M.G. licence, also secure permission from the Performing Right Society.

WIRELESS TRAGEDIES of the GREAT WAR



By "RADIAT"

Some astonishing details of the decisive part played by radio in battle. The author—himself a wireless operator—tells how the German general, Ludendorf, learned of his opponents' movements in the nick of time through his wireless watch on enemy communications.

THE recent lawsuits over the famous Rasputin film bring to mind one of the most terrible fiascos in wireless history—a fiasco which was responsible for the defeat of great Russian armies and the loss of many thousands of lives.

At the outbreak of war in 1914, wireless, although in a very crude state indeed, was seized upon by the Russian army authorities as the ideal means of communication for an army always on the move in the field.

A Dangerous Decision

The Russian army communications had always been weak. In wireless they saw, therefore, the ideal system, easy to handle, mobile and efficient; their army corps were accordingly fully equipped with this new and marvellous invention.

Alas! they were to learn to their cost that modern scientific inventions, however simple they may appear, are dangerous toys to play with.

In August, 1914, Germany was invaded by two Russian armies. The Eastern Russian army was commanded by General Rennenkampf and the Southern Russian army by General Samsonov.

Here is a field transmitter as used by troops in action. The transmitting key can be seen mounted on the flap which forms the writing table, the whole station being of the portable type that can be moved in a few minutes if necessary.

To stem this invasion the Kaiser had sent the eighth German army, with Ludendorf in command. In numbers Ludendorf's force was much inferior to the two Russian armies together, and the German general was therefore hoping to attack one army at a time.

The Armies Meet

More by luck than judgment, Ludendorf found himself opposed to only one Russian army, that commanded by General Samsonov. This army, as it happened, was not only weaker numerically than the Germans, but was exhausted, having been marching for nine days along dusty roads, under the burning August sun and on foreign soil. In addition to this, the country was barren, except for gloomy pine forests and still, black lakes. The hamlets were few and far between, and the Germans were on their own ground.

But although the Germans were in a superior position, Ludendorf was consumed with anxiety, and the issue of the battle was in very grave doubt.

Where Were the Others?

Where was the second Russian army? If that turned up unexpectedly the Russians would outnumber the Germans by more than two to one. Furthermore, the Germans might be hemmed between two armies.

The Russians had thoroughly beaten the Germans just before at the battle of Gumbinnen, and the latter therefore had a profound respect for the Russian Cossack, to whom the victory was largely due.

Ludendorf's state of mind can therefore be imagined as the two armies came into contact near the town of Tannenberg on the afternoon of August 27th. If that second Russian army should turn up!

From prisoners Ludendorf ascertained that the Russians engaging him were commanded by Samsonov, but this only increased his uneasiness, for the other Russian army was infinitely the more powerful and better equipped. Supposing it was behind him!

The Problem Solved

Should he retreat? But if he did it might be into a trap. A flank movement might mean the same result. The whole situation was terribly perilous.

At this moment a telegraph form was handed to Ludendorf in his headquarters. He glanced at it casually,

(*Please turn to page* 93)

The S.T.300 STAR —WHAT CONSTRUCTORS SAY

The S.T.300 has been firmly fixed in the affection of constructors for more than two years. It was only to be expected, therefore, that builders of its successor, the S.T.300 Star, would be equally delighted. Just how delighted they are is evidenced by this selection of letters taken from the vast correspondence received in this office.

"62 STATIONS AT PERTH"

[*From D. Horn, 12, North William Street, Perth.*]

The S.T.300 Star is what I term a marvellous receiver, and is much farther ahead than any other three-valver that I have handled or built. When your 300 Star appeared in THE WIRELESS CONSTRUCTOR I had it built, and I may safely and truly tell you that within two nights I had logged 62 stations with great ease, and there are still more to be logged yet.

I may also mention that I am a home constructor from beginning to end. I understand everything in connection with all the sets that you have designed, and will always be an S.-T. follower from now until the end of the chapter. Your sets come first with me before any other make.

Thanking you once more for the most wonderful sets that you have put before amateurs and practical men.

"IT'S A WONDER"

[*From W. R. J. Boyd, 36, Green Walk, Ruislip, Middlesex.*]

Following upon my letter of last month, I hasten to write another complimentary note on your S.T.300 Star. It's a wonder!

As previously stated, I am an S.T.300 and 400 user. This 300 Star beats the pair together. I cannot praise it enough, and I say to all WIRELESS CONSTRUCTOR readers: "Build this set."

Results are wonderful.

I am able, no doubt through my experience with the 300 and 400 sets, to get the best out of the set, and I feel it my duty to say I do not think you have exaggerated its abilities, volume and tone in the least iota. Again, it's a wonderful set.

As you will see, I live just outside London and find no difficulty in ousting London National or Regional when I want a foreigner close to them.

I will not bore you with any more, but before closing I say to all WIRELESS CONSTRUCTOR readers: If you want a really first-class three-valver, go in for the S.T.300 Star.

I have recommended it to all my S.T.300 friends. Six are being built in this small place to my knowledge.

Wishing you every success and thanking you for such a real set.

"BEYOND MY GREATEST IMAGININGS"

[*From "A. C.," Waltham Cross, Herts.*]

I am a comparatively new reader of THE WIRELESS CONSTRUCTOR. I purchased it last month with the blue print of S.T.300 Star, which I built.

I must say I am more than satisfied. The number of stations I get is much beyond my greatest imaginings.

"IT IS A KNOCK-OUT"

[*From Victor Whitbread, 14, Shakespeare Avenue, Harlesden, N.W.10.*]

I feel I must congratulate you for the circuit of the S.T.300 Star. It's a knock-out in the way of straight sets.

I must plead guilty to one alteration—I have added another L.F. stage similar to the S.T.400.

On my previous sets I could never get an American station, but on the two attempts that I have had with these two sets I have been successful.

I have built your S.T.500 for a friend of mine. He did not want Class B, as it would be too loud for his wife, so I put an ordinary L.F. stage, and even then it was too loud.

I also have to thank you for a fine book which should be a great help to the wireless enthusiast.

"WONDERFUL CLEARNESS AND NATURAL TONE"

[*From T. C. Davenport, 5, Gilbert Street, Seedley, Salford.*]

I wish to thank you for your latest circuit, i.e. the S.T.300 Star.

In my opinion, its greatest merit lies in the wonderful clearness and natural tone of both speech and music.

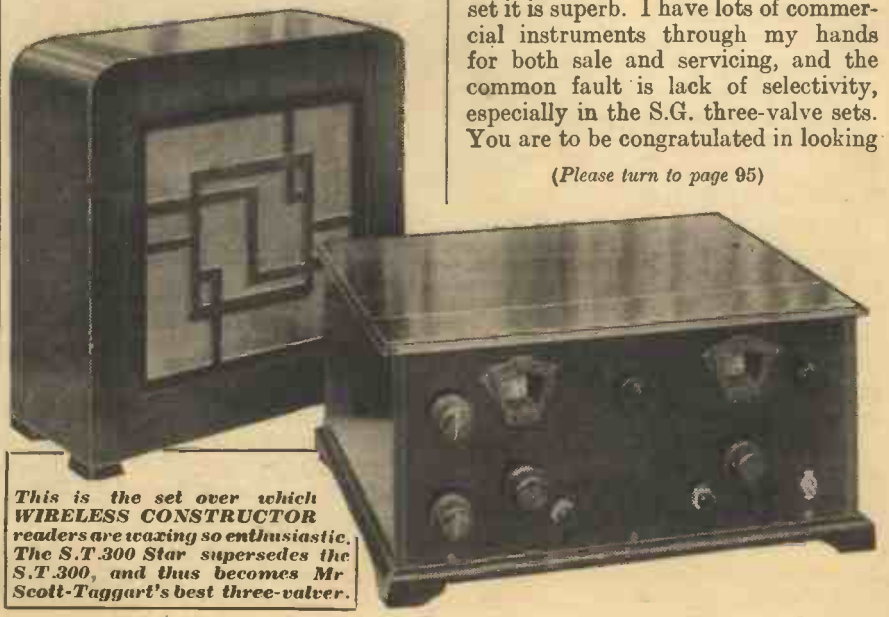
I congratulate you on your progress, for, however good your immediate set may be, somehow you always produce an improvement in its successor.

"IT IS SUPERB"

[*From T. Hudson Horsley, 5, Market Place, Guisborough, Yorkshire.*]

I have assembled the S.T.300 Star set as an A.C. set, and have given it a thorough try-out. I am more than satisfied; only, in my opinion, can a superhet equal the selectivity. The aerial reaction is just what was wanted, both in the 300 and 400. As an A.C. set it is superb. I have lots of commercial instruments through my hands for both sale and servicing, and the common fault is lack of selectivity, especially in the S.G. three-valve sets. You are to be congratulated in looking

(*Please turn to page* 95)



This is the set over which WIRELESS CONSTRUCTOR readers are waxing so enthusiastic. The S.T.300 Star supersedes the S.T.300, and thus becomes Mr Scott-Taggart's best three-valver.

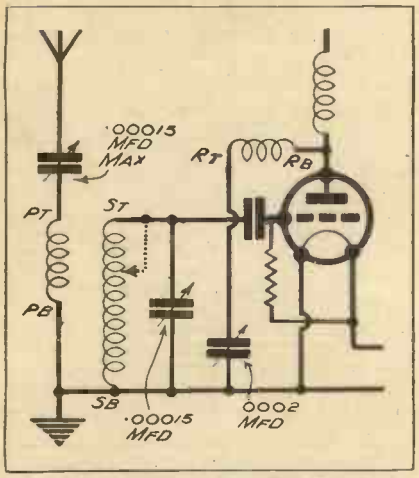
How to Make A SHORT-WAVE COUPLER

By H. BARNES.

ONE of the chief troubles encountered by short-wave enthusiasts is concerned with poor reaction. By this is meant dead spots—that is, when the detector will oscillate over some portion of the tuning scale and not others—fierceness, and in some cases failure to oscillate altogether.

Many a would-be short-wave fan has condemned his carefully constructed

SIMPLE CONNECTIONS



This diagram shows the coil connected in a simple detector circuit. P, S and R indicate the primary, secondary and reaction windings, while T and B stand for "Top" and "Bottom."

set to the junk bin merely because he had not paid enough attention to his aerial coupling.

Now the aerial can be coupled to the grid coil through a small aperiodic coil, a small condenser or both. These methods are perfectly satisfactory in many receivers, but in quite a number of cases, especially if a large-capacity aerial is being used, the coupling condenser has to be so small, or the primary coil so far from the grid coil, that signal strength suffers to a marked degree.

Of Primary Importance

This may not apply so much to the man who uses plug-in coils of different sizes to cover the required waveband, but when one coil is used and the wavelength altered by means of a crocodile clip, it becomes of primary importance. (I might mention that we are considering the type of coil wound on a cylindrical ribbed former,

Are you troubled with reaction fierceness or "dead spots"? If so, why not make this inexpensive and very easily constructed coil unit? You will then be able to adjust your aerial coupling to a nicety and so obtain maximum results from your short-wave set.

with the primary at the top, the secondary in the centre and the reaction coil at the bottom.)

Well, if the clip is three turns up from the bottom, the primary might be anything from an inch and a half to two inches from the effective portion of the grid coil. Possibly the set would still oscillate under these conditions, but do you know whether the degree of coupling is ideal?

Inexpensive to Make

It will be readily seen, therefore, that a coil unit with a primary that can be adjusted in relation to the secondary or grid coil is a necessity to efficient short-wave reception. And a coil of this type can be made at very small cost by any of the more practical amateurs.

The materials required are few:

One piece of ply about 3½ in. square and $\frac{3}{16}$ in. thick.

One piece of deal or similar wood about 3½ in. square and ½ in. thick.

About 38 in. of dowelling, $\frac{3}{16}$ in. in diameter.

One piece of deal about 2¾ in. square and ⅜ in. thick.

Quantity of 16, 18 or 20-gauge tinned copper wire.

Quantity of No. 30 D.S.C. wire.

About 8 in. of flex, two small wood screws and six terminals.

The first operation is to cut the ply to a diameter of about 3⅛ in. This having been done, a circle 2¾ in. diameter is drawn concentric with the outside, and six points marked off at equal intervals round it. Through each of these points is drilled a hole $\frac{3}{16}$ in. in diameter, an extra one being drilled in the centre.

The next operation is upon the base. This can be cut to a diameter of 3½ in., but if preferred may be left square.

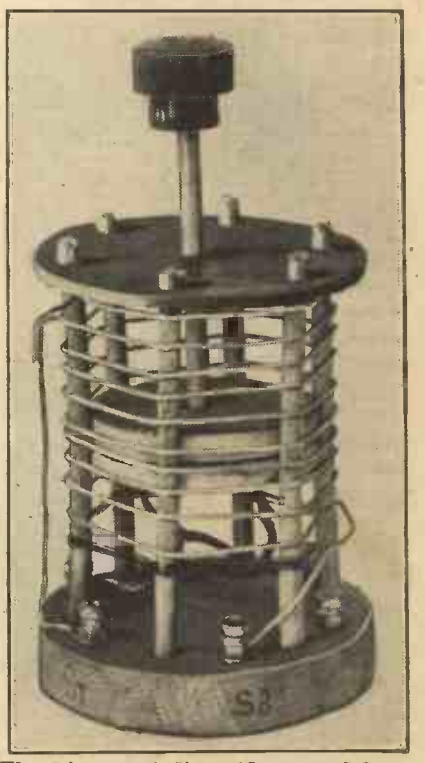
The piece of ply is laid on this, and the position of the six holes marked through with a pencil or similar instrument. Six holes are then drilled, and should correspond with those in the ply. These holes incidentally should be drilled square with the face of the wood.

The dowelling is now taken, and six pieces 3¾ in. long cut off. One end of each piece is smeared with glue and inserted in a hole in the base.

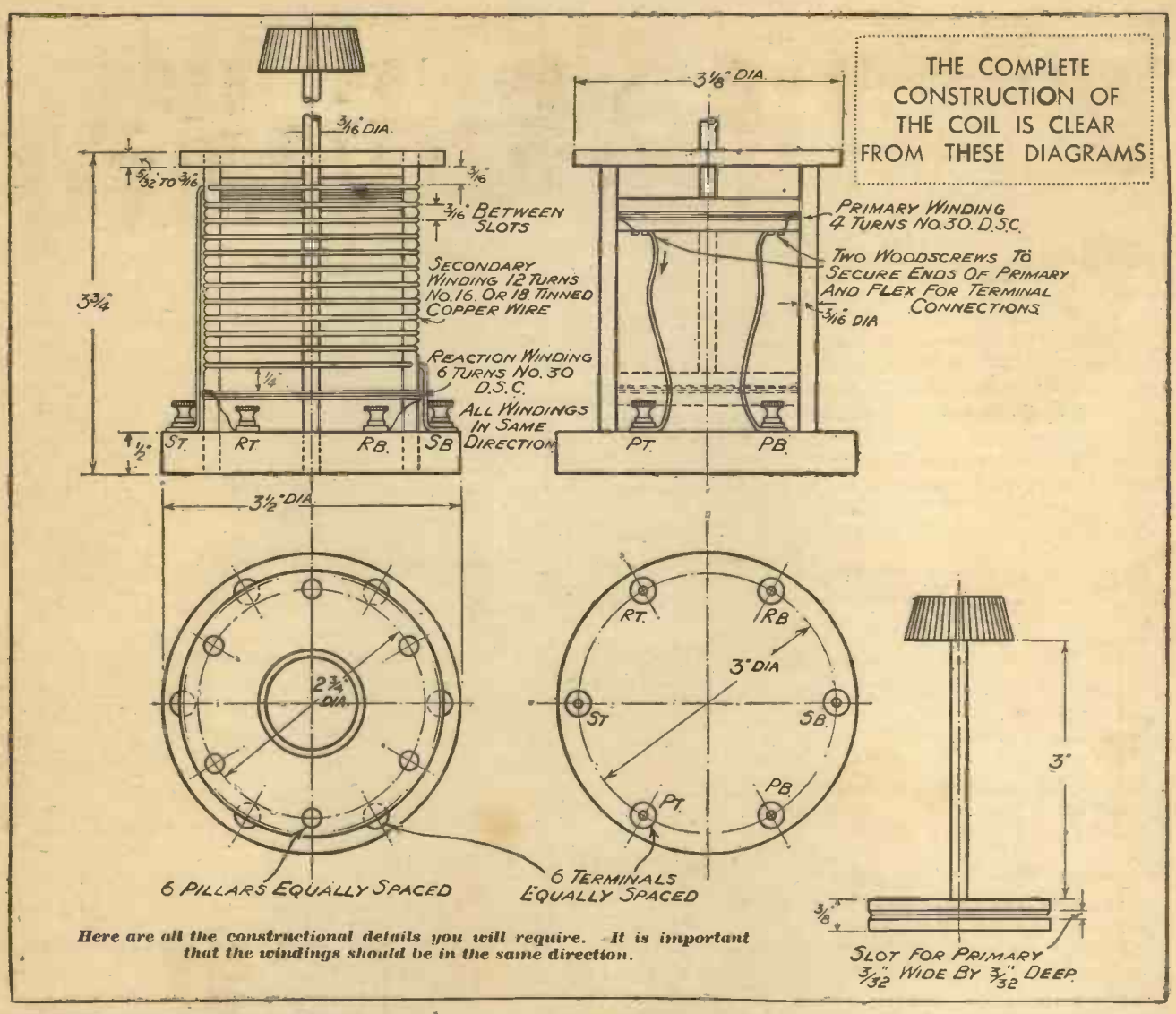
Smooth Sliding

The former for the primary coil is made from the remaining piece of deal, and is cut to a diameter of about 2⅜ in., care being taken to see that it is round. A trial-and-error method is recommended for this operation, small portions being filed off the former until it slides smoothly between the pillars.

EASILY ADJUSTED



The primary winding slides up and down inside the secondary, and its position can be readily adjusted to suit individual aerial and circuit conditions.



Here are all the constructional details you will require. It is important that the windings should be in the same direction.

A SHORT-WAVE COUPLER

—continued from previous page

When this is completed, a small groove $\frac{3}{32}$ in. wide and $\frac{3}{32}$ in. deep is cut with the corner of a file. This groove should be about $\frac{3}{16}$ in. from one face of the former. A hole $\frac{3}{16}$ in. diameter is drilled in the centre, and the former is ready for winding. The start of the primary is secured by a small wood screw driven into the former about $\frac{1}{4}$ in. from the edge.

Four turns of No. 30 D.S.C. are wound on in the groove, and the end secured by a wood screw, as was the start. To complete the primary former, another piece of dowelling about 4 in. long is cut off, the end smeared with glue and pushed into the hole in the centre of the former. Leave enough wire for connecting purposes.

When the glue is dry and the pillars fixed firmly in the base, a number of slots are cut in each pillar.

There are twelve slots in each, which start $\frac{3}{8}$ in. from the top and are $\frac{3}{16}$ in. apart. They are made with the corner of a file, and should be about $\frac{3}{32}$ in. deep.

Now to commence winding. A small hole is pierced in one pillar near the top, and the 16-gauge tinned copper wire pushed through, care being taken to leave about 5 in. of wire for connecting purposes. Wind on twelve turns, one in each slot, and secure the end in a small hole as at the start.

The Reaction Winding

And now the reaction winding. This consists of six turns of No. 30 D.S.C., and is wound at a distance of $\frac{1}{4}$ in. from the bottom of the secondary winding. This is an important dimension. It is secured in the same way as the secondary, is close wound and in the same direction as the latter.

The next operation is to push the primary down between the pillars carrying the secondary. When this has been done, slip the ply with the six holes in it over the pillars and the spindle of the primary, and touch the ends of the pillars with glue.

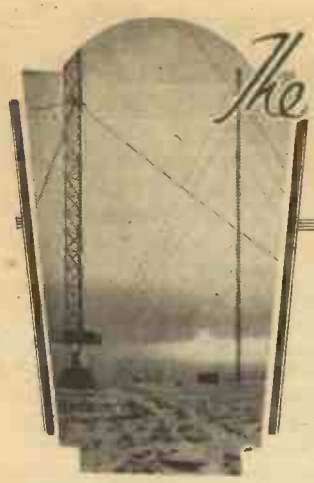
Six terminals are now screwed round the base, and the ends of the three coils connected thereto.

As the primary is movable, the constructor can, should he prefer it, connect short pieces of flex to the ends of the primary, as the wire with which the coil is wound might not be able to stand up to the continual movement. To complete the unit, a small knob is placed on the end of the primary spindle.

The unit is fixed by means of a screw driven up through the baseboard.

To operate: The primary should be moved up or down inside the secondary, consistent with maximum signal strength and regular oscillation.

The grid condenser may be taken via a crocodile clip to an intermediate tap on the secondary coil instead of direct to the S.T. terminal.



The Life of a Radio Wave

Accustomed as we are to wireless, the actual adventures and travels of a radio wave from aerial to aerial are still a mystery to most of us.

And here our distinguished contributor shows how fascinating the subject is, and discloses how scientists themselves have been unable to account for the amazing reception we obtain from low-powered wireless stations.

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

THE life history of wireless waves is a fascinating story. From the moment they are born, at the transmitter, until they reach their distant goal, they encounter and pass through every sort of physical condition, and, apart from inherited tendencies, their character is moulded during this brief span of life.

The energy of the waves is partly absorbed by the surface of the earth and of the sea and by the electrical conducting regions in the atmosphere, whilst their direction is affected by all of these conditions and by reflection, refraction and diffraction in the various media through which they pass.

How the Waves Travel

For some years past attention has been concentrated on the question of the factors and influences which bear on the waves during their travel through space, and, whilst our knowledge has greatly increased, it has in one sense served but to show how infinitely complicated is this story of the travel of wireless waves.

It is evident, even to the most casual observer, that the waves do not travel in straight lines as light does, otherwise they would never get to a place beyond the horizon; even with a high aerial mast the range would be limited to perhaps a hundred miles at the most. But the fact that radio waves travel enormous distances, and particularly that long-distance transmissions can be made upon short waves with almost infinitesimal power, shows quite definitely that any *simple* theory of the propagation of wireless waves entirely fails to accord with practice.

First Cousins to Light

We know that radio waves are first cousins of light waves, in the sense that both are electro-magnetic radiations, but their profound difference in wavelength puts them, as it were, into entirely different categories.

It was shown quite early on that on the assumption that the curvature of the path of the waves was due purely to the atmosphere, the radius of the earth, if the waves were to get round and remain parallel to the earth's surface, would have to be about four or five times what it actually is.

Forming a Complete Circle

On the assumption of an atmosphere of *hydrogen*, the radius would have to be more than a hundred times its actual value, whilst on the other hand, if the atmosphere consisted of a gas such as *krypton*, the circular refraction would be just about right with the actual value of the earth's radius. Incidentally, in such an atmosphere light waves would travel parallel to the surface of the earth, and—apart from obstructions and the absorption of the light—we should be able to look entirely round the world and see our own backs!

These conceptions have purely a theoretical interest, but they show how the size of a planet and the nature of its atmosphere affect the passage of electro-magnetic waves around it.

It is pretty evident from the foregoing that the refraction due to the atmosphere does not by any means account for the fact that radio waves can be made to "cling," as it were, to the earth's curvature and arrive at a distant point with an appreciable percentage of the emitted energy.

Absorption of Energy

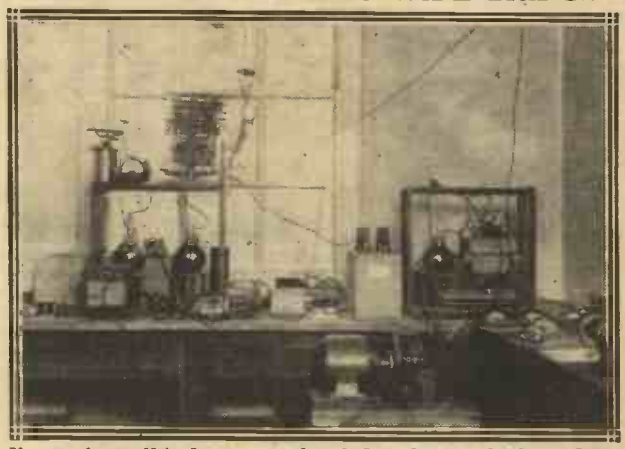
There is another very important influence at work which bends the wave front, for when there is a large conductor (the earth) in the immediate vicinity of the aerial, the travel of the waves is dependent to some extent on their wavelength and on the conductivity, dielectric constant and magnetic permeability of the earth.

It has been shown that a plane wave front, in which the electric force was originally vertical, is made to lean forward when it passes over the ground. Over sea water the lines are nearly perpendicular to the surface, but over dry land they are bent slightly forward in the direction of travel.

One result of this is that the energy does not travel parallel to the earth's surface, but the direction is such that as the wave travels forward some of its energy penetrates the earth. This naturally results in a certain amount of absorption of energy, the absorption being greater in a poor conductor like dry soil than in a comparatively good conductor like sea water. The absorption is also greater for short waves than for long ones.

The foregoing facts bring us a *little* nearer to understanding how radio waves travel around the curvature of the earth, but we are still a very long

ONE END OF A WORLD-WIDE BRIDGE



It was from this home-constructed and unpretentious low-powered outfit that a British amateur staggered the scientists by maintaining two-way communication with New Zealand. According to then accepted theories, he couldn't have done it even if all the power behind Niagara Falls had been harnessed to his aerial! As a matter of fact, he was using less than the power of an average electric lamp!

This historic apparatus was in use till 1925. The station's call was G 2 S Z and the owner was Mr. C. W. Goyder, of Mill Hill School, London, N.W.

Where Do Waves Go After Leaving an Aerial?

way from a complete explanation. The considerations already mentioned would by themselves only account for a relatively small curvature of the waves and would certainly not account for the long-distance transmissions which can actually be achieved.

A Shock to Theory

The biggest shock to the theoretical worker came from results obtained by amateurs operating on short waves. Amateurs were originally permitted to transmit and receive waves below 100 metres, in the belief that the small power used, and the rapid absorption of short waves by the earth, would prevent interference with commercial wireless services.

The story is well known of how one day, with no more energy in the aerial than that of an incandescent lamp, signals from New Zealand were received in England. The Marconi Company later showed by systematic experiments that for such long distances short waves were better than the long ones. The intensity of the received signals, calculated on the assumption of *diffraction alone*, was millions of times too small. In fact, according to the theoretical formulæ of that time, such signals could not be received even if the whole power of Niagara Falls were radiated from the aerial! It was perfectly clear, therefore, that some very large and unknown factor had still to be taken into consideration.

Kennelly and Heaviside

This brings us to the commencement of investigations into the so-called reflecting regions of the upper atmosphere, with which the names of Kennelly and Heaviside are so prominently associated. Very briefly, the Heaviside theory supposes a reflecting region in the atmosphere at a height of perhaps a hundred kilometres, and it needs little imagination to see what an enormous help such a reflecting outer "shell" would be in explaining the transmission of radio energy around the spherical surface of the earth.

I need, however, say little more about the Heaviside Layer, as this is very well known and the theory of this layer has held sway now for many years.

But this again, although an immense step forward, still leaves much to be explained. More recently we have learned a great deal about the composition and distribution of the upper regions of the atmosphere.

We have learned, for instance, that the Troposphere, the region in which turbulent air motion is the dominant physical characteristic—what we may call the "weather layer" of our atmosphere—exists no more than about 10 kilometres above the surface of the earth. At this point we have what is called Tropopause, that is the region of demarcation or "roof" where the troposphere finishes, whilst above the tropopause lies the Stratosphere.

The Ozonosphere

Still higher we have a most important region known as the Ozonosphere, in which, as the name implies, ozone is believed to be relatively concentrated. The ozone layer is roughly at about half the height of the Heaviside Layer.

The region above the Heaviside Layer is known as the Ionosphere, and at a height of some 200 kilometres or more we have the more recently discovered reflecting region known as the Appleton Layer.

Short-Wave Transmission

I have not the space to go into the extremely interesting investigations which have been made into these various regions, but you will find a fascinating account of them in a Paper by Sir Frank Smith, K.C.B., in the Journal of the Institution of Electrical Engineers for December, 1933: this Paper formed the twenty-fourth Kelvin Lecture, and is entitled "The Travel of Wireless Waves." I am indebted to Sir Frank Smith's paper for much of the information in this article.

Briefly, the conclusions drawn from recent experiments are that long wavelengths, over 400 metres, are in general *reflected* from the Heaviside Layer. With *decrease* of wavelength a critical value is reached. Reflection from this layer ceases; the waves then *penetrate* the layer and pass on to another higher layer of greater ionisation density which *reflect* them; this higher layer is, of course, what we now call the "Appleton Layer." Waves shorter than this critical value penetrate the lower or Heaviside Layer, and if the waves are *very* short (below 10 metres) they penetrate the higher layer also.

GAVE HIS NAME TO THE APPLETON LAYER

The scientist who is adjusting this apparatus is Professor E. V. Appleton, whose brilliant investigations into conditions above the atmosphere have thrown so much light on long-distance reception. He is here shown at King's College, London, explaining to students his methods of automatic recording of signal-intensity from a distant transmitter.

Reflection Effects

It appears from this that the Heaviside Layer must be regarded as more or less transparent to the short waves, but that these latter are reflected from the Appleton Layer. Moreover, waves of 100 metres and above are reflected from the Heaviside Layer even at vertical incidence, and the refracted waves play only a minor part.

These observations explain also the curious effect known as "skip," whereby signals will be inaudible at a place *within* a certain distance of the transmitting station but at a farther distance they will become audible again, the intermediate distance being known as the "skip distance." On the theory of reflections from the upper reflecting layer it becomes quite easy to see how this "skip" effect occurs.

The properties of the "Appleton Layer" are already well explored, and are the subject of continuing close study by the Radio Research Board. We are at present ignorant of the state of ionisation at the upper part of the Heaviside region. We conclude that all three processes—penetration, refraction and reflection—are operative.

HOW TO BUILD AN A.C. RADIOGRAM

WHEN it first originated, in our sister journal "Popular Wireless," the term "radiogram" was generally looked upon as covering any sort of radio receiver that would allow gramophone records to be played on it by means of a pick-up.

"All-In" Design

That, obviously, should be the meaning of the word to-day; but although it is sufficiently apt to cover the receiver that has pick-up terminals or an adaptor, allowing a pick-up to be used, the word "radiogram" has commonly come to stand only for that type of set that has a pick-up and the gramophone motor incorporated in it.

Moreover, the meaning has further been restricted by general use to mean only that type of outfit that is of the pedestal type. Such a restriction in the use of the word is quite unwarranted, for there is no need for a radiogram to be bulky—it need be very little larger than an ordinary radio receiver.

Tablegram Advantages

To many people the idea of a huge piece of furniture, however well designed, is abhorrent. Either because of space limitations or for other reasons they do not want an instrument resembling a small sideboard or chest of drawers in their living room.

And often, for this reason, apart from considerations of cost, they either go without the advantages of electrical gramophone reproduction or else they employ the somewhat makeshift and clumsy method of attaching a pick-up to their ordinary radio receiver whenever they require gramophone records.

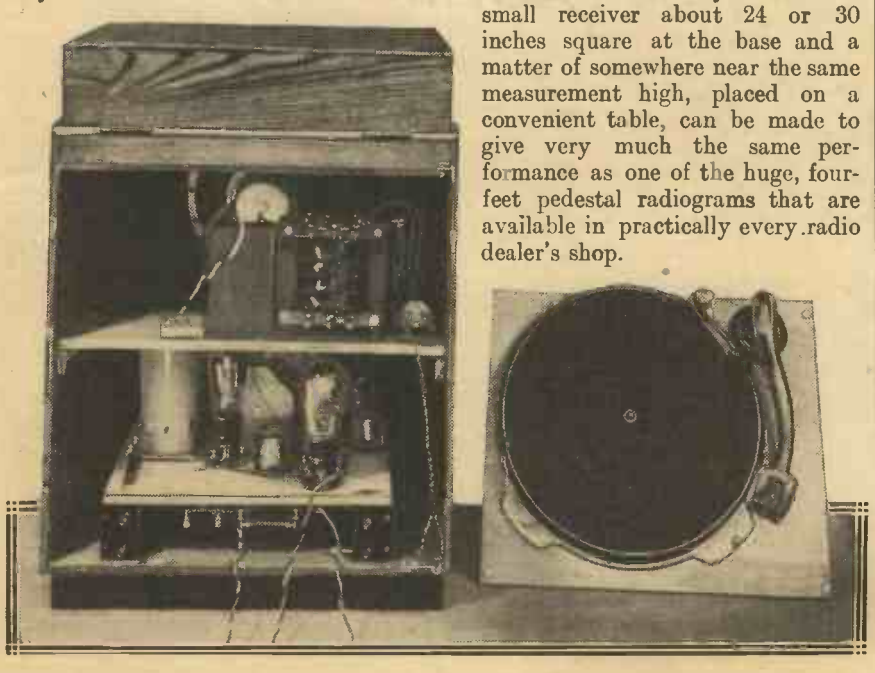
For some cause or other the radio trade has almost completely overlooked the capabilities of the small

FULL DETAILS OF AN ATTRACTIVE HOME ENTERTAINER

This instrument will appeal to those who want a mains receiver which is pleasing in appearance as well as efficient in results. The photographs on this page give an excellent impression of the table-type consolette cabinet which is employed, and show the general design of the radiogram.

Described by K. D. ROGERS.

table-type radiogram, or "tablegram," as it is often conveniently termed. A small receiver about 24 or 30 inches square at the base and a matter of somewhere near the same measurement high, placed on a convenient table, can be made to give very much the same performance as one of the huge, four-feet pedestal radiograms that are available in practically every radio dealer's shop.



We say "very much the same performance" because there is one restriction applied to the tablegram that the bigger one escapes, and that is the size of baffle. The loudspeaker baffle of the large radiogram will have an effective area of some 16 square feet in many cases, while the area of the tablegram baffle cannot be more than about half that figure.

Gives Better Quality

This is a restriction that cannot be overcome physically, though its effects can be largely nullified aurally by careful balancing of the musical reproduction of the set. The power of reproduction and the distance-getting qualities of the radio side of the receiver can be the same in the small version as in the large pedestal model.

When you come to think of it, the seven or eight square feet of baffle offered by the tablegram is more than that usually offered by the modern radio receiver, so that one can expect to obtain better reproduction from the tablegram than from the ordinary radio set—on radio itself, let alone the reproduction of gramophone records.

This is actually what does occur, and in a well-designed tablegram the quality is of a very high order indeed.

Not in the Shops!

And this is where the home constructor scores heavily. He cannot buy a tablegram (as far as we are aware), but he *can* build one for himself, and a very good one, too!

Whether he be on electric-light mains or whether he be restricted to battery-set use he can still make a really excellent table-model radio-gramophone, using Class B in the

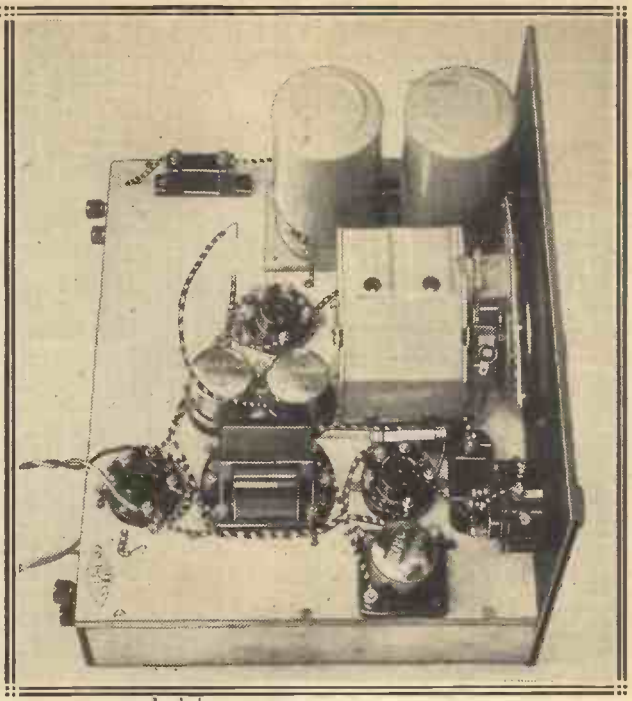
First-Class Quality

latter case and an all-mains circuit in the former.

No Batteries At All

It is with the all-mains type that we are concerned in this article, and indeed the all-mains set has something of an advantage over the battery type in the matter of size, for space does not have to be allowed for large H.T. batteries and the L.T. supply. Its mains-power pack can be quite small and easily accommodated behind the loudspeaker without in any way crowding the design.

Now, what are the requirements of a good tablegram? Obviously, the cabinet is one that must be carefully chosen. It must be business-like without being too severe in design, and it must not be too large. It must be conveniently arranged for the housing of what may be called the set portion, and have ample accommodation for the loud-speaker and the gramophone motor and pick-up.



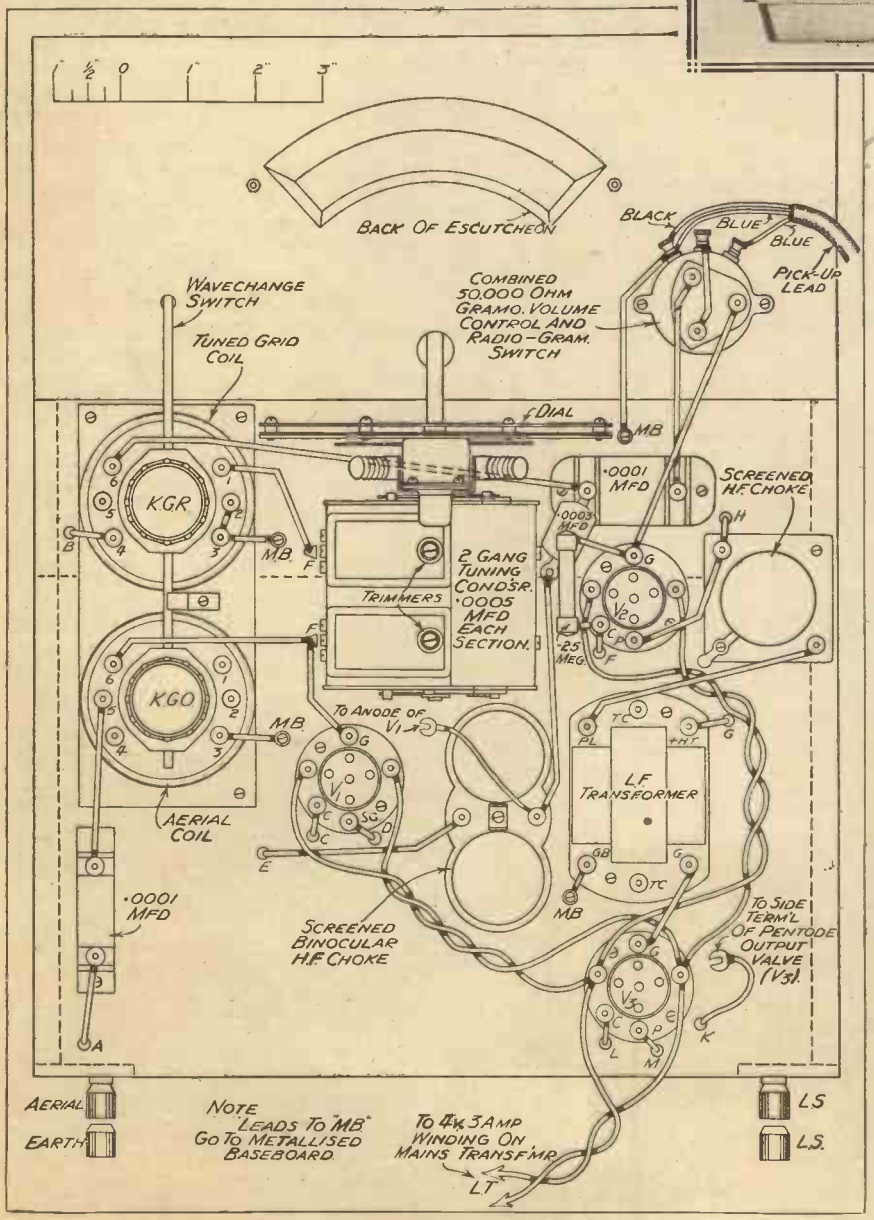
The most convenient design is that in which the set is housed at the bottom of the cabinet, with the loud-speaker portion immediately above, this section being arranged so that the mechanism of the electric motor can be housed in it. The turntable and the pick-up, of course, go on top.

An Economy Idea

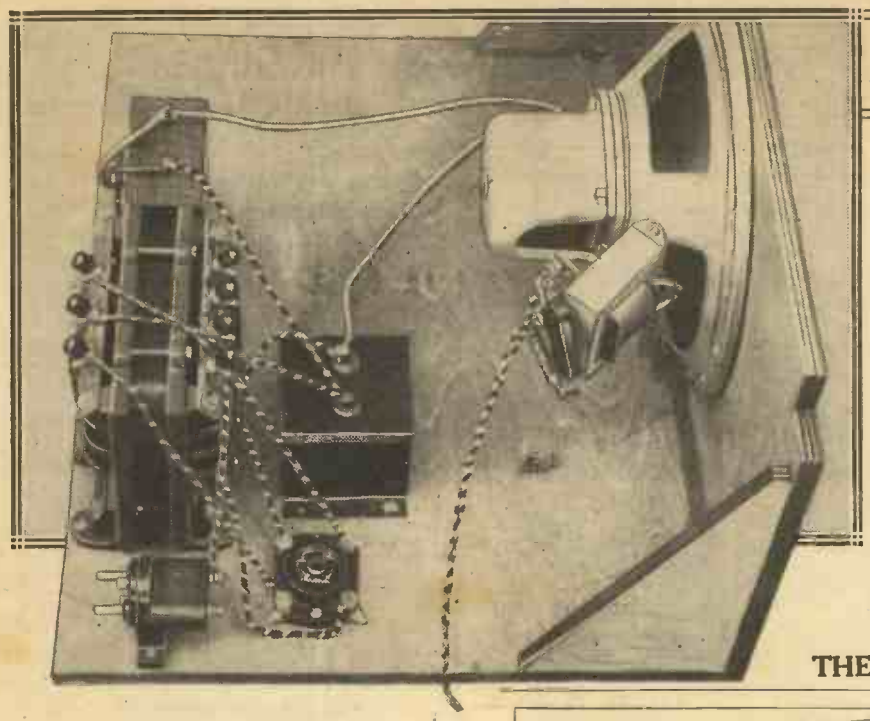
Such is the layout of the cabinet we have chosen for the tablegram illustrated in these pages. The set portion is housed below, and is completely self-contained. Its power pack is kept above it on the platform that runs under the loudspeaker, and the gramophone motor is housed on a second platform above that, the motor itself protruding slightly into the loudspeaker section behind the pot of the loudspeaker.

This latter is of the mains-energised type, giving more sensitivity than the permanent-magnet variety, and is used as a smoothing choke in the H.T. feed to the set. This is at once an

DETAILS OF THE CHASSIS ASSEMBLY



The whole of the set portion is built on a metallised chassis, which greatly simplifies the wiring, many of the earth-return connections being made by means of the metal surface of the board. The pick-up leads are brought down to the set through holes in the motor-board and the speaker platform. The dial lights are shown unconnected, but are easily wired, if desired, to one of the valve holder filaments with twisted flex. Keep such wiring away from the grid of the detector if V2 is chosen.



Ample Volume

economy in parts and space, for the usual smoothing choke associated with mains H.T. feed is completely absent, the loudspeaker pot taking its place.

The first thing to consider when designing a radiogramophone is the maximum output power required. Then the radio and the L.F. side are designed to load fully the output valve chosen, whether broadcasting or gramophone is being used.

Output Power

The set in question has a power of considerably over 2½ watts, probably more than 3·0 in most cases, but depending on the particular make of output valve used. Those listed will give at least 2½ watts of undistorted output when they are fully loaded, and this can be achieved easily with the pick-up on any loud record and with radio when listening to local or other powerful broadcasters.

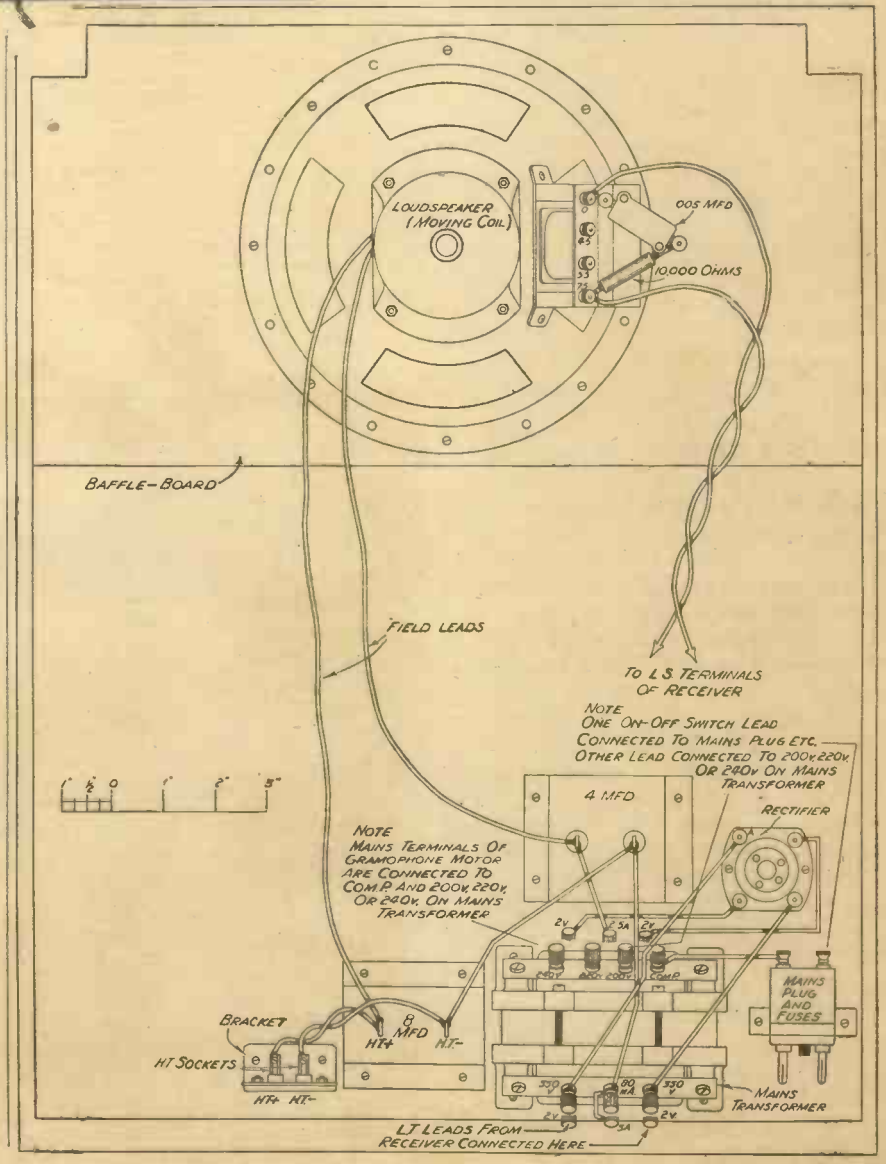
As the valves are all of the indirectly-heated A.C. type it is not difficult to obtain a high degree of sensitivity without employing a large number of valves. As a matter of fact, on the gramophone side only two valves are used, and with radio the number is three—not counting the rectifier for H.T., of course.

One of these valves (the S.G.) is idle when gramophone records are being played, but the other two are used whenever the set is operating, whether on radio or gramophone. The detector is one, being employed in a rectifying or a purely amplifying rôle as desired. The circuit for the former is a single H.F. stage tuned anode (or tuned grid), coupled to the detector, which is transformer-coupled to an output pentode.

For Greater Selectivity

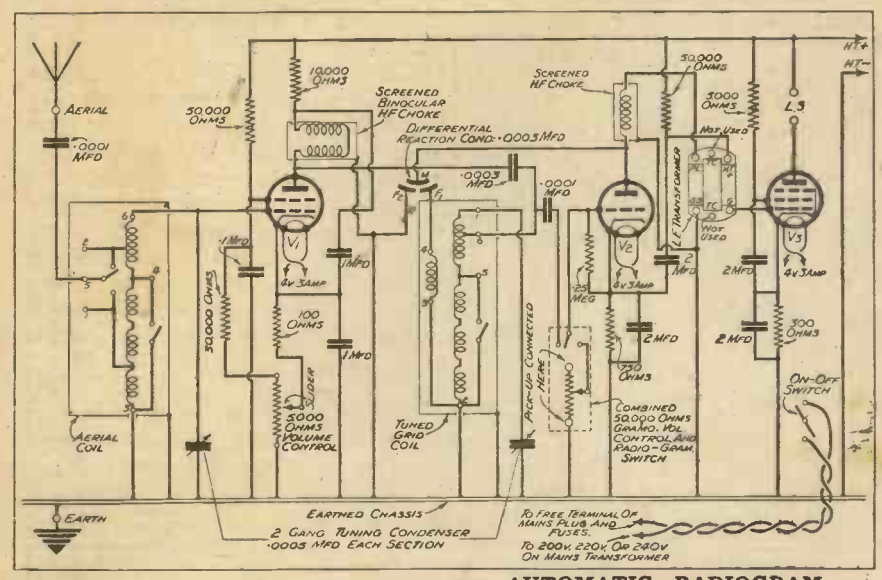
The coupling of the tuned-grid stage is arranged so that the anode of the

THE LOUDSPEAKER SECTION



The power pack is housed in the loudspeaker section above the chassis assembly. Note how the components are grouped at the back of the platform away from the loudspeaker, so as to allow ample clearance for the motor projection. The loudspeaker field winding is used as a high-tension smoothing choke.

A Simple and Efficient Three-Valve Circuit



AUTOMATIC RADIOGRAM SWITCHING

Multi-mu control is a feature of the H.F. side of this tablegram, whose circuit is shown above. Note how the connection between the mains-control switch, incorporated in the set section, is made to the power pack and the electricity supply. The photograph depicts the under-chassis layout and wiring. Chassis construction is one of the greatest aids to easy assembly and efficient performance. The gramophone volume control automatically operates the radiogram change-over switch.

screen-grid valve and the grid of the detector are both tapped down the tuning coil, giving a high degree of selectivity with ample sensitivity.

Air-cored coils are employed, with the switching so arranged that the aerial feed to the first coil is tapped automatically in different places for medium and long waves. This is carried out in the switching incorporated in the coil unit, so that there is no adjustment to be done by the constructor of the set.

Pre-Detector Volume Control

A multi-mu screen-grid valve is employed for the H.F. stage, carefully decoupled in both anode and screen H.T. leads, and controlled by means of a variable resistance in the cathode lead. This resistance is also common to the screen-grid circuit H.T. feed potentiometer, and while enabling variations of grid bias to be obtained it also controls the amount of H.T. applied to the screen of the valve. As the bias is increased the voltage applied to the screen is decreased, so that a rapid and wide variation of the mutual conductance of the valve is obtained.

The resistance takes the form of a wire-wound potentiometer of 5,000-ohms value, and is connected in series with the screen H.T. resistance system, the cathode of the valve being joined into the potentiometer by means of the slider.

No Screens Needed

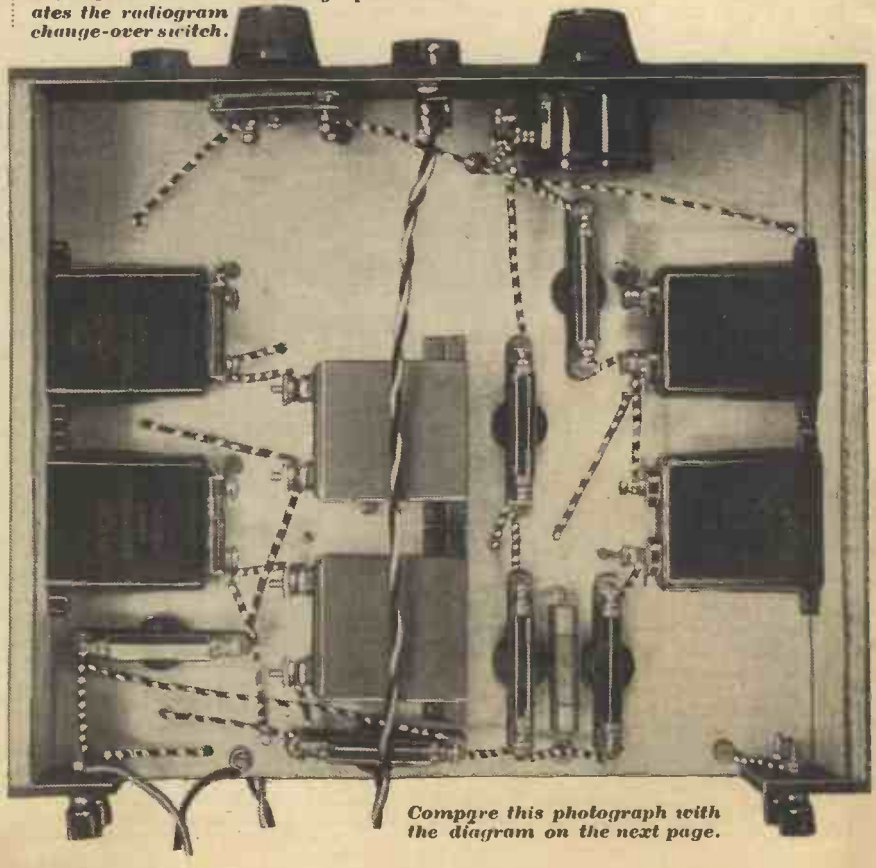
A minimum resistance in the cathode lead of 100 ohms is provided, so that the bias of the valve never drops to zero.

A series-aerial condenser of ·0001-mfd. capacity further enhances the selectivity of the aerial circuit, while the screening of the coil units (mounted on one chassis) and that of the S.G. H.F. choke and the detector reaction choke enable the set to be constructed without the need for any screen between the H.F. grid and anode circuits.

For Easy Construction

There is only one H.T. feed to the set—from the mains pack via the pot winding of the loudspeaker—all the voltage variations required by the various valves being obtained by means of series resistances, with the exception of the feed to the screen of the S.G. valve, which is carried out by the resistance potentiometer tap across the H.T. supply.

For most alternative valves the values of the resistances will hold closely enough, except in the cathode leads, and in the case of the S.G. valve the potentiometer which controls the sensitivity. The correct values for



Compare this photograph with the diagram on the next page.

Over 2½ Watts of Undistorted Output are Available

these should be ascertained from the valve makers, or from our Query Department if it is decided to use makes of valves other than those specified in the list.

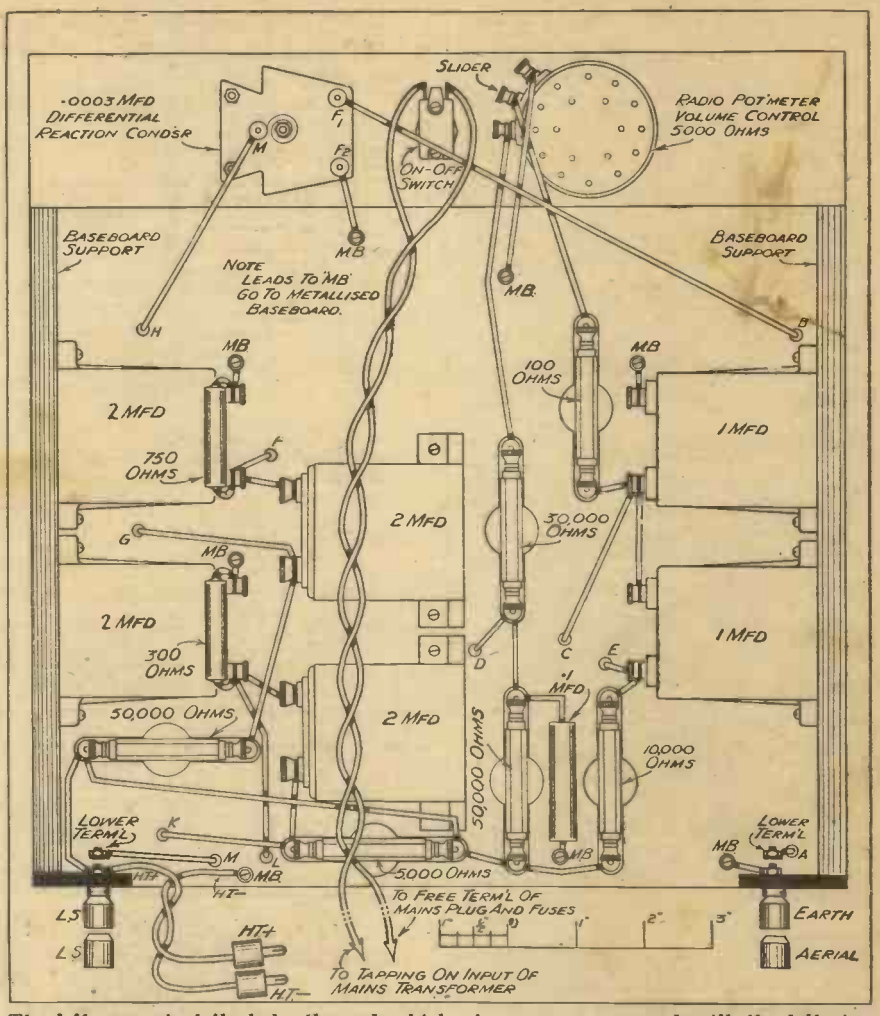
A metallised baseboard is employed for the set, and this makes for very great saving in wiring, for many of the earth or H.T.— connections can be made via the metal covering of the board.

The power pack is separate from the set and is mounted on the baseboard that forms a platform below the speaker. It must be assembled well back from the front baffle on which the speaker is actually mounted, for room has to be left for the protrudance of the motor of the gramophone, which is fixed to a flat board on the storey above.

The Input Connections

The diagrams and the photographs make the whole process of construction pretty clear, and it will be seen that the set, with its panel and baseboard, is quite a separate unit from the other parts of the tablegram, while the speaker and the power pack form another unit.

The connection from the A.C. mains is made to a combined plug and fuse-holder on the power pack, one side of the plug being connected direct to the mains transformer and the other side being taken to the switch on the panel of the set. The return wire from this switch goes to the necessary remaining terminal on the mains transformer.



The letters against the holes through which wires pass correspond with the lettering on the wiring plan of the top of the chassis. Pieces of stiff paper should be cut out and inserted beneath the six horizontal resistance holders to make short circuits to the baseboard impossible.

EVERYTHING NEEDED TO BUILD THE RADIOGRAM IS LISTED HERE.

1 Colvern 2-gang coil unit, type KGO : KGR.
1 British Radiophone 2-gang ·0005-mfd. tuning condenser, type 605.
1 British Radiophone slow-motion drive for above, type 711.
1 Bulgin 50,000-ohm potentiometer with 3-point change-over switch, type VS.36.
1 British Radiogram ·0003-mfd. differential reaction condenser, or Polar, J.B., Telsen, Graham Farish.
1 Igranic 5,000-ohm potentiometer, or Bulgin, Wearite.
1 Bulgin Q.M.B. on-off switch, type S.102.
1 Graham Farish screened binocular H.F. choke, type L.M.S., or Telsen.
1 Graham Farish screened H.F. choke, type H.M.S., or Bulgin, Telsen, Wearite.
3 Benjamin 5-pin valve holders, or Telsen, W.B., Lissen.
1 Multitone "Toco" L.F. transformer, or Varley, Ferranti.
2 Dubilier 2-mfd. fixed condensers, type BB, or T.C.C., Ferranti, Telsen, Graham Farish, British Radiogram, Lissen.
2 Graham Farish 2-mfd. fixed condensers, or T.C.C.
2 Dubilier 1-mfd. fixed condensers, type BB, or T.C.C., Ferranti, Telsen, Graham Farish, Lissen, British Radiogram.
1 T.C.C. ·1-mfd. tubular fixed condenser, type 250, or Dubilier.
1 Dubilier ·005-mfd. fixed condenser, type 670.
1 Dubilier ·0001-mfd. fixed condenser, type 610, or T.C.C., Graham Farish.
1 Dubilier ·0001-mfd. fixed condenser, type 620, or T.C.C., Graham Farish, Telsen.
1 Dubilier ·0003-mfd. fixed condenser, type 665, or T.C.C.
1 Dubilier ½-meg. grid leak, 1-watt type, or Erie, Bulgin, Varley.
2 Graham Farish 50,000-ohm 1½-watt type Ohmite resistances in horizontal holders.
1 Graham Farish 30,000-ohm 1½-watt type Ohmite resistance in horizontal holder.
1 Graham Farish 10,000-ohm 1½-watt type Ohmite resistance in horizontal holder.
1 Graham Farish 5,000-ohm 1½-watt type Ohmite resistance in horizontal holder.
1 Graham Farish 100-ohm 1½-watt type Ohmite resistance in horizontal holder.
1 Varley 10,000-ohm Electronic resistance, 1-watt type, or Dubilier, Erie, Bulgin.
1 Varley 750-ohm Electronic resistance, 1-watt type, or Dubilier, Bulgin, Erie.
1 Varley 300-ohm Electronic resistance, 1-watt type, or Erie, Dubilier, Bulgin.
4 Belling-Lee indicating terminals, or Bulgin, Eelex, Clix.
1 Peto-Scott panel, 12 in. × 8 in., or Goltone, Permcol, Becol.
1 Peto-Scott Metaplex chassis, 12 in. × 10 in., with 2½-in. runners.
2 Peto-Scott terminal strips, 2½ in. × 1½ in., or Goltone, Permcol, Becol.
1 R.I. mains transformer, type EY.35.
1 T.C.C. 8-mfd. fixed condenser, type 84, or Dubilier.
1 Dubilier 4-mfd. fixed condenser, type L.E.C., or T.C.C.
1 Bulgin combined mains plug and fuses, type F.15.
1 Belling-Lee twin socket bracket, engraved "+ H.T.—," and plugs.
1 Benjamin 4-pin valve holder, Vibrolder type, or W.B., Telsen, Lissen.
1 W.B. mains-energised moving-coil loudspeaker with 2,500-ohm resistance field winding.
1 Garrard A.C. gramophone motor, type A.C.4.
1 Columbia pick-up, type No. 22.
2 Coils British Radiophone "Pull-Back" connecting wire.
1 Peto-Scott cabinet.
Screws, flex, etc. (Peto-Scott).

A High Degree of Selectivity is Achieved

The transformer, it will be noted, has four terminals on the section devoted to the input of the mains. One is marked "Com. P," which stands for "common primary," and the others are marked with three different voltages of the mains—200, 220 and 240.

The connection from the mains plug nearer the transformer goes to the "Com." terminal, and the lead coming back from the switch on the set is taken to the terminal on the transformer denoting the voltage of your mains.

Black and Blue

Thus, if the mains are 200 or 210 volts, you use the terminal marked 200; if the voltage is 220 or 230, use terminal 220; and if the voltage is above 230, use the 240 terminal.

The W.B. speaker used in the set is particularly suitable, and should be connected as shown. The necessary baffle on which the loudspeaker is mounted and the platform and other parts of the wood construction are obtained ready cut to size from the makers of the cabinet.

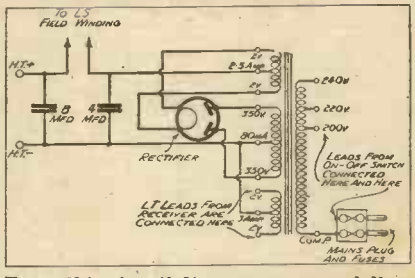
The pick-up will be found to have three leads from it, if the one specified is used. These leads are coloured black and blue, there being two blue leads. The blue leads are the "live" connections to the pick-up, and they have to be connected to the two outside terminals on the combined volume control and change-over switch in the detector circuit.

This automatically changes the set from radio to gramophone when the volume control is moved clockwise, and changes back from "gram" to radio when the minimum volume position of the control is reached.

The single black lead is connected internally to the pick-up's chassis (the metal tone-arm, etc.), and must be connected to the earth terminal of the volume control—that is, to the terminal on the left as the control is looked at from the back of the baseboard.

The gramophone motor itself has an automatic stop-and-start switch incorporated, so one need not control this separately, and it can be joined up direct across the mains with the necessary resistance set in accordance with the maker's recommendations.

THE POWER CIRCUIT



From this circuit diagram you can follow how the L.S. field winding is connected up to act as a smoothing choke.

The operation of the set is perfectly ordinary. The twin-gang condenser is trimmed in the usual way on a weak station somewhere near the bottom of the medium band. Reaction is normal, and the S.G. valve volume control works in the same way as an ordinary L.F. control—i.e. turns to the right (clockwise) for increase of volume.

Some Final Hints

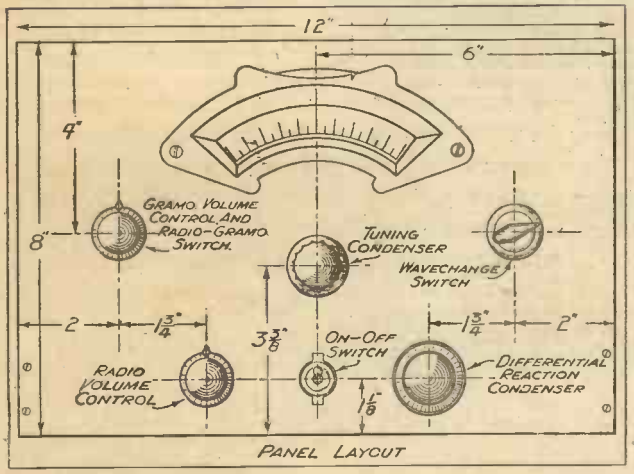
Remember that, in cases where interference is very bad, it is often advantageous not to use the full sensitivity of the S.G. stage, but to make up with reaction, keeping the volume control "down" a little. This has the effect of sharpening the tuning by a very large extent.

The two dial lights on the condenser are not connected in the diagrams, but it is an easy matter to do so. The lamps are joined in parallel, and are then connected across the two filament (heater) terminals of one of the valve holders in the set—probably that of V.2 being the most convenient.

VALVES SUITABLE FOR THE A.C. RADIOGRAM

Make.	S.G.	Det.	Output.	Rectifier.
Cossor	M.V.S.G.	41M.H.L.	M.P./Pen.	—
Mullard	M.M.4V.	354V.	Pen.4V.A.	I.W.3
Mazda	A.C./S.G.V.M.	A.C./H.L.	A.C./Pen.	—
Marconi	V.M.S.4B.	M.H.4	M.P.T.4	M.U.12
Osram	V.M.S.4B.	M.H.4	M.P.T.4	M.U.12
Dario	T.E.554	T.E.384	—	—
Tungsram	A.S.4125	A.R.4101	A.P.P.4120	—

IT SLIDES INTO THE CABINET FROM THE BACK



PANEL LAYOUT

Although a specially shaped vignette is used around the controls, the panel is an ordinary rectangular one, being slid up against the vignette from the back of the cabinet.

SUMMER FARE

Advance details of B.B.C. programme arrangements for the late summer.

THE Saturday night feature, "In Town To-night," which is being discontinued for the early summer months, will be on the air again before the autumn.

* * *

When the Droitwich transmitter comes into service during the summer, Plymouth and Bournemouth will probably cease their present relays of the National programme.

* * *

The Promenade Concerts for 1934 will begin, from the Queen's Hall, London, on Saturday, August 11th. This will be the fortieth summer season under the conductorship of Sir Henry Wood and the eighth under the auspices of the B.B.C.

PIONEERING for the RADIO

by ARCHIBALD HADDON

The world's first radio dramatic critic, our contributor is well qualified to talk about those early days when the B.B.C. was looked upon with more than suspicion by the entertainment industry. The struggle to overcome prejudice in many quarters and the final triumph for broadcasting make a romantic story which is told here for the first time.

IT may be inadvisable at the moment to recall in every detail the B.B.C.'s relations with the journalistic and theatrical professions in the first year of its existence, when I started my eighteen months' engagement as the then Broadcasting Company's dramatic critic.

They amounted to the beginnings of a fight for the freedom of broadcasting which is still going on. Much has been won for broadcasting, but recent actions of one music-hall combine show that a good deal of prejudice remains, and no false step can be taken with impunity.

A Few Kind Words

My own position at the outset was unenviable. The B.B.C. dramatic critic was the pariah of his craft: unwanted by theatrical managers, unrecognised by the general body of his own professional colleagues, the critics, with whom he had previously worked in perfect harmony for many years.

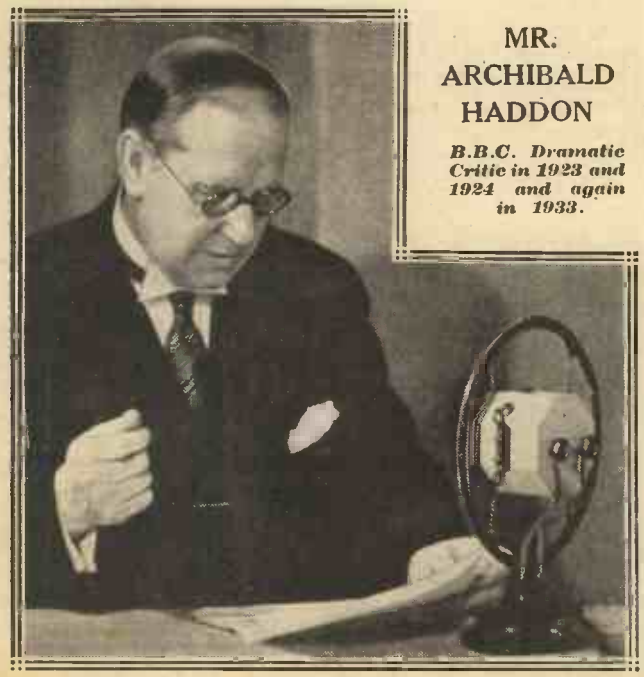
The situation was humiliating to me, and I set about the seemingly impossible task of putting it to rights.

I derived a little comfort from written assurances of leading theatrical managers that the attitude they had officially adopted was in no sense directed against myself. In extremely kindly words they absolved me from any such suspicion.

Winning Over the Critics

But I could not endure the aloofness of my critical colleagues. That I attacked like a fanatic. I pleaded my case at dinners and meetings of the critics. The then Mr. Reith came to my assistance personally.

At several of these discussions the critics defeated by large majorities my contention that broadcast criticism should be supported as a new branch of journalism. A lot more campaigning had to be done before agreement was secured.



MR. ARCHIBALD HADDON

B.B.C. Dramatic Critic in 1923 and 1924 and again in 1933.

Eventually Reith and I carried the campaign into the lions' den—actually into the hall of the Institute of Journalists. We won! The entire body of critics—after Mr. Reith had supported my cause in a wonderfully tactful speech—accepted my resolution that broadcast dramatic criticism should be supported by the Critics Circle.

There is now a Wireless Critics Circle, composed of men who partly or wholly earn their livings by writing about broadcasting. How ridiculous it seems that ten years ago they, or their predecessors in criticism, were quarrelling with their future bread and butter!

Having gone so far successfully, I became a rabid enthusiast for broadcasting in all its forms, and devoted all my spare time to voluntary work in its behalf.

The Cry in the Wilderness

I delivered a forty-minutes' speech on the subject at the playgoers' societies and at various clubs and institutes. Well-known broadcasters, managerial big-wigs and famous actors and actresses joined in the debates, and my campaign, as it proceeded, was reported in the newspapers.

As a journalist I was one crying in the wilderness. My only supporters at these debates were Reith, Eckersley, Cecil Lewis, Rex Palmer, Arthur Burrows and Percy Scholes.

A well-known journalist, to whom I outlined the position at a theatrical first night, turned on his heel with the contemptuous remark: "Wireless! Bah! A toy, destined for the nursery!" A celebrated theatrical manager, at another first night, also made a right-about-turn, exclaiming sarcastically: "The B.B.C.! . . . They've got no money!"

Biding His Time

On each occasion I said to myself, as I swallowed a lump of pride: "How's that for foresight!"

Throughout these trying times, my admiration for Sir John Reith's

The First Radio Play Ever Broadcast

unfailing patience and forbearance in the face of continual provocation was too deep for words. On every occasion, good or bad, he was the smiling personification of good will to all men. No doubt he knew even then that he could afford to bide his time. Already, I dare say, he was dreaming of Broadcasting House.

A Lone Critic

Another business appointment called me from the scene before my propaganda work was completed. Ten years later, when I rejoined the B.B.C. in my old capacity, all my former ambitions had been realised on behalf of my successors in the chair of criticism. If Sir John Reith were given to boasting he could say with Coriolanus: "Alone I did it."

Any way, there I was at the outset, a critic outside the pale both of journalism and the theatre. How was I to carry on the job in circumstances so discouraging?

I decided to emulate Sir John Reith's example of forbearance. If a play was bad I left it alone. I said in my first talk (the first dramatic criticism ever broadcast): "If I am to be of use to you in these talks I must necessarily dwell on those aspects

CECIL LEWIS

one of the earliest B.B.C. employees was Deputy Director of Programmes from 1922-25 under Arthur Burrows. His support of our contributor's fight for freedom of criticism was in no small way responsible for the final lifting of the boycott which the entertainment industry put on the B.B.C.

of the theatre which are for the common good. I must not go to the theatre with the intention of finding fault, but with a desire to broadcast merit."

Establishing Good Relations

The policy was my own entirely. Nobody at 2 L O ever made so much as a suggestion as to how I should deal with the theatres. The directorate was like a good newspaper editor, who never "instructs" a responsible dramatic critic. *Throughout the whole of my eighteen months at 2 L O my talks were given at the microphone as written;* and there were no complaints from any quarter at any time.

On the contrary, when I resigned the position I was presented with a souvenir by heads of the B.B.C., and Sir John Reith broadcast a parting speech of generous appreciation.

The policy was, therefore, justified by results. Its motive was a desire to establish good relations at the start between the B.B.C. and the theatrical profession.

Hard to Resist

Often there were no good plays to help me. Then I discovered that I spoke more truly than I knew when I said in my first talk: "Fault-finding is so easy that the inclination to indulge in it is hard to resist."

Frequently, therefore, in the absence of plays to praise, I devoted the whole of my talk to a subject of general theatrical interest. I dealt at length with the widest range of material, making it as topical as possible.

Continually, in my talks, I dealt with radio development as it affected or was affected by the theatre. I broadcast the first dramatic criticism of the first radio play. The title of that talk was "Enter the Radio Play."

I kept a close look-out for radio incidents in the theatres, directing dramatists' attention to the possibilities.

The Announcer Test

I said to listeners in February, 1924: "At present we have to be content in the theatre with the funny side of broadcasting and listening-in, but their day will come in serious drama. Who will be the first dramatist to earn the distinction of treating wireless seriously?"

On this, when I was sent to Birmingham to broadcast my impressions of the première of Shaw's "Back to Methuselah," I was able to tell listeners that in the play "there are marvels of photo-telephony, by means of which a person speaking hundreds of miles away is simultaneously seen as well as heard." Foresight again, but oh, how different!

No performer dealing with radio on the stage failed to get encouragement from the B.B.C. dramatic critic. Charlot did "London Calling," the first stage show to deal at length with broadcasting, and it got an excellent notice. "I persuaded two of your announcers," I said to listeners, "Mr. Palmer and Mr. Dodgson, to go to the theatre to see if their sense of humour would stand the strain, but no ambulances were sent for, and they are going about the office as usual."

Charlot's Time Signal

This in spite of the following jocularity by the announcer in the show: "I will now give you the ten o'clock time signal. . . . Stand by, please, for the ten o'clock time

P.P.ECKERSLEY

Chief Engineer of the B.B.C. at the time about which Mr. Haddon is writing, was one of the few who lent their support to our contributor's point of view. Mr. Eckersley was always an enthusiastic protagonist of progress, as his Regional Scheme proved.

signal . . . 26, 27, 48, 59" (here the studio clock struck five) . . . "That was the ten o'clock time signal. For the benefit of those who did not hear it, the time is now exactly 25 to 11."

In the middle of the B.B.C.'s second year I was in a position to report to listeners that the good work was proceeding so encouragingly that as many as six West-End theatres were simultaneously presenting wireless scenes in their plays. "And everywhere I go," I said, "I am impressed by the growing influence of wireless."

Radio's Mission to Humanity

The work at that time entailed the consideration of an appalling amount of correspondence from listeners. There was ample reward in listeners' appreciation. Most touching of all were the letters from blind listeners expressing their gratitude for the broadcasting of radio plays. This prompted me to say at the microphone about the radio play: "This new art form has a mission to fulfil beyond the immediate requirements of our own individual pleasures—a mission to humanity at large."

WHY ARE THOSE STATIONS WEAKER?

BY VICTOR KING

Are you one of those observant listeners who have wondered why a broadcasting station seems to come in much better when it is new than after a few years or so of regular working? Our contributor provocatively points out that the inference confidently drawn in such cases often ignores factors which are very important. And he goes on to tell of some of his own recent experiments which you will find of extreme interest.

THERE is nothing I like better than a good argument. It is stimulating and often amusing. Unfortunately, there are fewer and fewer keen controversies in radio as the years pass, for the simple reason that we are learning so much about its facts and fundamentals that precious little room is left for argument.

Of course, there are plenty of attempts to engineer arguments for some reason or other (generally, I fancy, the main object is the creation of limelight for the protagonists !).

How Controversies Start

I have no time for these spurious word battles. What I like is that kind of controversy which begins in this manner:

A modest, perhaps unlearned, correspondent experiences something interesting. He writes a letter about it to one of the papers, and it is quite clear that he is mainly fired by the desire to tell others about it.

The letter duly appears tucked away in a correspondence column. It provides the pedants with just the opening they have been hopefully waiting for, and they descend like a pack of wolves.

As a preliminary they tear the original correspondent to pieces, display his lack of academic lore for the multitude to deride, and then turn on each other with their rending pens.

I fancy I detected quite a strong element of this in a recent argument. It was started, I believe, in a contemporary by someone declaring that stations tend to grow weaker as they grow older.

Not Very Convincing

As a reason for this it was tentatively advanced that the earth gradually depreciates owing to the continued electrical activity in it and over it.

It was pointed out in confirmation that it does not happen to wireless stations on ships.

All very interesting, but I have yet to be convinced that the radiation from land stations does fall off. I don't think there is anything convincing to show that it does.

Mr. A., living at Puddlecomb-on-the-Marsh, may not receive station X as loudly as he used to, but that does not prove that station X is shaking the ether with less violence.

I, for one, would not be convinced of that even if Mr. A. assured me that his receiving equipment was every bit as good as it was when station X used to thump in.

Now this weakening of stations is a very interesting business. I know hundreds and thousands of you have experienced it, because many of you have mentioned the fact in your letters.

I have noticed it myself, and it is sometimes rather exasperating. For example, at one time I was able to tune in the Midland Regional with as much ease as the London Regional.

Since then certain foreign stations have put up their power enormously, and I can get them with proportionately greater ease.

What is the Cause?

I mention this fact because I fully recognise it and make allowances. But when allowances have been made and clear comparisons kept in mind there is still no disputing 5 G B's falling off. It certainly is not merely that 5 G B has maintained a consistent volume and that I *think* it is weaker because others are stronger.

Whereas at one time I used to be able to get it with a "det. L.F.," I can now hardly drag it in with an additional H.F. stage.

Nevertheless, I am not sure that it is the station that is to blame in either its apparatus or the earth surrounding it.

There are many other things that could produce the effect. A colossal number of new aerials have sprung up between me and 5 G B during the past four or five years.

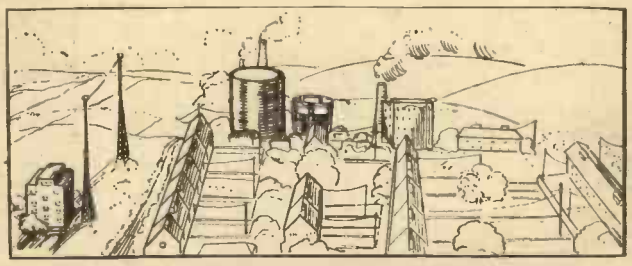
And it would be extraordinary if these aerials did not absorb some of the energy radiated so that I got less.

Again, the face of the land has probably changed along the route. New houses, new factories, new buildings of all kinds have no doubt sprung up, and these must surely interfere with the ether waves.

But the B.B.C. could easily settle the matter, once and for all, by measuring the field strength of, say, 5 G B at different points and comparing them with the field strength recorded in the past.

Experiences Wanted

In the meantime, I would be most grateful if those readers who have experienced such effects would drop me a line about them. From a large



WHERE YOUR PROGRAMMES ARE WAYLAID?

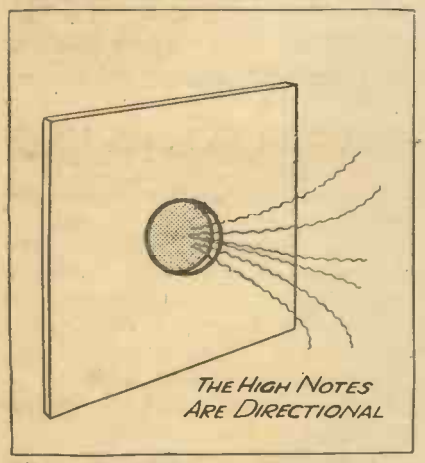
An often unsuspected cause of weaker reception is the "trapping" of distant stations by factories, new buildings, aerials, etc., which are erected between your own aerial and that of the transmitter in question. Victor King suggests that properly-controlled measurements on, say, Midland Regional should be taken by the B.B.C. to show just how serious such an effect may be.

Low Notes that Need a 12-ft. Baffle Board!

number of experiences it might be possible to derive some very useful information which I shall be glad to pass on to those concerned.

And now to turn to another matter. Mr. A. Moss (I hope I have the name right), of City Garden Row, London, N.1, writes: "I read with much interest your article on 'New Uses for Tone Control,' and congratulate you

HIGH-NOTE RADIATION



When attempting to gauge a loud-speaker's performance remember that, although the bass notes are radiated more or less impartially in all directions, the high notes tend more to concentrate in a beam.

on your method of attack, the first common-sense method I have heard of so far.

"The present-day methods are those of a dentist who pulls out the whole of a side of a jaw because one tooth is aching."

I think that is a wonderful analogy—one of the most apt I have ever seen. I am very fond of analogies, because they so often enable one to get a point over perfectly with a minimum of words.

Can be Misleading

But they are rather dangerous animals, these analogies. They can be apparently good but actually misleading. There are several always used in elementary text-books which I particularly dislike for that reason.

On the other hand, there is no such thing as a perfect analogy, as is obvious when you remember that the better an analogy becomes the nearer it is to the real thing.

But Mr. Moss' descriptive analogy is first class, and in a couple of dozen or so words it crystallises all my ideas in regard to tone control.

In reference to this particular subject, by the way, I have recently had some almost exciting experiences on the low frequencies.

Have you ever heard a pure 20-cycle sound frequency? Well, I have. I have been collaborating with my friend, G. V. Dowding, in some experiments necessitating the production of harmonicless sound waves of low frequency.

In order to obtain the necessary results we had to design and build quite an amount of special apparatus. Transformers could not be used, and ordinary coupling condensers also had to be eliminated.

Only direct-coupled amplifiers using separate H.T. and L.T. were found to be suitable.

The Scheme Used

The little diagram below shows two L.F. valves coupled in this fashion. If the filament of the second valve were joined direct to the H.T. plus of the first valve (separate H.T. batteries have to be used) its grid would be made very negative owing to the voltage drop across the coupling resistance.

To adjust the G.B. correctly, therefore, it is necessary to tap the filament connections back on the H.T. battery and so apply an off-setting positive bias.

It is little things like these that one encounters and which make experimenting in out-of-ordinary systems so intriguing.

In the end we obtained our bass pure and clean, and there was ample illustration of the value of this to music when we tested with orchestral items.

The bass response of the average outfit is pretty poor, you can take it from me. When you think you've got it, it's ten pounds to a "dud" grid leak that there is colossal coloration and frequency doubling with, comparatively speaking, very little overall bass power.

Approach to Perfection

An approach to perfection in bass balance gives at first, strangely enough, the impression that there is *less* bass owing to the absence of boominess and resonance.

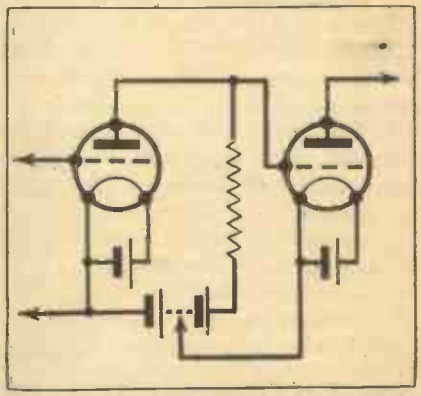
But clean bass is a most attractive accomplishment, and how thin and superficial the results are without it! One of the first essentials is a moving-coil speaker with a freely moving diaphragm, and a diaphragm that moves with the coil as a whole, and also one that does not produce an obvious resonance when the diaphragm is tapped.

Then, of course, a big baffle is needed, not a cabinet. A baffle of 12 ft. square is the sort of thing I use when I am out after the really low notes.

How They Cancel Out

For it must not be forgotten that, whereas the high notes leave the diaphragm more or less as a beam (see diagram), the low notes wander round to the back and, if they are not interrupted by a baffle of largish dimensions, they are neutralised by those which wander to the front from the back.

FOR QUALITY'S SAKE



This strange-looking circuit shows to what lengths it is necessary to go to preserve the very low notes. There is no coupling condenser, and the negative grid bias due to the directly-connected anode resistance requires that a counter-balancing positive bias be applied to the second grid. Different low-tension and high-tension batteries are necessary for each valve.

So you see that the low notes are not captured until they have actually been thrown clear from the speaker.

Worth the Trouble

Yes, I admit that it's a business getting them, but I think they are worth the considerable trouble that they involve.

I must not forget to remind you, too, that you don't get bass away from a 300-milliwatt output. Seven or eight watts are about the minimum.

Still, if any of you go chasing these bottom frequencies, don't neglect the higher ones. They are equally important. When you get both—that's perfect radio!

FROM MY ARMCHAIR

by S.T.

HAPPY days! Clearing up a lot of antiquated rubbish preparatory to moving into a new house, I have come across a copy of the "Daily Sketch" dated July 7th, 1913. There are two blue-pencil crosses against a paragraph headed "Students' Camp Wireless Set." It reads:

Mr. J. Scott-Taggart, one of the students who are under canvas at Abergele, North Wales, has constructed a wireless station, where signals are taken down from all parts of Britain, and even from Hamburg, 500 miles distant.

Now, wasn't that clever of me? I also note that "public news items received in this way are daily posted up at the camp. The operator's room is a tent which at night is lit by electricity."

I was very proud to get into the news. One is—at sixteen.

* * *

I was interested to read what grown-ups were saying and thinking a year before the war. On the same page are the following first few lines of news or correspondence by different readers:

(1) *Speaking as an artist who has studied for a long time from the nude, I can honestly say what a necessary and splendid thing it is.*

(2) *If a man is anxious to bathe with his lady friends, why shouldn't he? This is a free country.*

(3) *I have just returned from a year's stay in Germany. They all told me that they want to live at peace with England and look forward to an Anglo-German entente. However, I am grieved to see how the Englishmen over there adopt a very cold attitude towards the Germans in general.*

(4) *Mrs. Jane Remnant, of Godalming, who celebrated her ninety-fourth birthday on Saturday, wore spectacles until she was eighty and then discarded them.*

(5) *I hate Germans, from the Kaiser downwards, and if war broke out between Britain and Germany I would make it a hobby to try and put "paid" to as many Germans' accounts as I possibly could.*

(6) *I am not a prude, but I think that it is better to wear a light swimming suit and pass unnoticed than bathe naked and invite vulgar remarks.—Manchester Man.*

(Good for Manchester! Modest as always, but not prudish.—J. S.-T.)

(7) *James Ryder, a ship's fireman, was sentenced to death at Manchester for the murder of his wife.*

(8) *Haven't we been abolishing, prohibiting and hiding for years and years? That being so, can it be wondered that men go prying around bathing places and are generally immoral?—Anti-prudery, Birmingham.*

So that was what they were doing in 1913.

* * *

The same old question: "Do you think you're funny?" asks "Fed-Up" of Whitstable.

This man is no oyster, because there is a page of rude questions. Nevertheless, I take him with a grain of cayenne. These fellows are often kindly at heart, fond of animals and glad to hear the pattering of little feet about them. They water their nasturtiums, play dominoes, kiss their wives occasionally—and then suddenly some Sunday afternoon a tornado of emotion sweeps over them. They see red. Immediately I become their bête noir—or, rather, bête rouge

Are you reading the exclusive Life of Eddy, another instalment of which appears in this issue of THE WIRELESS CONSTRUCTOR? Do you know what factors Sir John Reith takes into consideration when he is engaging new members of his staff? Have you ever heard of a pork butcher's finger improving reception? All these—and much else besides—are dealt with this month by Mr. Scott-Taggart in his informal chat with readers of THE WIRELESS CONSTRUCTOR

Out of the Blue

Hitherto they have thought kindly of me. They have seen that photo of me puffing gently and contentedly in an armchair, and thought: "He's a decent sort. Funny in his way. Bit eccentric. Keen, of course. Bit silly sometimes. But quite decent, really."

And then, out of a hitherto clear sky, comes the storm. It breaks over me. It drenches my armchair. It damps my enthusiasm and puts out my pipe.

A Hallful of Members Standing on Their Heads

The cause? I never can tell. I am at present trying to link these phenomena with the sun-spot cycle.

* * *

New Readers Begin Here

(*In a West Country paper I read that eddy currents were so called after their discoverer. I give here the third instalment of the life of Professor Eddy, as he later became. Much research was needed to unearth these facts.*)

Herr Edelweishunter was received with acclamation by the phlegmatic English, the dour Scots, the something Irish and the something-something Welsh.

His Ice-cream Puddle experiment thrilled the members of the Royal Society, and as an encore he demonstrated in person the Crooked-Thumb Rule for finding in which direction a pith ball would move when placed near a Leyden jar.

It must have been a rare sight to see a hallful of members (most of them over seventy) standing on their heads doing odd things with their thumbs and toes.

Only one person in the hall remained erect and rigidly seated. An usher went up to him and asked him why he did not attempt with the others the Crooked-Thumb Rule. "Because," he retorted stoutly, "I don't care a damn which way a pith ball goes."*

* Needless to say, the cad was afterwards blackballed from every club in London. His grandson, who recounted the above incident to me, told me that his grandfather often used to mutter in his later years: "Better a pith ball than a blackball."

HOW THEY LOOKED IN A.D. 1913

Mr. Scott-Taggart's reminiscences of the year before the war will conjure up among our older readers some amusing pictures of the past. This photograph, for instance, taken in 1913, shows a party of young ladies in the height of contemporary fashion paying a visit to Ascot.

It must be confessed, however, that the Crooked-Thumb Rule was not universally liked. The older school thought it too much like physical jerks, while the younger ones could never remember whether the Leyden jar was positive or negative. On the other hand, there were many who stated that their arthritis benefited greatly from the Rule.

Dr. Edelweishunter was very much in the news, and the editors of the popular technical Press offered him large sums for snappy articles on "How to Make Your Own Pith Balls," "The Truth About Frogs' Legs" and "The Experimenter's Leyden Jar for Ninepence."

Eddy—as his friends now began to call him—spurned these alluring offers to encourage him to prostitute his knowledge. He read several papers, however, for the British Physical Society. On the advice of friends he did not restrict his researches to electricity. Pure science was his world and *ad hoc* experimentation merely the jam on the roly-poly of his existence.

What Did Lung Tsi Say?

To show that he was unconcerned with the ultimate usefulness of his work—thereby gaining the respect of every scientist in this country—I give a few titles of his papers:

(1) "On the effect of throwing a couple of matchsticks on the surface of a pool of water."

(2) "On the friction coefficient of sardine oil in relation to the eclipse of the sun."

(3) "On the muzzle velocity of pea-shooters situated in vacuo."

It is said that every single howitzer in the Late Great was designed on principles laid down by Edelweishunter in this last memorable paper: which shows that, as Lung Tsi (B.C. 2312) so succinctly put it: "One never knows what will lead to what."

The Test of True Science

On one occasion our hero submitted a paper whose title did not begin with "On." It was tactfully returned. Eddy was mortally offended, but only when his former English friends began to avoid him did he capitulate and insert the word "On," when the paper was at once accepted. As his best friend bluntly told him afterwards: "Only a charlatan would omit the word 'On.'"

(*More next month, chicks.*)

* * *

I see the B.B.C. staff are once more "seething" with discontent.

They are always grumbling. They "seethe" every couple of months. They hate their anonymity. They want their names in the papers—"Ooh, look, mummy, my photo's in the papers!"

Puling for Publicity

Even I, in my modest little fashion, get sick to death of seeing my photographs on posters, in advertisements, peering into sets—or over armchairs. As I usually cannot recognise myself, and as my friends never can, it doesn't matter so much.

If the B.B.C. want to be seen, let them join a male chorus at a revue; to me they sound like a lot of children. It ought to do them a deal of good having to stand to attention.

Flowers in the buttonhole are discouraged, I hear. And bars near Portland Place are not drunk at but frowned upon. Nor is it permitted to slink near the artistes' Polish Corridor. All good measures.

But the puling for publicity makes one ill. If the B.B.C. has developed the reputation for being a kindergarten

There Was Magic in the First Finger

run by a strict schoolmaster, believe me it isn't the fault of the schoolmaster.

And hasn't the schoolmaster himself told them all in his book, "Broadcast Over Britain":

The broadcasters are personages of much importance in the land, although this so far may not be recognised. It matters little or nothing to them whether it is recognised or not. In many ways I believe that they should remain in their comparative obscurity . . . . The desire for notoriety and recognition sterilises the seeds from which greatness might spring.

A Place in the Stars

As Sir John Reith says in conclusion: *A place in the stars is of more importance than a place in the sun.*

But lack of publicity is not the sole grouse that flutters out through the stone portals of Broadcasting House. The staff are "underpaid." Here one is more inclined to sympathise, although, if they got more than we did and we heard about it, we should all yelp that they were not worth it. Look at that programme last night: a lot of fatuous limpets sheltering under the wing of . . . . and look at that variety on Saturday . . . .

How does Sir John choose his men? He inquires closely into the candidates' reasons for seeking that particular job. He even tries to dissuade them by offering a lower salary than they might get elsewhere. "*Then, to make certain, I say: 'We can offer you £500, but what if you are offered £600 or £700 in another line?' Unless I can feel certain that the candidate would come to the B.B.C. at a lower salary I do not think he would get in.*"

This is indeed a hard saying. The candidate is to forgo both recognition and salary. Some may say it is idealism gone mad or else just cant. Others may say it is easy to adopt this attitude when you are receiving £8,000 a year.

Aerials and Ideals

To look upon a job merely as a means of eating and sleeping is not the highest ideal. An author, a poet, a film producer would become nothing if he did not prefer his particular work to any other. But he has more scope for idealistic work than the B.B.C. He can produce a work of integrity.

Let us look at things sensibly. The aerials of the B.B.C. radiate a hotchpotch of bunk, idealism, boredom, divine music, negroid caterwauling, sincere religion and questionable stories. That, unfortunately, is what we like. And some would like to cut out the idealism, boredom, divine music and sincere religion.

The point is this: The D.-G. and all his staff have to accept the responsibility for this ill-assorted compôte of the fruits of their work, just as an editor has to accept responsibility for his paper.

He can't disclaim responsibility by saying he has to pander to the mob. He is not flattering himself by calling himself a panderer. The more loyal a B.B.C. employee is the more he must accept responsibility for the whole programme.

Anyone who listens to the B.B.C. for twenty-four hours will find it difficult to regard employment therein as a holy vocation. The lowliest man of religion and the humblest doctor do more than any one of these candidates for the stars.

WHOSE EYES ARE THESE?

"This is indeed a hard saying," comments our contributor in referring to their owner.

What can a B.B.C. employee really hope for in the B.B.C.? Unless someone dies or gets the sack or gets fed up, his chances of promotion are remote. Star dust will neither clothe his wife nor feed his children.

Sense of Proportion

Sir John's is a hard saying. We need men of ideals in the B.B.C. lest it wither. We need men of vision lest it perish. But we also need men with a sense of proportion who can see the fine thing about their jobs and yet have the sense of humour to see its occasional vulgarity: who are loyal to their jobs and who love their work, but who, although their creations are in the skies, yet have their feet upon the earth.

Such are the men I would employ—if I were Reith.

* * *

I am still most anxious to add to my list of service men (professional or amateur) who are willing to service sets of my design in their areas on a payment-by-results basis.

Readers who are in any trouble will be referred to such service men.

Wireless dealers, service men or thoroughly experienced amateurs with spare evenings should send me their qualifications without delay. Many areas are not catered for, and there is a dearth of service men even in large centres.

* * *

Mr. A. L. V. W., of New Brighton, wonders why he receives stronger signals when he touches a loudspeaker terminal.

Peculiar to the Pork Butcher

I once knew a man who always got signals a hundred per cent louder when his next-door neighbour, a pork butcher, placed the first finger of his left hand on the earth terminal of the set.

The first finger of my friend's wife (this sounds like a French lesson) was no good at all; signals went weaker. Other members of the family were tried, but failed miserably.

There was magic in the first finger of the left hand of the pork-butchering neighbour.

The dwelling on the other side to that of the pork butcher housed a taxi-driver. It was a surprise to me to learn that a taxi-driver ever has a house. One feels that they sleep in their cabs, or even not at all.

I was, I confess, a little shocked to find myself within a few feet of the wall behind which a taxi-driver carried on a taxi-less existence and no doubt did the kinds of things you and I do. But the taxi-man's finger was of no radio use at all.

A Pretty Pass

Mind you, I was only called in to my friend's house after things had come to a pretty pass. The fellow was desperate: I could see that.

Whenever he wanted to hear a programme very clearly he had to fetch in his neighbour the pork butcher

(*Please turn to page* 94)

PLAYS!

HOW THE FUTURE OF RADIO DRAMA MAY BE AFFECTED BY LISTENERS' CORRESPONDENCE

A rehearsal of a radio production at Broadcasting House.

WHETHER or not the 12,726 letters which Val Gielgud, B.B.C. Drama Director, has received from listeners in answer to his microphone appeal in March have any value at all in judging whether licence holders as a whole want more radio drama is doubtful. Allowing for the fact that many of the letters had more than one signature, 15,000 is only a small percentage of the 6,000,000 people who have radio receivers—a quarter of one per cent, to be exact!

But there can be no doubt at all that the opinions expressed by 12,726 regular play listeners are a very valuable guide to what type of play these people want in the future; and it seems likely that the Drama Director will allow himself to be influenced, in part at least, by these opinions.

And if we are to judge by the analysis which Mr. Gielgud made in a recent issue of the "Radio Times," these opinions are generally very different from what one might expect.

"More comedy," of course, was a frequent cry, and the unfortunate but, nevertheless, quite apparent lack of suitable comedy for broadcasting is a matter with which Mr. Gielgud has dealt more than once in the past.

For the rest, the two most insistent demands seem to be for adapted stage plays and for longer productions.

The first demand is definitely all wrong. Whether it arises because the listener has not been able to adapt himself to a technique which is still comparatively young, or whether the B.B.C. has failed in its task of providing a new kind of material for a new kind of medium, is open to discussion. But quite obviously there *ought* to be an overwhelming preference for radio plays as such.

That there is not should be an incentive to give better purely radio plays rather than to pander to an expression of opinion which, in itself, is a condemnation of the B.B.C.'s drama policy.

The most satisfactory length for a radio play has long been a questionable point.

If one takes the regular play listeners as a basis the following figures would seem to be fair: 100 per cent can listen to a 30-minute play without becoming restless; 75 per cent., can manage 45 minutes; 50 per cent may find an hour within their limit; while only 10 or 15 per cent will endure two full hours.

From this it would seem that 45 minutes, while allowing sufficient scope for a capable dramatist, will please the biggest percentage of listeners.

Finally, listeners ask for more historical plays and simpler production. That they are likely to get both these demands seems more than possible. The historical drama we have been given has been really good, and the Drama Director himself has always championed the cause of simplicity in production.

(Continued at top of next column)

FLUID-LIGHT TUNING

Making Radio Easier

FLUID-LIGHT tuning is the latest development in radio research and manufacture, and, unlike many other loudly heralded improvements, it seems likely to prove of the greatest value.

On the front of one of the new radio receivers which were released by "His Master's Voice" early in May is a small glass tube about an inch long, having the appearance of a thermometer, in which a green column of light varies in height.

As the single-tuning knob is revolved and a station is heard, the column of light climbs up the tube until, when the station is dead in tune, it reaches its maximum height.

A FALLACY EXPOSED

The various exhaustive tests which preceded the adoption of this method brought to light some interesting facts. The belief that women could not operate radio receivers as well as men was proved conclusively to be a fallacy, but the research engineers discovered that the average time taken by all types of listeners to tune in a station accurately on a set incorporating fluid-light tuning was reduced by as much as 75 per cent.

Another advantage of the new system is the ability to tune in a station by sight alone, the volume control being left at minimum until the light indicator is in the correct position.

But the greatest advantage of all is that the incorporation of fluid-light tuning will not make any appreciable difference to the cost of radio. For instance, the cost of an H.M.V. all-mains superheterodyne receiver with the new tuning is no more than 15 guineas.

This is no mere stunt refinement, for in these days when the stations in Europe are increasing their power without any greater separation in wavelength, the importance of exact tuning to obtain interference-free reception will not be denied.

WOMAN IS FICKLE!

"We get so bored by men's voices," said a charming lady at the recent Annual Conference of the Women's Freedom League.

She was supporting a demand, heartily endorsed by her fellow-members, that the B.B.C. should employ women announcers.

Had they, perhaps, not heard of a certain Mrs. Borrett, who was given a trial not long ago in front of the microphone? Had they not heard, too, that the chief reason for the cessation of the experiment was the criticism which the B.B.C. received from women listeners?

Indeed, woman is fickle!

TELEVISION MOVE

A Parliamentary Committee

CONSTRUCTORS have for so long been accustomed to treat television entertainment as a matter for academic discussion and fruitless rumour that a definite parliamentary statement on the subject has come as a bit of a surprise.

The most hopeful side of this new development is that Sir Kingsley Wood, the Postmaster-General, is responsible for the setting up of a committee for the purpose of considering the conditions under which a public television service could be provided.

If the improvements and the sensible attitude which have been applied to the various branches of the Post Office are transferred to television, there is every likelihood that, at long last, something may happen.

The committee, the constitution of which had not been definitely announced up to the time of going to press, will consist of Post Office and B.B.C. officials who will co-opt many of the leading authorities on television.

Its object will be to direct the B.B.C. as to the future use of this latest radio science for entertainment.

Ever since strong claims were made by various competing companies for the adoption of 120–180-line transmissions, the B.B.C.—which has been working with the Baird 30-line system—has tried to avoid the responsibility of a definite decision for the future.

The Postmaster-General has no axe to grind. He can consider each system on its merits and on the advice of impartial experts.

Both the B.B.C. and the rival companies will welcome the formation of this committee, which, if it does its work as the public confidently expects it will, should have the effect, as the managing director of E.M.I., Ltd., said recently, "of placing Britain in the forefront of the radio industry."

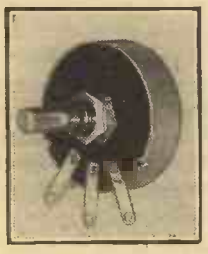
AS WE FIND THEM
NEW APPARATUS TESTED

Interesting reviews of the latest apparatus submitted by radio manufacturers and traders for examination and test in "The Wireless Constructor" laboratories.

The Erie Volume Control

THE Erie 50,000-ohm potentiometer is one of the neatest and most effective volume controls we have had the privilege of testing.

It is light in weight and its dimensions are such that it takes up the minimum of panel space. As far as the electrical characteristics are concerned, it is evident that the makers have given careful thought to the design.



POSITIVE CONTACT

The Erie volume control is designed to give perfectly smooth and noiseless operation. The metal parts are of solid nickel-silver.

The contact arm rides smoothly upon the surface of the resistance element—a hard material which it is claimed will not wear—and we were unable to detect any suggestion of noise during our tests of the sample submitted.

In addition to the model under test, four other types are available, these having resistance values of ½ megohm, 250,000, 100,000 and 25,000 ohms.

We may add that we measured the resistance value of the potentiometer sent in, and found it to conform accurately to the maker's rating.

Erie volume controls are available to the public through Messrs. Radio Resistor Co., Ltd., Golden Square, London, W.1.

The "WX6" Westector

The Westinghouse metal rectifier, as a means of rectifying alternating currents, has been well established for several years, and the efficiency of the method is proved by the extensive use of this form of rectification by leading radio manufacturers.

In early 1933, Messrs. Westinghouse were successful in developing a rectifier of small dimensions and low effective capacity, thus rendering it possible to replace the second detector of a superheterodyne with a unit of this type.

The model W Westector, which was the name given to this baby metal rectifier, rapidly became popular, the more so as soon as its undoubted advantages in H.T. economiser circuits were recognised.

But these units, though still functioning perfectly as rectifiers, were not practical at frequencies higher than 100–200 kc., on account of the heavy damping thrown on the circuit.

As the result of further research Messrs. Westinghouse have now been able to produce a new model, called the WX, which has a considerably smaller capacity, enabling it to be used satisfactorily up to frequencies of the order of 1,500 kc.

A NEW DEVELOPMENT

The latest Westector development is a model which can be used satisfactorily at frequencies up to 1,500 kilocycles.

The type WX Westector can be readily used as a diode detector in straight receivers, and it is interesting to note that the static characteristic is linear from 2 volts upwards for the model WX6.

The low damping factor of this latest model enables it to be employed in radio circuits of every type, and its development may justly be hailed as another step forward in the progress of radio technique.

Among the uses to which the model WX may be put are those of first detector in superheterodynes and detector in conventional H.F. amplifying circuits.

In this connection the makers recommend a half-wave circuit utilising a load resistance of 250,000–500,000 ohms and a reservoir condenser of ·0001 mfd. Other applications are in reflex and A.V.C. arrangements.

The price of the WX6 Westector is 7s. 6d., and the makers are The Westinghouse Brake & Saxby Signal Co., Ltd., King's Cross, London, N.1.

Goltone Lightning Arrester

How many listeners are there who ever give a thought to the possible consequences of a sudden lightning discharge down their aerial lead? Probably the majority, or at any rate, a very large number, just don't bother to earth their aerials when the set is switched off. They take a chance and trust to luck.

Yet the amount of static electricity that an efficient outdoor aerial can accumulate is surprising, and during the summer months, when storms are liable to develop at a moment's notice, some kind of safeguard is highly advisable.

Perhaps the most convenient scheme is to use a lightning arrester, a device consisting of a minute gap between two metal electrodes, one of which is joined to the aerial and the other to earth.

The gap is left permanently in the

VERY STRONGLY MADE

The Goltone lightning arrester is outstanding for its massive construction a feature which enables it to withstand the roughest weather conditions that are likely to be met with.

As We Find Them—*continued*

aerial-earth circuit and provides an easy path to earth for any static charges which may accumulate on the aerial in the course of a thunderstorm (and also during periods of heavy snow, sleet and hail).

COMPACT CAPACITY

Although of small physical dimensions, these Dubilier electrolytic condensers each have a capacity of 50 mfds.

When the charge on the aerial reaches a certain amount it breaks down the insulation across the gap (normally air) and discharges to earth, a spark occurring at the gap when the discharge takes place.

Messrs. Ward & Goldstone, Ltd., of Frederick Road, Salford, Lancs., have sent us a very substantially constructed lightning arrester which they are listing at 2s. 6d. The brass electrodes comprising the gap are enclosed in a massive bakelite moulding, which is equipped with a large cowl to prevent surface leakage. Heavy brass-winged terminals are provided, and the angle bracket is of stout galvanised iron.

This Goltone arrester is undoubtedly designed for long and trouble-free service, and its massive construction fits it to withstand the roughest of weather conditions.

Mica washers are inserted in the gap between the brass electrodes to obviate any possibility of short circuits.

Dubilier Condensers

We have recently tested two new types of Dubilier electrolytic condenser. The first (type 402) is a particularly neat model for chassis mounting. In size this condenser is little larger than some anode resistances, is designed for a working pressure of 12 volts and has a capacity of 50 mfds. The method of fixing will make a special appeal to constructors. Only one hole in the chassis is needed, the threaded stud on the end of the condenser being passed through the hole and secured by a nut and patent washer. The result is a perfect fixing, which also forms the negative connection via the metal case of the condenser to the chassis.

FOR NINE-PIN VALVES

This Clix 9-pin valveholder for chassis mounting is of the floating type.

The positive connection is made by a flexible lead on the other end of the condenser.

The second electrolytic (type 3,003) is built into a bakelised tube, and connection is made to it via two wires.

This model has a capacity of 50 mfds. and a maximum D.C. working voltage of 50. It is of the dry type, and can be fixed in any position.

Our tests of both models proved them to be entirely satisfactory in every way, and we can recommend them. The makers are The Dubilier Condenser Co. (1925), Ltd., Victoria Road, North Acton, London, W.3.

Clix Valveholders

Probably no firm has done more to ensure perfect electrical contact with such items as plug and socket fittings and valveholders than the well-known makers of Clix components.

The name of Clix has become synonymous with efficiency, and the 9-pin valveholder which the firm has lately produced fully maintains the high standard of excellence set by the other "gadgets" in the Lectro-Linx range.

The valveholder in question is of the floating type and is designed for chassis mounting. The resilient sockets are provided with screw terminals, so that soldering is quite unnecessary.

(*Please turn to page* 95)

SAVES H.T. COSTS

The Benjamin Autocontrola which, when added to an existing set, results in a marked economy in H.T. consumption.

SHORT-WAVE NOTES

Jottings on the latest aspects of short-wave technique

By W. L. S.

Short waves have been very much in the news lately. We have heard of experiments, both in the U.S.A. and in London, concerning the cure of diseases by ultra-short waves. According to the latest news, experts on the subject are actually evolving a scale of wavelengths for the various treatments! Thus 4–6 metres is used for encephalitis, while 10–15 metres is stated to be the best wavelength for treating headaches.

Signs of "Sunburn"

Parallel with this is the experience of research engineers working in close proximity to a high-powered 5-metre transmitter. They all complain of feeling sleepy after a few hours, and all of them are showing distinct signs of "sunburn." Who can foretell the uses of short waves a few years hence?

Rumour has it, too, that Professor Appleton will be collecting data from short-wave listeners in connection with a special series of tests on the subject of long-period echoes.

We all know the "ring" on a weak, distant signal, which is really an echo of one-seventh of a second caused by its passage right round the world. But what of these mysterious echoes that arrive 4 or 5 seconds late? Where have those transmissions been off to?

To descend to the more commonplace aspect of short-wave work, there is every probability that, by the time these notes appear, conditions will be abnormally good.

Spring conditions generally *are* good, but this spring, according to those who know, should be something quite out of the ordinary. The Eleven-Year Cycle has descended into its trough, and now it is coming upwards on the far side. A peak is indicated for May, June and possibly July.

Through the Small Hours

At the time of writing the best stations are those in the 19-metre band and some of the Americans in the 49-metre band; 19 and 16 metres are good during the afternoons and evenings, the 19-metre stations sometimes lasting as late as 11 p.m.

The "forty-niners" start coming through well at about the same time that the "nineteeners" fade out, and may be heard all through the small hours. As a matter of fact, it is well worth getting up at 6 a.m. occasionally to see what is about.

TELEVISION WITHOUT SCANNING

IN ordinary broadcasting the received signals are reproduced in the same order as they reach the aerial. That is to say, they follow one another in a simple sequence of time. With television, on the other hand, the signals have to be arranged in a very definite order *in space*, as well as in sequence of time, before the eye can identify them as a picture.

A NEW SCHEME

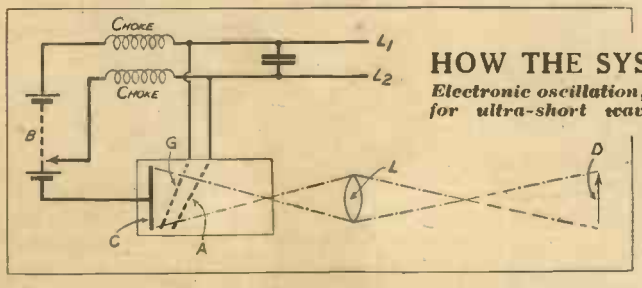
for the transmission of vision by radio or land-line has been invented. It is fundamentally different from all other systems in that scanning, one of the biggest difficulties in present methods, is not employed. How this is achieved is described

By CARDEN SHIELS.

This important difference gives the clue to the real reason why the development of television has been so painfully slow in comparison with that of broadcasting.

Present Drawbacks

Correct "spacing" involves the use of a scanning device at the transmitting end to cut the picture up into a number of elementary "points," and a second synchronised scanner at the receiving end to reassemble the different "point" signals in their original order.



HOW THE SYSTEM WORKS

Electronic oscillation, recently developed for ultra-short wave transmission, is utilised to split the picture up into an infinite number of points, each represented by its own frequency.

It would be an obvious advantage if we could get rid of all this troublesome business of cutting up and piecing together, but the problem is how to avoid it.

Each part of the original picture must clearly be repeated at the receiving end in its proper position in space, and this in turn necessitates some method of sorting out the incoming signals before throwing them on to the receiving screen.

Ten years ago the well-known inventor, Fournier D'Albe, hit upon the brilliant idea of identifying each part of the original picture with a particular frequency. The picture was, in fact, radiated in the form of a "group" of different frequencies, which were sorted out in reception by a bank of tuned resonators, so that they automatically fell into their proper positions on the viewing screen.

Awarded a Prize

This did away with all scanning and synchronising as we know it now.

It is interesting to record the fact that in 1924 this idea was awarded a prize of £150 by the Editor of "Popular Wireless" as the most ingenious contribution submitted in the course of a competition designed to encourage research in television. Unfortunately, other considerations prevented the inventor from developing his system beyond the experimental stage.

Recently the same idea has been revived on lines which render it unnecessary to use any special "resonators" at the receiving end. In fact, the sorting out of the signals is performed automatically by a new type of valve.

As before, each point on the picture is made to produce its own particular frequency, and each frequency is then fitted in to its proper place on the screen. Actually, the picture is transmitted and received as a whole—and in one operation—instead of being sent out in a series of fragments which have to be fitted together before they can be recognised.

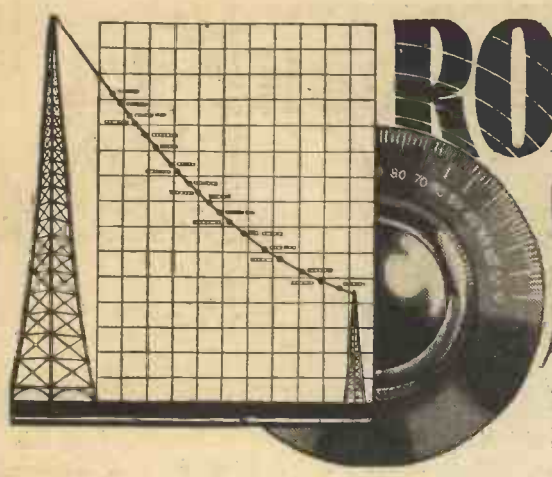
Naturally, it must all be done on ultra-short waves, otherwise the various frequencies would take up too much ether space—though, as a matter of fact, this problem of elbow room has to be faced whether scanning is used or not. Also it is clear that some special means must be found for producing the various frequencies required, since it is obvious that ordinary tuning would be quite impracticable.

The solution lies in the new "short-wave" method of operating a valve with the plate and grid voltages

(*Please turn to page* 96)

DR. FOURNIER D'ALBE

The fundamental principle of the new television scheme was first suggested ten years ago by Dr. Fournier D'Albe, a distinguished worker in scientific fields.



ROUND the DIALS

A review of reception conditions, together with hints on the best stations to tune for and the most interesting times to listen.

THIS is the time of the year when it pays to keep a close watch on the long-wavers. There is a comparative absence of fading above 1,000 metres and a reliability in daylight reception which is unobtainable on medium wavelengths. And the programmes themselves are good.

* * *

Too often the B.B.C.'s idea of a daytime programme is the plain instrumental one, and it is a relief to turn to the foreigners. They seem to have an unerring eye for picking the gladsome one out of a bunch of records, and it is seldom that you can listen to Luxembourg or Radio Paris for long without something really good coming over.

* * *

The new attitude in France towards broadcasting, and its importance to the State, is reflected in the Radio Paris announcements, the term "Poste Nationale Radio Paris" now being constantly used instead of the somewhat casual and abbreviated announcements of the past. So far the official touch has not marred the programmes, and both strength and quality have been first class.

* * *

Luxembourg has been doing excellently on 1,304 metres, but it is not an active morning station. Would-be listeners who tune in vain for him early in the day should remember, when disappointed, to look out for Kalundborg as an alternative.

The dial reading is a little lower and the power not so great, but Kalundborg is proving a really first-class station on 1,261 metres. His choice of items is distinctly cheery, and he is an energetic worker at all sorts of hours.

* * *

On the medium waveband conditions have been somewhat variable. The top of the dial seems to be the better end for foreign reception, Athlone being particularly notable. Stuttgart seems to have settled down on 522·6 metres with a determination to outdo Budapest as the best foreigner above the 500-metre mark, though occasionally Vienna lords it over everything above the North Regional.

* * *

What has happened to the Dutch stations? At one time, not long ago, their power was a by-word, but now they do not shine on either medium or long waves. The Italians, on the other hand, have been particularly good, Florence on 491·8 metres meriting a special pat on the back.

Transatlantic reception seems to have fallen through for the time being, and on the half-dozen or so occasions on which it was tried recently not even a carrier-wave worth hanging on to was located. But that is not to say that there is no hope, for possibly some readers have been successful, and conditions may change again at any moment.

* * *

Have you ever tried for foreign stations in the early mornings, round about breakfast-time? It seems a curious time to switch on the set for long-distance work, and yet some very interesting reception at that hour was possible last year in early summer.

* * *

For some hitherto unexplained cause it was found possible, at the end of last spring, to hear many of Europe's almost unknown medium-wave stations in the mornings. And it will be very interesting to see if similar long-range reception is again possible this year.

If you are interested in unusual stations and topsy-turvy results, try the medium waveband from about 7 a.m. until 10 o'clock any morning that you have the chance.

P. R. B.

STAR OF THE MONTH

OUR BROADCAST CRITIC GIVES HIS OPINION AS TO THE MOST MERITORIOUS RADIO PERFORMANCE.

IT has been a month of very mixed qualities on the air. There have been good talkers and very bad talkers, first-class musical virtuosity ascending above a pretty thick stratum of second-rate performances, particularly in the day-time programmes.

The variety has been distinctly "so-so," though, curiously enough, it is from this that I am impelled to make my selection of candidates for the honour of being THE WIRELESS CONSTRUCTOR'S Star of the Month.

Serene and Self-Assured

Two artistes stood out head and shoulders over all the rest. One was a veteran variety artiste and the other a newcomer.

After careful consideration I finally chose the latter. Hughie Green is his name, and he is not yet as well known as I believe he will eventually be—providing he maintains his present form into manhood.

He is only 14 years of age, and he came serene and self-assured to the microphone through none but his own efforts. With a number of the children known as "the Gang," he had been giving shows in a succession of halls of steadily increasing magnitude and importance.

The B.B.C. bent its august glance in his direction. Followed an appearance in a play, "Emil and the Detectives." Then came a variety show, compèred by Hughie Green, in which this surprising infant also gave a turn comprising some remarkably good impressions.

His mimicry of Gracie Fields and members of the Buggins family was equal to the best imitations given by any artiste of any age.

Hughie Green.

V. G.

S.T.300 STAR MARK II

S.T.300 STAR • S.T.300

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EXACT TO SPECIFICATION

The Pilot Kit SERVICE was founded in 1919.

See the PILOT on the carton. It's a real guarantee.

IMPORTANT Miscellaneous Components, *Parts, Kits, Finished Receivers or Accessories for Cash, C.O.D. or H.P. on our own system of Easy Payments. Send us a list of your wants. We will quote you by return. C.O.D. orders value over 10/- sent carriage and post charges paid (GREAT BRITAIN ONLY.) OVERSEAS CUSTOMERS CAN SEND TO US WITH CONFIDENCE. We carry a special expert staff and save all delay. We pay half carriage—packed free. Send full value plus sufficient for half carriage. Any surplus refunded immediately.* **Hire Purchase Terms NOT Available to Irish or Overseas customers.**

A.C. RADIOGRAM

KIT "A" Author's Kit of First Specified Parts, including Peto-Scott METAPLEX Chassis, ready assembled, but less valves, cabinet, speaker and gramo. equipment. Cash or C.O.D. Carriage Paid **£9-10-0**

Or 12 monthly payments of 17/6.

ESSENTIAL ACCESSORIES

	£	s.	d.
Set of 4 Specified Valves	3	4	6
1 PETO-SCOTT Radiogram Cabinet with motorboard	2	7	6
1 W.B. Mains-energised M/C Speaker, with 2,500-ohm resistance field winding	1	9	6
1 GARRARD A.C. Gramophone Motor, type A.C.4	2	2	6
1 PETO-SCOTT Pick-up		17	6

KIT-BITS

You pay the Postman. We pay post charges on all orders over 10/- *Great Britain Only*

	£	s.	d.
1 Colvern 2-gang Coil Unit, KGO and KGR		19	0
1 British Radiophone 2-gang ·0005-mfd. tuning condenser, type 605		15	0
1 British Radiophone slow-motion drive for above, type 744C		6	6
1 British Radiogram ·0003-mfd. differential reaction condenser		2	6
1 Multitone "Toco" L.F. Transformer ...		17	6
1 Peto-Scott Metaplex Chassis, 12" × 10" with 2½" runners		3	6
1 R.I. Mains Transformer, type E.Y.35 ...	1	18	0

PETO-SCOTT S.T.300 STAR WALNUT CONSOLETTE

Panel size: 16" × 7". Baseboard size: 16" × 12". Top Loud Speaker and Battery Compartment: size 16" × 10" high × 12" front to back.

25/-

Regd. Design No. 787010.

An outstanding example of cabinet craftsmanship. Hand French polished. Veneered Macassar and Walnut finish by experts. Cash or C.O.D., 25/-. *Carr. and Packing, 2/6 extra.*

Or 6/- Deposit and 4 monthly payments of 6/- (including carriage and packing). Baffle-Baseboard Assembly, 3/6 extra.

TABLE MODEL Original design Table Cabinet with Veneered Macassar and Fine Walnut finish. Hand French polished. Constructed of the finest wood by London's leading craftsmen. Cash or C.O.D., 19/6. *Carriage and Packing, 2/6 extra.*

Or 6/- Deposit and 3 monthly payments of 6/-. (Including carriage and packing.)

ADAPTO THREE

KIT "A" Author's Kit of First Specified Parts, including Peto-Scott Ready-Drilled Metal Panel and Baseboard, less Valves and Cabinet. Cash or C.O.D. Carriage Paid, £5/2/6, or 12 monthly payments of 9/3.

	£	s.	d.
1 Set of Specified Valves	£1	11	3
1 Peto-Scott Universal Table Cabinet...		15	0

S.T.300 STAR MARK II

KIT "A" Author's Kit of First Specified Components, including Ready-Drilled Panel, Terminal Strip and METAPLEX Baseboard. Cash or C.O.D. Carriage Paid, £4-0-0. Balance in 11 monthly payments of 7/3

SEND **7/3** ONLY

KIT "B." As for Kit "A," but with Set of Specified Valves only. Cash or C.O.D. Carriage Paid, £5/11/3, or 12 monthly payments of 10/3.

KIT "CT." As for Kit "A," but with Valves and PETO-SCOTT Table Cabinet, as illustrated. Cash or C.O.D. Carriage Paid, £6/10/9, or 12 monthly payments of 12/-.

KIT "CC." As for Kit "A," but with Valves and PETO-SCOTT Consolette Cabinet, with Shelf and Baffle, but less Speaker. Cash or C.O.D. Carriage Paid, £6/19/9, or 12 monthly payments of 12/9.

S.T.300 STAR

KIT "A" Author's Kit of First Specified Components, including Ready-Drilled Panel and Terminal Strip with METAPLEX Baseboard. Cash or C.O.D. Carriage Paid £4-7-6. Balance in 11 monthly payments of 8/3

SEND **8/-** ONLY

KIT "B." As for Kit "A," but with Set of Specified Valves only. Cash or C.O.D. Carriage Paid, £5/18/9, or 12 monthly payments of 10/9.

KIT "CT." As for Kit "A," but with Valves and PETO-SCOTT S.T.300 Star Table Cabinet. Cash or C.O.D. Carriage Paid, £6/18/3, or 12 monthly payments of 12/9.

KIT "CC." As for Kit "A," but with Valves and PETO-SCOTT S.T.300 Star Consolette Cabinet with Shelf and Baffle, less Speaker. Cash or C.O.D. Carriage Paid, £7/7/3, or 12 monthly payments of 13/6.

IF PETO-SCOTT P.M. SPEAKER REQUIRED WITH ANY OF ABOVE KITS, add 19/6 to Cash or C.O.D. Price, or 1/9 to Deposit and each Monthly payment.

YOURS FOR **5/-** BALANCE IN 2 MONTHLY PAYMENTS OF 4/6

CASH or C.O.D. Carriage Paid, **25/-**

Or 5/- deposit and 5 monthly instalments of 5/-.

CONVERT your S.T.300 to the S.T.300 STAR or the S.T.300 STAR MARK II

PETO-SCOTT Conversion Kit comprises Mr. John Scott-Taggart's Kit of Specified Parts for converting the S.T.300 into the S.T.300 STAR* or the S.T.300 STAR MARK II** complete down to the last screw.

*If POLAR CONDENSERS and NEW PANEL required, add 21/3 to cash price. Or, complete, yours for 6/-; balance in 9 monthly payments of 5/-.

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Please state which Kit required when ordering.

A FIRM FAVOURITE S.T.400 BATTERY MODEL

KIT "A" Author's Kit of specified parts, Ready-Drilled Panel and foil-covered baseboard, but less Valves and Cabinet.

CASH or C.O.D. CARR. PAID. **£4/12/6** or yours for 8/6 deposit. Balance in 11 monthly payments of 8/6.

KIT "B." As Kit "A," but with Valves, less Cabinet. Cash or C.O.D., £6/10/9, Carriage Paid. Balance in 11 monthly payments of 12/-.

KIT "C." As Kit "A," but with Valves and Table Cabinet. Cash or C.O.D., £7/7/9, Carriage Paid. Balance in 11 monthly payments of 13/9.

S.T. SUPER

KIT "A" Complete Kit of First Specified Parts, including Peto-Scott Metaplex Chassis & Ready-Drilled Terminal Strip, Less Valves and Cabinet. Cash or C.O.D. Carriage Paid, £9/12/6, or yours for 17/9; balance in 11 monthly payments of 17/9.

KIT "B" As KIT "A," but with specified Valves only. Cash or C.O.D. Carriage Paid, £13/5/0, or 12 monthly payments of 24/3.

KIT "CT" As KIT "A," but with specified Valves and Peto-Scott S.T. Super Table Cabinet. Cash or C.O.D. Carriage Paid, £14/4/6, or 12 monthly payments of 26/-.

If Consolette Cabinet required in place of Table Cabinet, add 29/6 to Cash Price of KIT "B," and 2/9 to deposit and each monthly payment.

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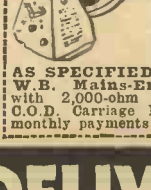

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MICROLODE PERMANENT MAGNET SPEAKER

complete with switch-controlled multi-ratio input transformer. Cash or C.O.D. Carriage Paid £2-2-0. Send **5/9** only

Balance in 7 monthly payments of 5/9.

AS SPECIFIED FOR THE A.C. RADIOGRAM. W.B. Mains-Energised Moving-coil Speaker, with 2,000-ohm resistance field winding. Cash or C.O.D. Carriage Paid, 29/6, or 4/- Deposit and 7 monthly payments of 4/-.

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for which I enclose £.....s.....d.

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IMMEDIATE DELIVERY—CASH—C.O.D. or H.P.

Practical and up-to-date hints that will help constructors and listeners.

ZIP! Round swings the ebonite as the drill emerges on the underside. Haven't we all experienced this? I know I have, and never before have I wished I had another pair of hands.

It was when putting my tennis racket back into its press after a spot of recreation the other week-end that the following idea occurred to me. The diagram which illustrates this page will make the scheme perfectly clear.

A Good Service

A tennis-racket press of the rectangular type, with four screws at the corners for clamping, is screwed with countersunk woodscrews to the bench or worktable. One of the taper-shaped presses would do, but the rectangular one is to be preferred.

The centre of the bottom part of the frame is filled in with a piece of wood the same thickness as the wood from which the frame is made. That completes the arrangement.

Whenever a piece of ebonite or a panel is to be drilled, it is simply slipped into the press and clamped into position. The frame will also be found useful for holding other small jobs on which work has to be performed.

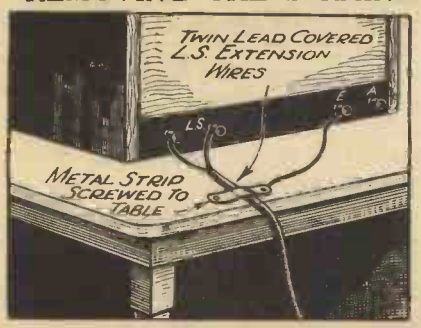
And now for a slightly more technical item. It concerns the use of screened loudspeaker extension wires when ordinary leads are found to pick up hum.

Wire with a braided screening is rather expensive for this type of job, and ordinary lead-covered bell wire makes an ideal substitute. Unless the leads are unusually long, trouble from the by-pass effect of the wires' capacity will not be noticeable.

Since this double lead-covered wire is somewhat on the heavy side, some means of anchoring it at the set end is desirable. The best way is to clamp it to the table with a short strip of metal and two screws (see diagram).

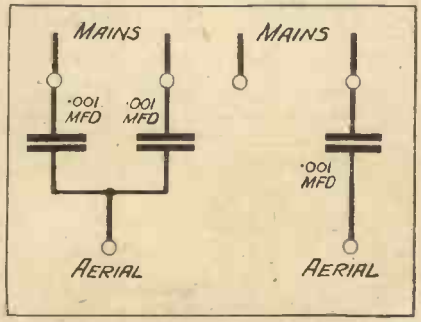
Incidentally, this clamp provides an easy means of earthing the lead covering, an extra wire being fixed under one of the clamping screws. This wire is then attached at its other end to the earth terminal of the receiver.

REMOVING THE STRAIN



Lead-covered bell wire makes excellent extension leads. It can be earthed and anchored in the manner depicted here.

A USEFUL AERIAL



If you do not want to erect an aerial, try using the mains by means of a good quality condenser (or condensers) joined up in one of the ways shown in this diagram.

The Mains Connection

Writing about mains hum reminds me of the "mains" aerial plug which is so often provided on commercial A.C. mains receivers these days. Although they puzzle some people, there is actually no mystery in their operation.

The aerial terminal is merely connected up to the mains wiring by means of a smallish fixed condenser. The coupling condenser being small, there is little chance of L.F. hum being passed on to the set by it.

The only important point about the condenser is that it must have good insulation, and should have a working voltage at least as high as the voltage of the mains.

For Battery Sets, Too

One of the diagrams on this page shows how mains-aerial connections can be applied to an ordinary set.

Two methods are shown, one using a single condenser connected to one mains lead only, and the other with a condenser in each of the mains leads. The double scheme is usually the more effective, and if the single scheme is chosen the condenser should be tried first in one lead and then in the other to see which gives better results.

There is another point about the mains which I feel justified in bringing up. To many of you it will be obvious, but since it might lead to danger in the few cases where it is overlooked it is worthy of being detailed.

Lengthened Leads

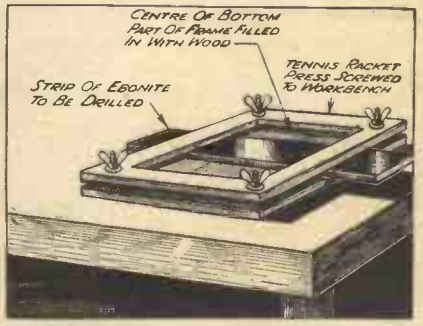
Occasionally the mains lead to a set requires lengthening, and a convenient way of doing this is to prepare a length of wire with a socket connection at one end and a pin connector at the other.

The important consideration to bear in mind is to see that the pin connector is never on the line side of the joint. The socket connector, you will find, is always arranged so that accidental contact with the mains is not possible, because the metal is sunk into the surrounding insulating material.

If the plug and socket were arranged the other way round it would be possible for the projecting pins to be shorted with any metallic object. Also there would be the chance of someone touching them and so receiving a shock.

A. S. C.

FOR HOLDING EBONITE



A tennis-racket press screwed to the bench is ideal for holding ebonite or small objects on which you are working.

QUESTIONS I AM ASKED by JOHN SCOTT-TAGGART

Q. 83. I find that some of the condensers in my set have a slight leak. Does this matter?

A. Not much. And when I say "not much" I do not mean "not 'arf." But it depends on the position of the condenser.

Decoupling condensers can leak slightly without ill effect on reception—but the leakage must be steady; erratic leakage may produce a slight noise, but the condenser is there to cure such troubles!

All-electrolytic condensers are leaky, and nobody weeps. But remember that your H.T. battery will tend to run down if you have leaky decoupling condensers.

While the set is "on" the H.T. current may be excessive. When "off" there will also be a drain of current unless you disconnect the H.T.

Coupling condensers—e.g. in a resistance-coupled arrangement—should be like Cæsar's wife. Mica condensers are used. A leak would mean that some of the H.T. would be applied to the subsequent grid; "S.T.400" users should note this. It is a vital matter.

Q. 84. Since the Lucerne Plan came into action, I find difficulty in getting down to Newcastle and Fécamp on my set. Can you offer any suggestions?

A. Very many commercial sets have a limited wavelength range, Newcastle slipping off the bottom end or Budapest off the top end of the dial. You can do nothing about it except cry.

If your set is an S.T.300, S.T.400, S.T.500 or S.T.300 Star you can do several things. You should first find out whether it is the aerial or anode circuit that will not tune down. If, for example, the lowest station is obtainable with the aerial condenser at 30° and the anode condenser at 2°, it is plainly the anode circuit at fault.

On the S.T.300 the cause will be either the medium-wave winding of the anode coil being too large or else the ·0001-mfd. differential being of too high a capacity (the best are only approximately ·0001 mfd.). You should set the anode coupler as near zero (full left) as you can. This reduces the parallel capacity effect, and you will be able to tune lower.

Reaction must be used, of course. A further reduction is possible by inserting a selectivity-range adjuster preset of ·0001-mfd. capacity (J.B. or Graham Farish are the only types approved) in the position adopted in the S.T.400, S.T.500 and S.T.300 Star. This preset should be opened out so that its capacity is low.

You will obtain quite a wide knowledge of the technical side of radio if you follow this monthly feature by our popular contributor. The questions with which he deals in his well-known lucid style are selected because of their general appeal from those actually sent in by readers.

If your set is the S.T.400, try reception with anode coupler near zero. If this fails to bring the wavelength low enough, unscrew selectivity-range adjuster till its capacity is low.

The same suggestions apply to the S.T.500 and S.T.300 Star. A further hint is to reduce the phase reverser preset (·00005 mfd.) to a very small capacity.

If the aerial circuit is the one at fault and will not tune low enough with the aerial coupler at or near zero, then you would have to remove one or perhaps two turns from the top end of the coil. This must be done carefully, and reconnecting the end to the appropriate terminal calls for care to ensure certain contact.

The same drastic remedy will cure a bad anode case. Any practical wireless dealer would do the job for a few pence, as would also the makers of the coil.

Q. 85. Why not give us a really ultra-ultra set of the expense-no-object type? Some of us are ready to pay for really superb quality, and all the rest would be very much interested.

A. I have such a set in mind. Something really grand. But what is superb quality? I have a pretty shrewd idea myself, but I have never yet obtained a unanimous opinion from a group of listeners. It depends very largely on the volume of sound desired.

A battery set, for example, will never give really full-bodied volume of the kind that a 400-volt mains outfit would supply. But, then, tastes vary, as, in fact, do houses. In many modern houses one could hear neighbours eating watercress.

Exquisite quality is obtainable with battery valves, provided one is not too greedy.

Q. 86. When first switching on my mains receiver, signals are always strong, but after about ten minutes they go off. What is the cause?

A. Sounds as though it is due to something heating up and, when warm, ceasing to function or not functioning as well. The grid of a valve may be getting overheated and emitting electrons "on its own." This might be due to its being too near the cathode, or else because the cathode, for some reason or another, has become too hot; for example, the wrong tapping on the mains-transformer primary may be in use, resulting in excess voltage across the heater winding.

Sometimes the insulation of a condenser breaks down, and I have known of transformers that work perfectly when cold, but fail when slightly warm. Sometimes the ends of a broken wire separate when the transformer becomes warm.

FOR THE PRACTICAL MAN

The ideas described on this page are of special utility to builders of modern sets which employ chassis construction and consolette-type cabinets.

ALTHOUGH I find home-made chassis perfectly satisfactory, there is one feature that I always insist on having in my own.

This is the *middle* cross batten, illustrated in Fig. 1A, in addition to the battens at the ends. Fig. 1B shows how the batten is shaped. The cut-away portions serve for the passage of any leads that have to be brought from one side of it to the other.

Readers may wonder what is the purpose of the cross batten, except, of course, that it helps to keep the base from sagging in the middle. I find that it saves room *and* wire to mount decoupling condensers, chokes, and other out-of-sight components horizontally on both the middle batten and the end ones. In this way their terminals are brought very close to the under surface of the base, and the shortest of leads suffice to connect them to components on the upper side.

Using Wooden Baseboards

In Fig. 2 is seen the underside of the wooden chassis of a set that is under construction. The cross batten nearest the eye has been omitted for the sake of clearness. In this case the upper surface of the baseboard will be covered with copper foil, and strips of the foil will be brought right across the two compartments into which the middle batten divides the underside. The ends of these strips are tucked under the foil on the upper side of the base and securely anchored down with screws.

Their purpose is to form handy earthing points for the sub-base components. In the drawing two decoupling condensers are shown; one terminal of each has been earthed by taking a wire from it to the copper strip and fixing the end down with a wood screw and a washer. The number of components that can be accommodated beneath the base when three cross battens are used is quite surprising, and the wiring is enormously simplified by the use of the foil strips.

Keeping Your Set Neat

It is often very important to screen certain rather long leads in the set which have no need to be of flexible type. Typical examples are those between the oscillator and the first detector in a superheterodyne and those running to the pick-up terminals or radiogram switch in a set adapted for the playing of gramophone records.

Flexible metal sleeving can be used for these leads, but a much neater job results from the use of the tip illustrated in Fig. 3. Stiff insulated wire is used for the leads, and they are shielded by running them through copper tubing of the kind used for petrol pipes in motor-cycles.

Readily Obtainable

This is readily obtainable from most garages, and it is so soft that it is easily bent into any required shape. Note, by the way, that the lead should be inserted before the tubing is bent. Earthing the screen is accomplished either by fixing it with metal clips to the chassis (or the copper covering of the baseboard) or by soldering an earthed lead to it.

If clips are used care must be taken to ensure a good electrical connection with the copper tubing. Both the clip and point on the tubing to which it makes contact should be cleaned.

SHORTENS WIRING

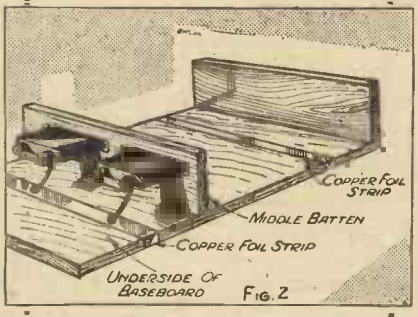


FIG. 2

Fig. (2 above) shows how components may be arranged on supporting battens. By enabling by-pass condensers to be mounted horizontally and so bringing their terminals nearer the baseboard, the scheme helps to keep the wiring quite short. The diagram below shows a good way of screening leads which do not require to be flexible, by means of copper tubing similar to that used for petrol pipes on motor-cycles. The lead should be inserted before the tubing is bent.

FOR SCREENING LEADS

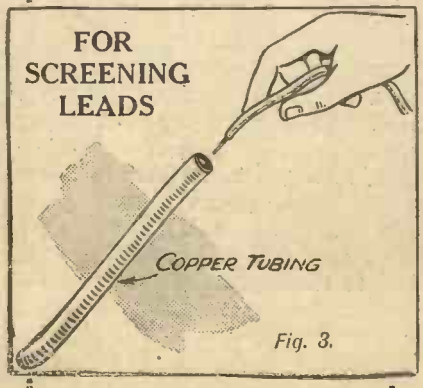
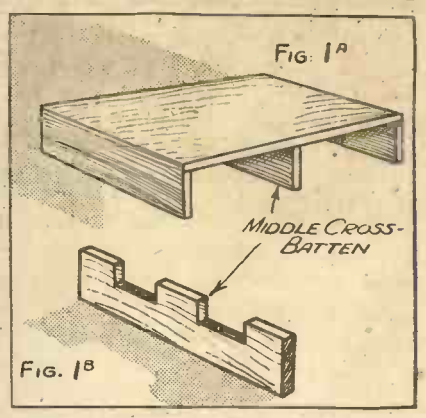


Fig. 3.

A CHASSIS IMPROVEMENT



An extra vertical batten is an improvement worth adding to a wooden set chassis.

Easy Panel Marking

Many sets are still built nowadays with panels, and slide into their cabinets from the front. A design, however, that is becoming more and more popular, especially for radiograms, is one with a baseboard or chassis, but no panel, which slides into its cabinet from the back. Once such a set has been made the problem is how to drill the front of the cabinet exactly so that the spindles of variable condensers and other controls may be passed through.

Here's a tip which may be found useful. Remove the knobs from all of the controls and give the tip of each spindle a light coating of black lead. Now slide the set into position and press it firmly forward. The spindles will mark the positions of the holes required with easily-seen black dots.

Perfectly Straightforward

"Ah," says the reader, "I've got you this time. You are assuming that all of the spindles are of exactly equal length. As a matter of fact, that of my ganged condenser is nearly a quarter of an inch longer than the others. Are you suggesting that I should make the black-lead coating of the remaining spindles a quarter of an inch thick?"

Not a bit of it. The longest spindle will make its mark first. You drill its hole and then push it through until the others are able also to reach the inner side of the cabinet's front. It may again happen that one of them is longer than the rest. Drill another hole in the position marked and continue until all are made. Elementary, my dear Watson!

R. W. H.

B.B.C. NEWS

BY OUR SPECIAL CORRESPONDENT

Better Bulletins
Light Entertainment
Henry Hall's Popularity

Dick Sheppard Again
Bishop of Broadcasting?
Politics and Radio

Summer Programmes

THE B.B.C has decided to repeat the practice instituted last summer of dropping alternative programmes during the early part of the long summer evenings. Part of the money saved in this way will be spent on making the single-programme service more attractive in the seasonal sense. The rest of the money saved will be held over for development of programmes next autumn and winter.

An analysis of correspondence last year shows that the experiment, as then conducted, was very popular. The truth seems to be that in the summer the average listener is more concerned about being able to receive one good programme of light entertainment than to be able to choose between several rather indifferent programmes, some being of a serious nature. Frankly, also, it is a great relief to many when the avalanche of talk is temporarily interrupted.

No Women Announcers

There has been another flurry about the B.B.C. engaging women announcers. The Director-General, Sir John Reith, is supposed to be on the point of resignation because of the alleged insistence by his Board on the immediate appointment of two women announcers. I have taken the trouble to find out the truth. It is simply this: That the B.B.C. so burnt its fingers over the experiment with Mrs. Borrett as an announcer that the whole idea has been dropped. It is true that Mrs. Agnes Hamilton is personally in favour of taking up the matter again, but she has not raised it at a Board meeting.

Farewell to Pedro Tillett

Pedro Tillett, who has been for ten years the concert impresario of the B.B.C., has retired under the age limit. Mr. Tillett knows personally about 2,500 musicians, and has given about 13,000 auditions during his service with the B.B.C. There is comment in musical circles because such a valuable servant as Mr. Tillett is having to retire under an age limit from which certain more favoured officials seem to be immune.

More News

I have just heard of plans which have been maturing for some time to develop the B.B.C. news service. This has previously been in the hands of a small staff, not all of whom have been professional journalists. The idea now is to bring in an experienced Fleet Street man with several new assistants, and give him full authority to develop the news service to the full extent allowed by the agreement with the agencies and the Press.

The names of several prominent journalists have been mentioned in this connection. It seems to me that Mr. Tom Clarke would make an admirable choice—that is, if the B.B.C. really wants news.

A B.B.C. Flying Club

The staff of the B.B.C., not content with disturbing the ether with radio signals, are now to go "hedge hopping" and "cloud climbing" in aeroplanes. They have formed a flying club which will work in conjunction with the Herts and Essex Club. Apparently there is a rush of bright-eyed broadcasters to learn the secrets of the joy stick and the loop. I wonder if the B.B.C. is arranging a special form of insurance! Prominent among the flyers from the Big House will be Mr. Hytch, of the Press Department, and Mr. John Snagge, of the O.B. Department—both members of the R.A.F. Reserve.

Mr. Whitley's Health

Mr. Whitley's unfortunate illness towards the end of his voyage to South America extended over the return voyage, to some degree, though when he landed back in England he was better. As the voyage was meant to cure a chronic attack of bronchitis from which the Chairman of the B.B.C. had been suffering, speculation has begun whether his health will enable him to carry on with his duties.

My information is that there was nothing serious in the illness, and that he will ultimately benefit from his recent voyage. If, however, Mr. Whitley does retire he will be succeeded by Mr. Norman, the Vice-Chairman,

TELEVISION ADVANCES

Here is an actual photograph taken during a television transmission from the Crystal Palace tower to an audience in Film House, London. It shows the great strides which have been made in ensuring the clarity of televised images.

Henry Hall May Have to Use the Luggage Lift

who has been carrying on for him in his absence.

Embarrassing Popularity

The popularity of Henry Hall is becoming an embarrassment both to him and the B.B.C. It has got so bad that, on occasions, when it becomes known that Henry and his boys are due to perform and may be arriving from outside, a large crowd gathers at the entrance to Broadcasting House. As the hero approaches he is greeted with cheers, and there is usually a rush for his autograph. These attentions have become so exacting that a proposal is being considered to let Henry and his boys use the luggage lift round the corner.

Dick Sheppard's Come-Back

The Rev. H. R. L. Sheppard seems to enjoy more success in regaining his old form than most professional pugilists do. Anyway, he is back at St. Martin's on a straight five months' run while the vicar, "Pat" McCormick, disports himself on the Continent in a much-needed holiday. Incidentally, this will bring Dick Sheppard in touch with the listening public once again. Recently he has been writing for popular newspapers, and has re awakened part of that enormous correspondence which he used to have from listeners. No doubt the process will continue.

What will happen after the five months' deputising for Mr. McCormick? Surely this will be the moment to invite Mr. Sheppard to become the official padre of the B.B.C., or the "Bishop of Broadcasting," if you like. Alternatively, and perhaps much better, why not make him consultant on light entertainment? He has a genius for entertainment and a rare sense of humour. He would certainly enjoy this better than preaching, and it would be more appreciated by listeners.

Broadcasting Politics

The second investigation by the I.L.P. Committee into broadcasting organisation is now complete. I have compared the resultant report with a similar document which had been prepared at Fascist headquarters. The conclusions are strikingly similar. Both Sir Stafford Cripps' and Sir Oswald Mosley's advisers counsel taking over broadcasting as a direct instrument of government. There would be an end to impartiality, which is the avowed B.B.C. ideal at present. There would also be a "Pride's Purge" of staff in both cases. If I were on the B.B.C. I would much rather be in the variety department or the engineering branch than have anything to do with policy. There is only one senior policy official who would be spared by both sides.

R. Q.

"STARS" AT HOME

Mr. A. Stuart Hibberd, the Chief Announcer at Broadcasting House, and probably the best known and most popular of all radio "voices." Mr. Hibberd also takes part on occasion in the Children's Hour.

VOICES ON THE AIR

Making the acquaintance of the people in the programmes.

Commander Stephen King-Hall ("Economics in a Changing World," Mondays, 7.5 p.m.).

A naval expert who treats broadcasting as a hobby, Commander King-Hall has become the most popular of the regular speakers on foreign and home affairs. His Children's Hour talks are eagerly awaited by youngsters and grown-ups alike, just as thousands of theatre-goers flocked to see the plays, "The Middle Watch" and "The Midshipmaid," in which he collaborated with Ian Hay. The fact that he has three daughters, for whom he has written books on history, politics and economics probably accounts for his popularity with children as much as his motto, "Anything is understandable providing it is intelligently explained." He lives in Hampshire (his address is beautifully alliterative), where he indulges in gardening and tennis, and enjoys his other hobby—writing. Apparently the man never works!

* * *

Gerald Heard ("Science in the Making," Wednesdays, 6.50 p.m.).

"Being not at home" is the avowed hobby of this popular broadcaster, who lives in Portman Court, West London. At Cambridge he took honours in history, and his book, "The Ascent of Humanity," written in 1928 when he was thirty-nine, was granted the Henrietta Hertz award by the British Academy. His broadcast science talks started in 1930 and continued for three years under the title of "This Surprising World."

* * *

Oliver Baldwin ("Films Worth Seeing," alternate Wednesdays, 9.20 p.m.) has been politician, journalist, author, dramatist and film critic in his 35 years of existence. In his own words, "much travelled, much knocked about, but still going strong." He has seen the inside of six foreign prisons and has been present in two revolutions and three wars (two of them with a foreign army). Oliver is, of course, the son of Mr. Stanley Baldwin. He first broadcast in the early days of wireless, but tells me that, not having been to Oxford, he had not the right accent. Believe it or not, his hobbies are microscopes and pathology.

* * *

Sir Walford Davies ("Keyboard Talks," Fridays, 6.50) is probably the best known of all British musicians—certainly to listeners. His recent appointment as Master of the King's Musick has brought great pleasure to the hundreds of thousands of listeners who have learnt to appreciate music under his microphone tuition. Sir Walford's broadcasting work has led to a partial forgetfulness of his merit as a composer of the first rank, but his church anthems, his cantatas, his orchestral compositions and a large number of songs will never fail to find a place among the best in British music.

Incidentally, you may like to know that the King's Musick now consists of about 30 musicians, and Sir Walford's duties as Master include responsibility for the music on such occasions as State weddings, balls and funerals.

P. C.

RAPID RADIO REPAIRS

By J. E. WATSON, A.I.R.E.

Here's an ingenious scheme for measuring a wide range of resistances by adapting a multi-range voltmeter. The author shows how it can be made to act as a Wheatstone bridge without affecting its normal uses

IT is possible to measure resistance in a number of ways with instruments which the engineer may have available, but in any such measurements, however, it is necessary to have resistors whose resistance is definitely known in order that a comparison with standards may be made.

In its multiplier resistors the engineer's multi-voltmeter provides standards which are sufficiently accurate to meet all his needs in this respect.

A WHEATSTONE BRIDGE

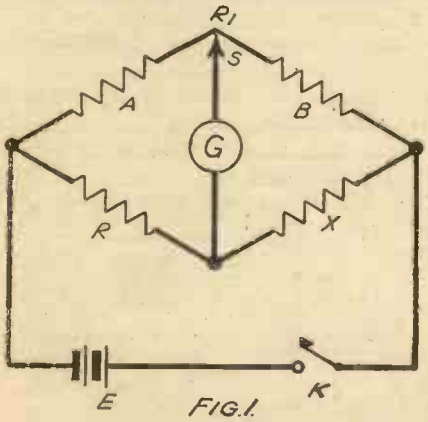


FIG. 1.

Fig. 1 shows a fundamental bridge circuit consisting of a known resistance R; a resistance R1 which is divided by the contact arm S into two parts, A and B, whose ratio is known: all arranged in circuit with X, the resistance to be measured.

A Simple Formula

When the ratio of A and B is adjusted so that the deflection of the indicating instrument is zero, then the value of the unknown resistance X may be obtained from the proportion $\frac{A}{B} = \frac{R}{X}$ from which $X = \frac{BR}{A}$. In Fig. 2 is seen the arrangement of the internal resistors in a multi-voltmeter. Most good-class instruments are of the thousand-ohm-per-volt type, and possess a full-scale sensitivity of one milliampere.

Two of the most usual calibrations encountered in a multi-voltmeter are 0–10, 50, 250 volts, and 0–10, 100, 750 volts. Taking the latter for example, the series resistors SR1, SR2 and SR3 have values of 10,000, 100,000 and 750,000 ohms respectively.

Such instruments, then, provide us with three resistances whose values are accurately known and of a known fixed ratio, and may be used, therefore, as the ratio arms of a Wheatstone bridge.

Safeguarding the Meter

The schematic diagram of this bridge is shown in Fig. 3. The resistance Rb is joined in series with the battery E. The purpose of Rb is to serve as a protection for the meter during preliminary adjustment. This is necessary because the meter is a milliammeter, and any application of voltage, either direct or through a small resistance, would damage the instrument. The voltage of the battery is of no importance, since voltage does not enter into the calculation, and E, therefore, may be a 4½-volt bias battery.

When the Wheatstone bridge has no current flowing through G (left) it indicates that the resistances are "balanced." To the right is shown the usual arrangement of voltmeter resistances referred to by the author.

The second battery Ea, in series with the resistor Ra and the meter movement, serves to adjust the needle to some midpoint of the scale so that deflections may be had in both directions.

If the meter has a sensitivity of 1 milliampere for full-scale deflection, then a 1½-volt flashlight cell for Ea and a resistance of 3,000 ohms for Ra will be suitable. The point to which the needle is adjusted is considered the zero position, as in the case of a galvanometer.

It is now necessary to purchase a a wire-wound variable resistor and a dial marked with 100 divisions and covering the full range of the resistor. If the resistor chosen has a value of 1,000 ohms, then each division on the dial will represent 10 ohms. If the ratio arms A and B are arranged so that $\frac{A}{B} = \frac{1}{10}$, as in Fig. 3, then the value of the unknown resistance will be ten times the value marked on the dial,

WIDE RANGE SELECTION

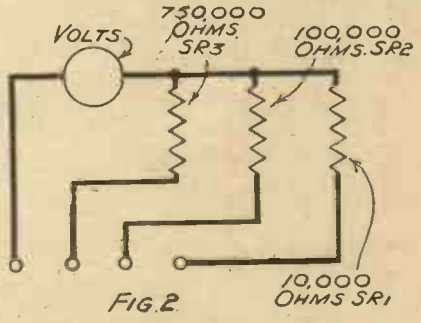


FIG. 2

in which case the range of the bridge will be from 100 ohms to 10,000 ohms.

Obtaining Low Values

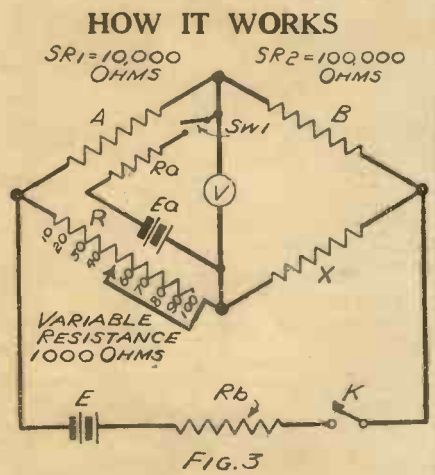
By reversing the ratio arms A and B, which may be accomplished by interchanging the two resistances SR1 and SR2, the value of X will now become one-tenth of the dial reading, and the range of the bridge will then be from 1 ohm to 100 ohms.

Accurate Measurements Easily Made

In the same manner, if SR1 and SR3 are used as the ratio arms, then the values of X will vary from 75 times the dial reading down to 1/75th of such reading, depending upon the value of the ratio. It can be seen that a voltmeter with the above ranges may be used to measure, with a fair degree of accuracy, resistances varying from a fraction of 1 to 75,000 ohms.

Fig. 4 presents a pictorial diagram of the connections. The instrument, with the exception of the meter, may be constructed as a separate unit in a small cabinet or box, with the batteries permanently housed therein and all wiring beneath a panel.

Four terminals are brought out to the panel, to which the meter may be readily connected and clips or terminals to accommodate the resistance to be measured. SW1 and the key K are, of course, placed on the panel, as is also the variable resistor dial.



This is the scheme on which the instrument is based, X being the unknown resistance.

Obtaining a Balance

To make a measurement, join up the bridge to the meter, as in Fig. 4, choosing the desired ratios A and B. Close the switch SW1, which will cause the needle to deflect to some point near the centre of the meter scale. This point must be closely noted, as it becomes the zero position for the test.

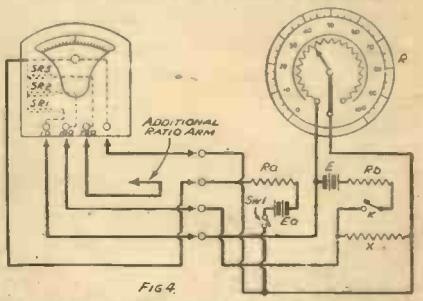
The resistance to be measured is now inserted and the key K closed. This will cause a further deflection to the right or left. By carefully adjusting the variable resistor dial a balance will be obtained at some reading of the latter, and is indicated when the needle rests at the zero position previously noted.

If the ratio chosen is $\frac{A}{B} = \frac{10,000}{100,000}$ or $\frac{1}{10}$, as in Fig. 3, then the dial reading in ohms, multiplied by 10, is the value of the unknown resistance X. For low resistances, where A equals 100,000 ohms and B equals 10,000 ohms, suppose the dial reading is 50 (or 500 ohms) at the point of balance, then:

$\frac{A}{B} = \frac{R}{X}$ or $\frac{10}{1} = \frac{500}{X}$ Therefore

$X = \frac{BR}{A} = 50$ ohms.

This type of bridge is not confined to voltmeters of the above ranges only. Various range instruments may be used, and providing they possess a full-scale sensitivity of 1 milliampere, the values of the internal resistors may be found by multiplying the maximum voltage reading of each scale by 1,000.



The full connections, showing how the graduated resistance is wired to the other components.

For Clipping on Class B

Apart from the home-construction angle, many readers of this journal are interested in the practical and immediate application of Class B methods of amplification.

In many instances their expert advice is asked about the revitalising of an old but serviceable receiver by the addition of an extra stage of Class B, with suitable speaker to handle the augmented output. And with these needs in mind the British Rola Co., Ltd., have issued a folder which explains how a complete loudspeaker amplifier unit can be added in a matter of moments to a battery set.

Applications from readers of THE WIRELESS CONSTRUCTOR should be addressed to the above-named firm at Minerva Road, Park Royal, London, N.W.10.

A New Westector

In the new type of Westector which was recently released and which is reviewed in our "As We Find Them" columns, this month, the self-capacity of the rectifier—a nuisance on any but long wavelengths—has been reduced to an amazingly low figure. These new Westectors function on circuits tuning right down to 200 metres, instead of being limited, as were the original types, to the comparatively long wavelengths.

POINTS FOR PURCHASERS

An outline of interesting new trade activities.

Items of Interest

With British licences at the six-million mark, it is interesting to note that Dubiliers can now claim that well over ten million of their resistances are in use in Britain to-day.

* * *

Owing to the support it has received from the public, Colvern, Ltd., have been able to reduce the price of their variable Colverstat from 5s. 3d. to 3s. 6d. (5-watt type, values from 25,000 down to 250 ohms).

* * *

A two-shilling H.F. choke, rated at 190,000 micro-henries and with a self-capacity of only ·0000035 mfd., is the latest remarkable achievement of the Bulgin factory. Known as the Bulgin Junior, it has a magnetic core.

* * *

Constructors will be interested to know that the famous Formo products will again be available through the new Formo Company—Formo Products, Limited, Bromley, Kent. T. Graham Farish is the managing director.

Cutting Out Interference

Sufferers from man-made interference will be glad to know that this problem has been tackled by Belling & Lee, Ltd., and the result of their work is available in book form, price 3d. post free.

A copy of the work, which is called "Disturbance Suppression," will be sent on application to the firm at Cambridge Arterial Rd., Enfield, Mdx.

THE AMAZING ADVENTURES OF RADIO'S MOST ENTHUSIASTIC EXPERIMENTERS

The American invention by which, it is claimed, listeners can give their opinions on the programmes by pressing a button on their sets has recently been described in the Press. Actually, Professor Goop and Wayfarer have perfected a much more efficient and ingenious device for the purpose, and only their well-known modesty and dislike of publicity have prevented them from publishing it before.

IT is really most annoying that the papers should have got hold of an invention by an American johnnie which enables a wireless audience to answer back if it doesn't like what is being poured out from the studio.

Most annoying, I say, because the Professor and I have for months been engaged in the perfection of a far more effective system, and, but for the fact that, as readers so well know, we never breathe a word about our inventions until everything is in thorough working order, we could long ago have told the world something about our idea and have been easily first in the field.

Do you remember how this American contraption works? Every mains-operated receiving set is provided with a little device which shoots impulses along the mains. These are picked up by the broadcasting station and recorded by a milliammeter or something.

A Strong Negative

Thus, if the chappie at the studio wants to know whether you are all enjoying Mr. Aloysius Squiggle's talk on the "Courtship of Earthworms," he just says: "Hullo, Everybody. Will those in favour please press button A?" The recording instrument remains unmoved, so he says: "Now, those against, please press button B," whereupon the needle flies with a whack against the end stop, the moving coil is burnt out and the instrument requires replacement.

The Professor and I were moved to mirth when we read particulars of this scheme, which seems almost childish in comparison with our own. You see at once—do you not?—its glaring defects. Only those on the mains can vote, though it is, of course, always open to the battery johnnie to call round at the broadcasting station with a gun.

Then, again, anybody who likes to increase the power of his little voting transmitter to something considerable can make the recording instrument register hundreds or even millions of votes when he presses his button.

Revolving such things in my mind, I trotted round to see the Professor.

The Teleplauder

"Don't you think," I asked, "that we might now give readers of THE WIRELESS CONSTRUCTOR some details of our Teleplauder?"

"Of our what?"

"Teleplauder. The instrument to which we have been devoting the whole of our energies for months and months now."

Absentmindedly, the Professor flung the butt of his cigarette into an armchair and sat down on the fire.

Next instant he had leaped through the closed French windows and was racing round the garden with a trail of flames and smoke pouring from his southern end.

ABSENTMINDEDNESS

"The Professor flung the butt of his cigarette into an armchair and sat down on the fire."

With commendable presence of mind I made for the water butt, plucking the garden syringe from the toolshed on my way. As the Professor passed the water butt on the completion of his first lap I raised the syringe and let fly with unerring aim. By the fifth lap there were signs that the flames were getting under control, and the conflagration was completely extinguished by the time that a dozen had been completed.

The Professor, luckily, was not much burnt, though his nether garments had suffered sadly. It appeared that no other pair was available for him to change into, but our fertile minds soon devised a neat little kilt to hide the damage from view by cutting down one of Mrs Goop's skirts.

Once the Professor had recovered his breath, we returned to our previous subject.

First Details

"Shall we tell them?" I asked, "about the Teleplauder?"

After some deliberation the Professor agreed that we should, so I am now able to give you particulars of what is, perhaps, the most earth-shaking invention the Professor and I have so far evolved.

In order to describe it, it is necessary to go into certain technicalities; so wrap a wet towel round your head, pull up your socks, take a deep breath and off we go.

Others have accomplished dual transmissions on a single carrier-wave. This just means that two messages are sent at once, and the receiving set sorts each of them out to its proper loudspeaker. The Professor and I have solved the problem of two-way working on a single carrier.

Reversed Oscillations

This is done by the use of Goopian reversed oscillations, whose chief characteristic is that they are sine waves inside out, the crests preceding the troughs instead of t'other way on as in ordinary broadcasting.

Each receiving set, whether battery or mains, is provided with one of the dodecode 12-electrode valves specially designed for the purpose. These contain seven grids, as well as various other bits and pieces, and I need hardly say that they revolutionise all present ideas about wireless.

"The Big Five Had All Arrested Each Other"

By means of the dodecode, Goopian reversed oscillations can be transmitted from the receiving set along the carrier to the broadcasting station. At the broadcasting station recording is done by means of a kilogoommeter, the goop being the unit of approval, whilst its reciprocal, the poog, is that of disapproval.

By means of a special relay and a mechanical hand the artiste before the microphone is awarded a pat on the back as each kilogoop is registered.

BAFFLING CLUES

"So baffling were the clues that he kept on supplying . . . that within a short time the Big Five had all arrested each other."

Should kilopoogs be recorded, an artificial foot comes into play, complete with shooting boot. In this case the pats are harder and lower down.

Simple, is it not? But simplicity is the keynote of all great inventions.

A Stringent Test

Recent tests made in Mudbury Wallow have demonstrated the complete effectiveness of the instrument, and I have no hesitation in saying that, once we have succeeded in overcoming a few minor problems that still remain to be solved, the Teleplauder will soon be as commonly seen in the homes of Britain as the loudspeaker, the mincing machine and the final notice from the gas company.

Let me describe in detail the stringent test that was made a few evenings before these notes were penned. Primpleson, Sir K. N. Pepper and Gubbsworthy were provided with Teleplauders in their own homes, whilst the rest of us arranged to conduct a little broadcast programme by means of the private transmitter of young Pigglethorpe, Miss Worple's favourite nephew.

We could not use the Professor's transmitter, for his transmitting licence was cancelled some time ago through an excess of zeal on his part. He had evolved a new transmitter, specially designed for use by Scotland Yard and other police headquarters, and decided to see how it would work.

An Imaginary Murder

He therefore sent out a broadcast S O S, about a completely imaginary murder, and had half the police of the country tearing about in cars within ten minutes. So baffling were the clues that he kept on supplying at intervals that within a short time the

ANOTHER BIFF

"'Who threw that kilopoog?' bellowed Captain Buckett into the microphone. The only reply was another biff."

Big Five had all arrested each other and half the speed cars of flying squads were lying in ditches and duck ponds.

But to return to our great test. Tootle was our first star turn with a solo on his flute. Before he was halfway through the recorder suddenly shot up to several hundred kilopoogs, and Tootle received such a swat from the shooting boot that he was removed in an ambulance to the infirmary.

"Magnificent!" cooed the Professor. "Now wasn't that fine, Miss Worple?"

SUCH A SWAT!

"Tootle received such a swat from the shooting boot that he was removed in an ambulance to the infirmary."

"Y-y-yes," faltered Miss Worple, for it was her turn next.

I managed to restore confidence by assuring her that nothing but kilogoops could come her way. "And," I said, "just to make you feel perfectly composed, the Professor shall stand beside you."

No sooner had she got under way with her recitation than I noticed that Miss Worple was edging gradually off to the left. The Professor, of course, followed, like the perfect little gentleman that he is, and presently I saw, to my horror, that it was upon him that the blow would fall.

"Passing the Baby"

Luckily, the same idea occurred to the Professor, who beckoned Captain Buckett to his side, at the same time taking a full pace to the left in a smart and soldierly manner.

"Who threw that kilopoog?" bellowed Captain Buckett into the microphone when the blow fell.

The only reply was another biff.

I see that obviously button B will have to be used with a certain amount of discretion.

The Editor, WIRELESS CONSTRUCTOR

I have never before penned a letter praising a set designed in any wireless paper, although I have been building sets since before the old "2 Z Y" was on the air, but I have never before constructed a set as good as the "Adapto Three."

As I am writing this I am listening to Pittsburg W 8 X K on 25·25 metres, who is taking the programme radiated by K D K A on 49 metres. It is coming through at the same strength as the majority of the locals, and that speaks volumes.

THE "ADAPTO" THREE

A reader gets America as loudly as the local

The beauty of the present reception is that there is *very* little fading, *no* static and *no* mush. Time, 9.15 p.m.

I only tried the set out on Monday night, and up to date (two days) I have logged the following: W 3 X A L, 48·86; H J 3 A B F, 48; D J A, 31·38; W I X A Z, 31·35; W 3 X A U, 31·28; G S B, 31·55; W 8 X K, 25·27. All these stations were tuned in on the loudspeaker. I connected the Adapto to Q.P.P. output, using a W.B. P.M.4 A speaker.

Not having ·00015 condensers amongst my spare parts, I am using ·00025, and tuning is razor sharp.

I am also using a ·00004, instead of a neutralising condenser, on the aerial side, and an Igranic neutralising condenser which I took out of a short-waver eight years ago.

Hoping this will be of interest to you, I remain,

Yours faithfully, H. A. HADFIELD.

322, Victoria Street,
Shawhall, Cheshire.

HOW TO MAKE A HOME-RECORDER

What would you sound like on the radio? Have you a microphone voice? These are questions which intrigue most of us, and they can be answered in a very effective and simple manner by means of the home-made recording apparatus which is described in this article

By ALFRED J. POTTS

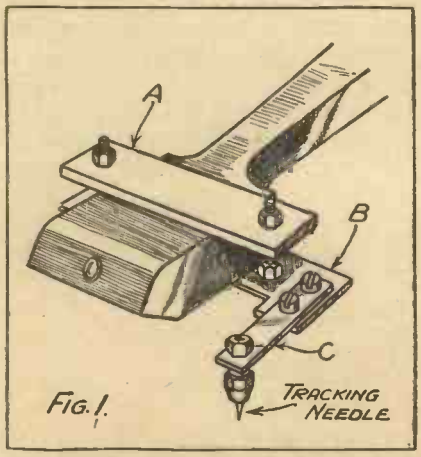
THERE are many keen experimenters who would like to try home recording, but are deterred by the thought of purchasing fairly costly apparatus which, if it should not give real satisfaction, can be put to no other useful purpose, and so becomes just so much money thrown away.

The apparatus I am about to describe is made of odds and ends which practically everyone has available, needs no tools which the average radio enthusiast has not got available and will afford a considerable amount of interest when made. The quality will be found to be quite good and equal to that given by many commercially made home recording outfits.

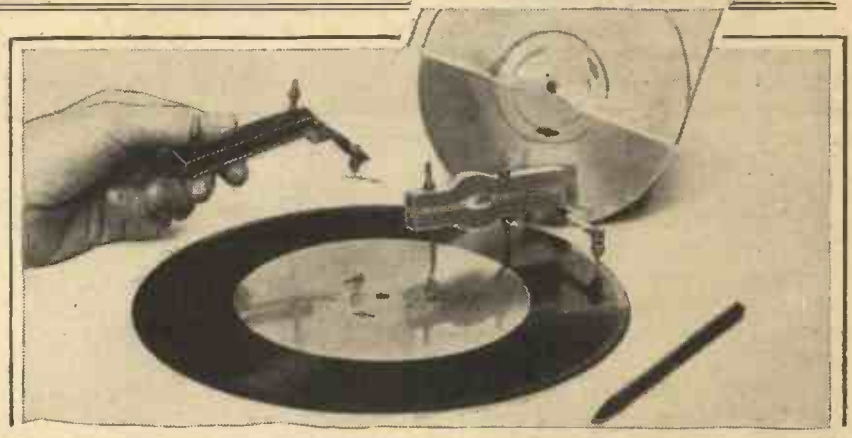
Any Good Make

The first essential, and incidentally the only real one, is a pick-up. It does not matter what make of pick-up you use. So long as it is capable of good working when records are being played with it, then records can be made with it.

FOR FLAT PICK-UPS



The flat, square types of pick-up, such as the B.T.H., Marconiphone and H.M.V., are dealt with in this manner.



Clips of two different types are described in the text, and practically every pick-up on the market will be found to be suited to one or the other of them.

As in these days most owners of radio sets have a pick-up of some kind, no difficulty should be entertained on this score. It might perhaps be mentioned, however, that an ordinary tone-arm and sound-box can be made to do the job, but it is, of course, limited very much by the fact that to get anything on to the record the horn has to be shouted into, and that the quality cannot be anywhere near as good as that which can be obtained by proper use of a pick-up in conjunction with the recorder to be described.

Before I start the description of the recorder, it might be as well to explain that the actual model used was designed to fit on one of the flat, square types of pick-up, such as the B.T.H., Marconiphone and H.M.V. There are other types with which it will be suitable without any alteration whatever, but such an alteration is simple to make and one such alteration is given in this article.

No Danger of Damage

In point of fact, these two models can be made to fit nearly every pick-up on the market with only slight and easily-carried-out alterations in the measurements to suit the size of the pick-up to be used.

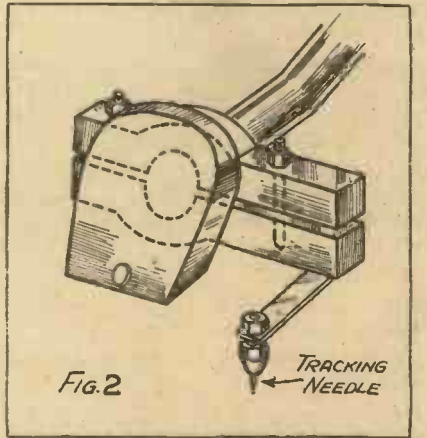
One of the models described here actually fits over the head of the pick-up itself and can be put on in a moment without any danger of damage to the pick-up, providing, of course, the instructions given in the article are carried out. A sketch of this model is shown in Fig. 1, which shows how it fits on to the pick-up and the strong but simple way in which it is constructed.

The other model is intended for those pick-ups which have either upright heads, such as the older B.T.H., the Harlie, Belling-Lee, G.E.C., Bulgin, and many others too numerous to set out here. This second design is intended to be fixed to the pick-up carrier arm, as close up to the head as it will go in the manner shown in Fig. 2.

Not Really Difficult

Full details and approximate measurements are given of both models, but it should be remembered that these measurements may not be quite correct and can best be ascertained by measuring the pick-up

AN ALTERNATIVE CLIP



With pick-ups of this type, with a round section arm, this kind of clamp, which differs from that shown in Fig. 1, is used.

Apparatus That is Simple to Make

to be used and allowing for the thickness of the wood, ebonite or metal. This may sound difficult, but it is not really so.

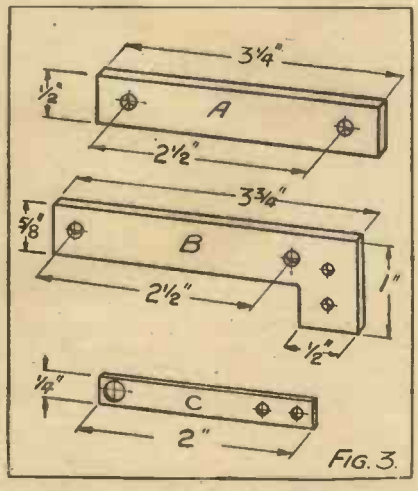
The construction of each of these recording adaptors is quite easy, and with the details given below and in the drawings should be quite simple to carry out.

Constructional Details

I will deal first of all with the design for use with flat or horizontal heads. The only materials needed for making this are a piece of ebonite or ¼-in. plywood measuring 3¼ in. x ½ in., a piece of 3/32 brass or copper measuring 1 in. x 3¾ in. (it should be mentioned that iron or steel must not be used for this) and two short lengths of 4B.A. threaded brass rod, together with half a dozen nuts.

Cut the ebonite or plywood to the shape shown at A in Fig. 3 and drill two holes large enough to clear the threaded brass rod without causing it to stick. Then cut the metal to the shape shown at B, and trim off all sharp edges with a file or emery paper. This must be drilled with a drill slightly smaller than the size of the B.A. rod—about a ⅛-in. drill. The two pieces of rod must be of sufficient length to reach from the bottom of the metal to the top of the ebonite or wood and allow ¼-in. at the top to spare. Two pieces approximately 1½ in. long will be correct in most cases, but this obviously varies according to the thickness of the pick-up.

THE DIMENSIONS



The chief materials needed for the clamp illustrated in Fig. 1. A is ebonite or wood, B brass or copper and C a piece of clock spring.

It is now necessary to tap the two holes in the metal piece with a 4B.A. tap to enable the threaded rod to be screwed into it. It might appear at first sight that a 4B.A. nut could be used on each side of the metal to hold the rod in place, but it will be found that in most cases this is not so, as most of these "flat" pick-ups have very little space between the record and the underneath part of the pick-up head.

If you have not got a 4B.A. tap, some friend is sure to have one or else a Whitworth of similar thickness, which can be used just as well if Whitworth threaded rod and Whitworth nuts are used as well.

Follow the Diagrams

Two more holes have to be drilled and tapped, but these can be practically any size provided you can find two small or, rather, short screws to fit them. A small piece of clock spring (C) is required (about 2 in. long is most suitable), and this must be drilled with two holes large enough to clear the two screws to be used, one a ¼ in. from one end and the other ½ in. from the first.

Place this piece of spring over the piece of metal with the holes coinciding and screw together with the screws. These screws should not be more than ¼ in. long, but if longer can be cut off after they have been screwed in place. Now screw the threaded rod in place, as shown in the figures and photographs, so that it just comes through to the other side. Then screw a nut down in place tightly against the metal. This will stop the rod from unscrewing.

The Holder for the Needle

The only other thing to be done is to fix some form of needle holder at the other end of the spring, and this might conveniently take the form of a nipple from an old loudspeaker chuck or the needle holder from an old or useless sound-box. Either can be soldered or screwed in place ¼ in. from the end of the spring, as shown in the illustration. This completes the constructional work for the first model; and to fix it to the pick-up, simply place the metal part under the pick-up head and the two holes in the ebonite or wooden part over the tops of the threaded rods and screw up finger-tight. Do not use pliers for this or damage might result to the

THESE ITEMS KEEP THE CUTTER IN TRACK

The needles seen in the pick-up clamps run in grooves on a tracking record, and thus move the cutter needle across the blank disc as it is rotated.

Results That are Entertaining to Hear

pick-up, particularly if it is of moulded bakelite material.

The construction of the other recorder is very similar, excepting that the spring will need to be about 3 in. instead of 2 in. The two clamp pieces are made of ⅜-in. wood (plywood for preference) and are shaped as shown in Fig. 4. Both are shaped the same, and they are screwed together with 1-in. lengths of threaded rod, as in the other model.

For the Best Results

The size of the arcs cut out of each will vary in some cases, and may, in one or two cases, even be square according to the shape and size of the pick-up arm at the back of the head. It would, of course, be this model which would be used if an ordinary sound-box should be decided upon.

For best results from both models the length of the spring should be adjusted so that the needle, when inserted in the spring holder, will come just opposite the one in the pick-up holder looking from the side. The point of the spring needle should be adjusted so that when it is lowered on to a record, so that it just touches the surface, the pick-up needle itself is about ⅜ in. to ½ in. above the record. This will make certain of the tracking needle holding well to the grooves.

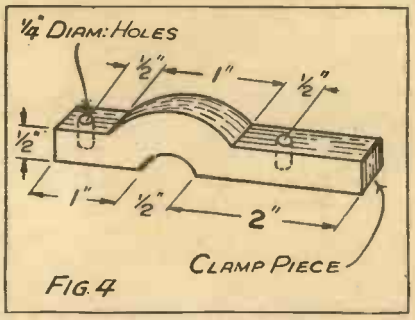
For these recorders the Wearite Kingston Home-Recorder discs will be found best owing to no slipping being able to take place, and therefore better records are obtained. There is a special tracking disc sold for these records, but for the purpose of testing out the recorders an old and useless record can be adapted for use with very little trouble.

Obtain one of the recording discs and place the old record on the turntable of the motor. Then place the aluminium disc on top of this, thus assuring that they shall both be in alignment and that the metal disc shall be central.

No Tendency to Slip

Without moving either record, mark the paper label on the old record where the three holes come in the metal disc. Take both records off and insert three small screws at these marked points. This completes the tracking disc, and it will be found that if the metal disc is placed on top of this tracking disc and given a slight turn in a clockwise direction, it will remain in place with no tendency to slip.

CUT FROM WOOD



Two pieces of wood this shape are required for the pick-up clamp illustrated in Fig. 2 of this article.

All that is now required is a cutting needle. These are specially shaped needles of very hard steel, and are obtainable quite cheaply. This completes all the details required for the construction of both recorders and the tracking disc.

A few tips to help you get the best results from the apparatus may be welcome to many. Place the cutting needle in the pick-up and an ordinary steel needle in the spring holder. Place the metal disc on the one to be used for tracking, as described. Connect the pick-up to the output of the set instead of the loudspeaker and tune-in, feeling the needle to see that it vibrates.

HOLDING THE DISCS

The disc on which the sounds are to be recorded is securely held to the large record which provides the groves for the guide needle to run in.

It might be added here that the output from the set to obtain best results should be somewhere about 500 to 700 milliwatts, and with anything less than this the volume is liable to be rather small. Another important point is that dealing with volume controls. Some pick-ups have such a control in their base, others have them mounted separately.

Use an Output Filter

Since this volume control is often of a fairly low value, it should be disconnected, as otherwise the volume will be very much cut down when recording. An output filter or transformer is recommended when using a pick-up connected to the output of the set, although this is not an absolute essential providing the output valve does not take an excessive H.T. current.

When these little points have been dealt with, start the motor and place the cutting needle about ⅛ in. from the outside edge of metal disc and record for about ½ in. Then take it off and replay with a fibre needle (steel needles must not be used), and if satisfactory continue the recording.

Your Own Voice

A small weight which varies considerably according to circumstances, but is often between one and two ounces, can be added to the pick-up to help it make slightly deeper grooves. A little experimenting may be necessary at first, but when carefully carried out with a little patience there is no reason why quite good records should not be obtained with this simple, though efficient, apparatus.

If care is used, it will be found that if the grooves cut are looked at through a magnifying glass a remarkable accuracy of spacing is noticeable.

If your receiver has provision for using a pick-up you can record your own and your friends' voices or playing by connecting a microphone (together with its associated transformer and energising battery) to the pick-up terminals.

A little experiment will show the best position of the microphone, and excellent results will be obtained.

SOME WIRELESS CABINET WOODS

PLYWOOD—VENEER —AND DESIGNS

In the last of the present series of articles on radio cabinet work, the use of plywood and the designs used in home-constructed and manufacturers' models are discussed

By C. J. ELLIOTT.

A WIRELESS cabinet is now an article of furniture and is expected to last some years. Circuits for wireless reception *do* alter from year to year, but we look forward to being able to fit the new chassis into the old cabinet.

Now a wireless set is placed fairly near the fireside, so that the wood gets every chance of shrinking or twisting if it has not been thoroughly seasoned. It will readily be seen, therefore, that it is waste of time and labour to work with badly seasoned wood.

HOME DESIGN

An example of what our contributor calls the "open-frame" form of cabinet construction. The set is conveniently located at a sensible height with a useful table-top above and a shelf below.

The parts of a cabinet that are not easily seen are made with soft wood, the cheapest of which is ordinary deal, but yellow pine at a slightly higher price is to be preferred. The front and side panels, also the top, usually belong to the veneered class, and the finest figured oaks, mahoganies and walnuts are reserved for making veneered panels.

Plywood is very strong and light, and is often preferred for the backs and the bottoms of cabinets. The making of plywood occupies to-day a position of high importance in the timber industry, and its future is a very bright one. Plywood does not split, shrink or warp, and it is both strong and light. It is made by gluing three or four *thin* layers of wood one above the other, and in such a position that the grain of the wood of one layer is at right angles to the one below.

It is sold in sheets ranging in thickness from about one-sixteenth of an inch to three-quarters, and can be obtained in larger squares than in the case of solid wood. For cabinet panels, sides and tops it bears a veneer of oak, walnut or mahogany

The Necessary "Grip"

For high-class veneers the best woods are either knife-cut with about 14 sheets to the inch, or saw-cut with 8 sheets to the inch. The thicker sheets are to be preferred in gluing up, because there is less risk of the glue making its way through the layer when subjected to pressure. These thin sheets of cabinet wood are fixed on to a "ground" wood which has its surface finely roughened with a toothed plane. This gives it the necessary "grip." Most panels are veneered on both sides, so that pressure by contraction is balanced and the panel remains flat.

In cabinet work we have two classes: (1) Open-frame work, as in the case of chairs and tables, and (2) box-type work, as exemplified by chests of drawers, desks, bookcases and the like. A wireless cabinet is usually in the second class, but it is possible to construct a cabinet partaking equally of each class. We have only to imagine a chair with the upper part, above the seat, in the form of a box, the top of the box forming a small table. The four legs of the chair are visualised as carried up above the seat, all to the same level. This is a plain cabinet, forming a table and a wireless set combined, the whole standing on four legs.

Let us carry our imagination a little farther, so that we may evolve a more artistic piece of furniture. Try to visualise a rather narrow type of chair, tall in construction and with each leg slightly curved outwards as

(*Continued on next page.*)

COMMERCIAL CABINET WORK

A fine specimen of the modern cabinet design by the Carrington Manufacturing Company—the "Camco" Oxford Pedestal type.

SOME WIRELESS CABINET WOODS

—continued from previous page

it reaches the top, or table-top. Having now a rather large and heavy top, we should have something to brace the legs together, so we visualise a shelf about six inches above the floor, and to this shelf the legs are firmly attached. Now from this shelf we make each leg curve out again, so that, on reaching the floor, an area is covered quite equal to the area of the table-top.

This design is shown in the sketch on the previous page.

Awkward and Inartistic

Most wireless and gramophone cabinets, either separate or combined, are rectangular figures, rather taller than they are wide, and standing vertically on the short side. Thus they present a more artistic appearance than would be the case if made like a cube. A wireless cabinet in the form of a cube would be awkward and inartistic; but two and a half cubes, one above the other, would be a better arrangement, and would be better still if one of the dimensions could be reduced—namely, in the direction from front to back.

In spite of the fact that there is a monotony about the plainness of rectangular bodies on account of their severely straight outline, by far the majority of commercial sets are of this type. Certainly they are easier to make, and the modern fashion in all household furniture is largely inclined to straight lines rather than curves.

Proud of Their Set

In the early days of wireless there was rather a craze to disguise the wireless set and loudspeaker—particularly the latter. A loudspeaker would be constructed to hang on the wall like a picture, while the receiving set would be built into a desk or into the panel of a bookcase: in fact, in any place so long as it did not appear to be there at all. Now all this is changed, and people are proud of their wireless set as a separate article of furniture.

For the amateur who wishes to make a cabinet for his own wireless set there are hundreds of designs which he may elaborate or improve upon, according to his own experience and ingenuity; but the majority of people will be content with something simple in design.

A NOVEL COMPETITION FOR ALL OUR READERS

FINDING unusual faults in radio receivers is not, as a rule, a money-making business, however intriguing it may be to the enthusiast.

However, the makers of the famous AvoMinor testing instrument, which was dealt with in all its many useful aspects in THE WIRELESS CONSTRUCTOR quite recently, have devised a novel scheme for a competition which will appeal to every one of our readers. Full details will be found on another page, but the conditions of the competition are interesting in themselves.

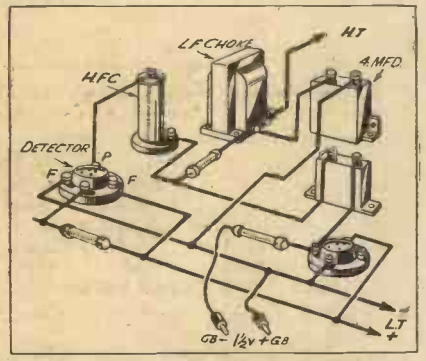
All you have to do is to find some unusual or interesting fault in a radio receiver with the help of the Avo-Minor, and then write and tell the makers all about it. Or, if you prefer, you can see how many separate tests you yourself can make with this instrument of many uses.

The prizes offered include £1 a week for a year, 10s. a week for the same time and a lump sum of £10. This is one of those opportunities which no one will want to miss.

MOTOR-BOATING in amplifiers, or the amplifying portions of a receiver, especially where R.C. coupling is used, can be very troublesome to cure. By this I do not mean difficult to stop, but difficult to eliminate *without losing amplification due to loss of H.T. voltage.*

One can go on piling on decoupling condensers without very much success,

INCREASING DECOUPLING



A high-value choke in the first L.F. stage will often cure a persistent tendency to motor-boat.

and the increase of decoupling resistance has the inevitable result of cutting down H.T. on the valve anode concerned, and thus causing loss of amplification. Especially is such H.T. reduction trying if power-grid rectification is being used.

Try a Choke

But you can almost bet your boots that the troublesome stage is the detector, or, in an amplifier, the first. So make a dead set at that right from the start. And try *choke* decoupling as a change—if you like, in series with a small resistance decoupler, or " neat " as shown in the sketch.

I find a 300-henry choke is wonderfully efficacious, as it should be theoretically, for its impedance, even at very low frequencies, is greater than that of the usual decoupling resistance. And use a 4-mfd. condenser, not a 2-mfd.

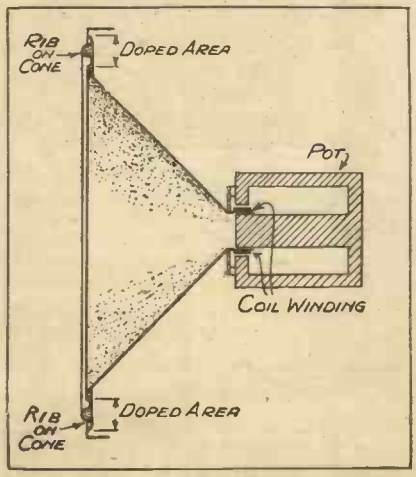
I must be one of the most discontented people where radio is concerned, for I am never really satisfied with the results I am getting from my set; certainly I am not satisfied for any length of time.

Queer faults and unusual methods of curing troubles and improving results are dealt with each month

By FREDERICK LEWIS.

The result of this radiophobia, as it might be called, is that I am for everlasting trying out new ideas, new components and new accessories. If I am not tackling a mains hum that has appeared in a new set I am trying to find a loudspeaker that is

NO BASS RESONANCE



How a moving-coil speaker was improved in the bass register. Glycerine was the " dope " used.

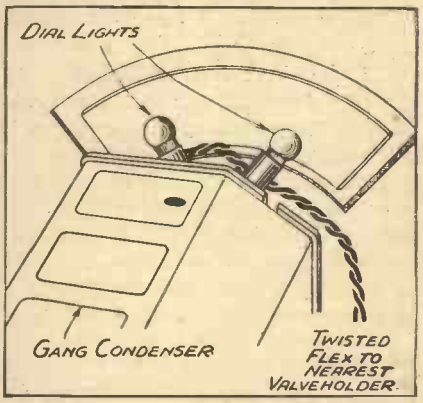
one step better than the one at the moment in use or to find one to suit someone else's taste.

The Perfect Speaker

Probably the hunt for the perfect speaker is the one that holds the greatest interest, and at the same time the largest amount of exasperation.

My frequent searches in this direction put me in touch with the latest acquisition to my rapidly swelling battery of speakers. My last speaker was a " Blank," and I have been very pleased with it for a long time—

THOSE DIAL LIGHTS



Twisted flex should be used for dial lights in mains receivers.

unusually long for me. In fact, it suited my set remarkably well. And the suiting of individual receivers is one of the greatest troubles in choosing a speaker.

You cannot go right away and condemn a speaker unless you are sure you are giving it the right stuff to deal with and are using it in the best way. Room acoustics come into it, too, of course.

But I divert. I was saying that I had settled down with my last acquisition, and should not yet have changed if it had not been for a certain firm ringing me up and asking if I would like to try their new commercial model with the " doped " diaphragm.

Doped with Glycerine

As this sounded rather intriguing I said I would, and so one more was added to my collection. This time the speaker is a Benjamin Magnavox, with fairly loose suspension and a heavy fabric cone. But the interesting part is that the cone is ribbed near the outer edge, and the ribbed section is doped with glycerine.

The effect is that the cone resonance is extremely low in frequency (I cannot hear it, any way), while the

(Continued on next page.)

HOW TO OBTAIN BETTER RADIO

—continued from previous page

free suspension provides really good bass response.

I mention this because, while I do not know if the firm in question can yet supply it for the constructor market, some of you may feel inclined to experiment with a ring of glycerine near the outer edge of your speaker diaphragms if they are of the fibre type. Don't blame me if it does not work in your case. It does in mine.

* * *

Here is a short hint for mains-set users. I have found that the use of dial lights sometimes provides, in addition to light, two snags. One is hum and the other is the need for frequent replacement of the bulbs.

The cure for the first is usually to make sure that the leads to the lights are carried out in twisted flex or shielded wire and kept away from the detector grid. The other is cured by using 6-volt bulbs instead of 4-volters. Simple, but not often realised.

EUROPEAN VALVE PATENT BATTLE

A LONG patent battle has been going on in certain foreign countries in Europe, Philips and Tungsram being involved over some very interesting technical points. Of certain claims put forward by Philips, one of the most important of those disallowed by the courts concerned the "Cascade" patent (re-tuned circuits), on which this company would have been entitled to royalties from Czechoslovakian set makers, but which has been declared to be invalid.

Similarly, Tungsram succeeded in a case against the centre-tapped patent.

But a third patent of this group, the grid-detection patent, has simply been restricted in Czechoslovakia in such a way that it no longer covers all variations.

In Hungary important issues centred round a Philips patent for horizontal electrode structure and one on cathode manufacture by vapour process. The supreme court of that country has finally found both these to be invalid.

A new patent application on slanting electrodes, put forward in Germany by the Valvo Company of Hamburg (a sister concern, by the way, of Philips), has been refused in the supreme court there.

WIRELESS TRAGEDIES OF THE GREAT WAR

—continued from page 53

and then read it again. Did his eyes deceive him?

Slowly he read the vital news issued by wireless from the Russian general himself: "The other Russian army will not arrive in time for the present battle, but will be along a day or two later." The telegram also stated the exact strength of both Russian armies!

It was the Russian wireless, of course. With unconscious faith in their new toy, they were broadcasting to the world all their moves and arrangements, every detail of their armies, even the amount of food required!

Regular Information

Day by day the wireless operators in the German fortress of Konigsberg listened with amazement to the Russian wireless transmitter telling the world their every order. To Russia the result was tragedy.

In that battle of Tannenberg practically the whole Russian army was destroyed, and the Russian general committed suicide.

It would have been thought that this would have awakened the Russians to the fearful harm which their wireless was doing them. But no—for military secrets great and small continued to be broadcast to the delighted Germans. When, for instance, the Grand Duke Nicholas gathered four armies together beyond the Vistula, either to advance on Germany or to guard Russia, as might be required, the ubiquitous wireless told the Germans all about it.

Was It Treachery?

Eventually, wireless or no wireless, the Germans were beaten back by sheer weight of numbers; but here again, and although fighting a stiff rearguard action amidst fearful difficulties, they were able to make good their retreat, due largely to the information supplied them by the Russian wireless.

Such a ghastly mistake could not go on for ever, and some weeks later the Russians awoke to the peril of wireless leakage. It is still undecided whether there was treachery.

Many say there was—most foul and unforgivable; others believe that this wireless blunder was due to the innate simplicity of the Russians and their child-like ignorance of wireless.

Next Month—The Battle of Coronel.

FROM MY ARMCHAIR

—continued from page 71

so that he could do his act. And then, in fact, I once saw the family gathered round the set, the pork butcher sitting next to the piano with his podgy first finger pressing on the earth terminal of the set, a rather sickly smile on his equally podgy but quite good-natured face.

I found that the p.b. had to exert a fairly precise pressure. If the p.b. pressed too hard, signals weakened. If he touched the terminal too lightly, signals also went down. But the p.b. knew exactly how much pressure to apply.

At first the butcher thought it was rather a joke and felt flattered and indispensable. My friend, however, began to get worried. He had bought all his meat at the Co-op., but now felt obliged to pass more and more business to his neighbour. You couldn't go borrowing your neighbour's finger night after night and buy all your meat at the Co-op.

It certainly had become a question of "night after night." Having tasted perfect reception, my friend could not bear to listen to the anæmic whisper that oozed out of his speaker at normal times.

Well, the first sign of trouble was that the butcher's wife resented her husband's constant neglect. As my friend's wife hated her like poison, she was never invited into the house. The neglected woman accused the butcher of disloyalty, having cotter with the enemy and other serious things like that.

The Effect of Refreshment

He began to feel that perhaps he was spending too much time away from home, and began to go less often to my friend's house. Whereupon my friend doubled and trebled his meat orders until the butcher felt that, after all, business was business, and if a man couldn't give a hand (or, rather, finger) to help his pal, he wasn't much of a pal.

So the evenings became jolly again. Glorious volume, perfect quality and selectivity beyond reproach! They were all jolly people, and I remember dropping in once and finding glasses of stout being filled and refilled. But the odd thing was that the butcher was never given even a sip. He just sat there with his finger on the terminal and watching the others guzzling their brew.

"T.T.," I thought. But a teetotal butcher is as rare as a dodo. I took my friend aside.

"Hopeless!" he said. "Often tried him. Signals fade right away."

Of course, I saw why: altered his specific inductive capacity or his resistance or something like that.

To cut a long story short, everyone got very nervy, including my friend's family, who were now eating meat three times a day and looked like it.

I was asked to suggest what was wrong with the set. I said: "Try a resistance or condenser to replace the butcher's finger." "No good whatever," said my friend. "It's usually traceable to obscure reaction effects," I murmured. "Hopeless," said my friend.

The fact of the matter was that he had developed an obsession that nothing would do but the magical first finger of the pork butcher's left hand. I honestly do not think he ever tried any of my suggestions.

"But Why the Sausage?"

One evening the owner of the finger was taking it away with him after they had all been listening to "Faust." I had dropped in to see how things were going.

"Well, this is my last evening," said the p.b.

I have never seen anyone so dejected looking as my friend was at that moment. Hoping to cheer him, I said:

"Since our friend is leaving for good, why not persuade him to leave his wonderful finger behind?"

The fellow's face took on an almost inhuman look of triumph. His eyes travelled to a knife lying on the table, and I believe it would have taken very little to persuade him to cut off his neighbour's finger there and then.

The following week things went from bad to worse. No one dared to mention wireless to the fellow. I decided to reason with him.

"It's a question of substitution," I said. "One should be able to find some substitute for his finger. These aren't days of magic. A small variable condenser or a high resistance connected between . . . ."

He appeared distrait, but a little happier. A month later he was radiant.

"Amazing signals!" he enthused. "Got Schenectady last night. Cut out the local in half a degree. Magnificent quality!"

Well, that's the end of the story. He's now a perfectly happy, normal fellow. But when his friends call on him they almost invariably ask:

"But why the sausage hanging on the earth terminal?"

J. S.-T.

THE S.T.300 STAR—WHAT CONSTRUCTORS SAY

—*continued from page 54*

after the interests of the amateur builder. My 400 set has given every satisfaction, and I should like you to hear it. I shall be happy to help any amateur in my district who is in trouble with any of your sets; personally, I have never had the least. I am also prepared to demonstrate the A.C. 300 Star to any interested amateur by appointment.

"A CRACKLING NOISE"

[*From H. J. Lewer, 68, Trafalgar Road, Peckham, S.E.15.*]

When I heard about your S.T.300 Star I decided to build it. The only new parts which I have not bought are the two ·0005 tuning condensers.

Since I finished the set, about a week ago, I have been unable to obtain any results beyond a crackling noise.

[Perhaps one of the many successful constructors of the S.T. 300 Star—see letters by other correspondents—would like to offer Mr. Lewer a helping hand.—The Editor.]

"A WONDERFUL SET"

[*From G. C. Baker, 18, Longfield Road, Dover, Kent.*]

I have just converted my S.T.300 to the S.T.300 Star, and I must say that it is indeed a wonderful three-valve set, although certain items have not been changed, notably 1-mfd. fixed condenser, ·00004 aerial coupler and the P.M.12 screen-grid valve.

My 300 has been in constant service for eighteen months, but although it gave me such wonderful service, your 300 Star is a far better set, the volume is considerably greater and the selectivity far superior.

[The P.M.12A or Cossor S.G.220 is better for this set.—J.S.T.]

THIS COPYRIGHT "MUDDLE"

—*continued from page 52*

the listeners. In other words the B.B.C. only pays for a limited form of copyright—something like the man who pays two shillings for an ordinary piece of music to be played at home. It therefore has no power—even if it desired—to authorise reproduction of copyright transmissions in "public" places.

For this one must naturally assume that the audience pays something extra, either directly or indirectly, for what it gets, and that the proprietor of the premises is also a gainer.

In either case, the Performing Right Society argue that some part of this extra profit is due to them—in part because of the merit of the music itself, and in some cases also because of the merit of the artistes who perform it before the microphone. They accordingly insist upon claiming a share of it in the form of copyright fees.

The True Position

In conclusion, if the owner of an hotel, restaurant or other place of public entertainment wishes to include wireless as one of the attractions offered to his clients, then he is quite entitled to do so. But he must, in addition to taking out a P.M.G. licence, also secure permission from the Performing Right Society, at a cost which varies from a few guineas a year, according to the rating of the premises concerned.

AS WE FIND THEM

—*continued from page 74*

Constructors who require valveholders for 9-pin valves can rest assured that this Clix product will carry out its job really well.

The price is 1s. 3d., and the makers are Messrs. Lectro-Linx, Ltd., 79a, Rochester Row, London, S.W.1.

The "Autocontrola"

The principle of Class B amplification is already known to most constructors. Briefly, it gives you an H.T. current consumption proportional to the volume, so that on the soft passages you are using very little current indeed, the consumption increasing as the volume gets greater.

But Class B amplification entails a new valve and a special driver stage, apart from one or two modifications to the circuit. There is, however, a method by which the same economy of H.T. can be achieved with ordinary power valves or pentodes.

The "Autocontrola," marketed by Messrs. Benjamin Electric, Ltd., of Tariff Road, Tottenham, N.17, is a unit which you can add to your existing set and obtain a great saving in H.T. consumption.

The unit is designed round the Westector economy scheme, a tried and tested method which we ourselves have used with great success.

The "Autocontrola" is sold at 7s. 6d., minus the Westector and an external resistance, which slip into two pairs of clips conveniently placed on the side of the unit.

Constructors who are interested in the device and who require particulars as to circuits and so forth should get into touch with the makers at the above address.

The unit will soon pay for itself in reduced H.T. battery costs.

A NEW MARKETING DEVELOPMENT

THE tremendous demand for the products of the Telephone Manufacturing Company Limited, of West Dulwich, London, S.E.21, has necessitated the formation of a new company for the sole purpose of ensuring more efficient marketing of T.M.C. manufactures.

This new development means that the home constructor will now find no difficulty in obtaining, wherever he may be, prompt and adequate supplies of T.M.C. products, including the "Temco" A.C. mains electric clocks and also the "T.M.C. Hydra" condensers, which were reviewed in THE WIRELESS CONSTRUCTOR last month.

Commodious premises have been taken in Central London for the new company, which, under the name of "T.M.C.-Harwell Sales, Limited," will occupy an important position in the Electrical and Radio Industry.

TELEVISION WITHOUT SCANNING

—continued from page 75

reversed. That is to say, the grid is given a high positive voltage, whilst the plate carries little or no positive charge.

Under these conditions the valve generates continuous oscillations at a very high frequency, the wavelength being determined not by the frequency to which the external circuits are tuned, but by the time taken for the electrons to travel between the filament and grid. In brief, one tunes by controlling the grid voltage instead of by adjusting the capacity or inductance of some external circuit.

Simple Control

The reason is that the grid, being an open spiral wire, does not collect the whole of the electron stream, but allows most of it to pass through. But only for a certain distance, because the plate (being negatively charged, relatively, to the grid) tends to drive the electrons back again.

In this way the whole of the electron stream is set into rapid vibration inside the valve, rushing to and fro across the grid. Each time it cuts across the grid it induces a high-frequency pulse in the external circuits.

The rate of electron vibration, and therefore the frequency of the wave generated, depends essentially upon the time taken for the electrons to travel across from the filament to the grid. Now, this in turn is controlled partly by the positive or accelerating voltage on the grid and partly by the actual distance between the grid and the filament.

The figure shows how this method of operation can be used for transmitting a television programme. In the first place, instead of an ordinary heated filament, the cathode consists of a comparatively large photo-sensitive surface C, upon which an image of the picture D is projected by means of a lens L.

Electrons are therefore emitted from the cathode C, not in a uniform stream, but at a rate which varies from point to point with the light-and-shade value of the picture at each point. By applying a magnetic field outside the valve, the electrons so given off can be made to travel in straight lines, so that a cross-section taken at any point along the stream will contain an "electron image" of the picture.

The Receiving End

In the second place, and this is important, it will be seen that the grid G and anode A are not set parallel to the cathode C. In fact, they converge towards each other, both in the vertical and in the horizontal planes. Also the grid is given a high positive voltage from the battery B, whilst the anode carries only a few volts.

Now, since the distance between the grid and cathode is not the same for any two points on the surface of the cathode C, it follows, from what has already been said, that every point will produce its own special and definite frequency.

Simultaneously each of these frequencies will be modulated by the electron stream flowing from the cathode at that particular point. Accordingly, the picture will be radiated "as a whole" from the leads L_1, L_2 which serve as short-wave aerials.

At the receiving end a similar arrangement is used, except that the photo-sensitive cathode C is replaced by a heated surface, which normally produces a uniform stream of electrons.

As the signal waves come in they automatically sort themselves out into a position at which the grid-cathode spacing corresponds to their own wavelength. At the same time, they control the electron emission at each point and convert it from a uniform stream into one which reproduces the details of the transmitted picture upon a fluorescent screen.

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THE AVOMINOR

An Important Announcement

THE Automatic Coil Winder and Electrical Equipment Co. Ltd., have asked us to inform all readers entering for the competition announced on page 50 of this issue of THE WIRELESS CONSTRUCTOR that there is a printers' error on the free entry form and folder which they will receive.

The last range of readings on the AvoMinor is given in the folder as 0 — ·3 megohms. It should, of course, be 0 — 3 megohms, and readers should bear this in mind when carrying out their tests for the competition.

INDEX TO ADVERTISERS

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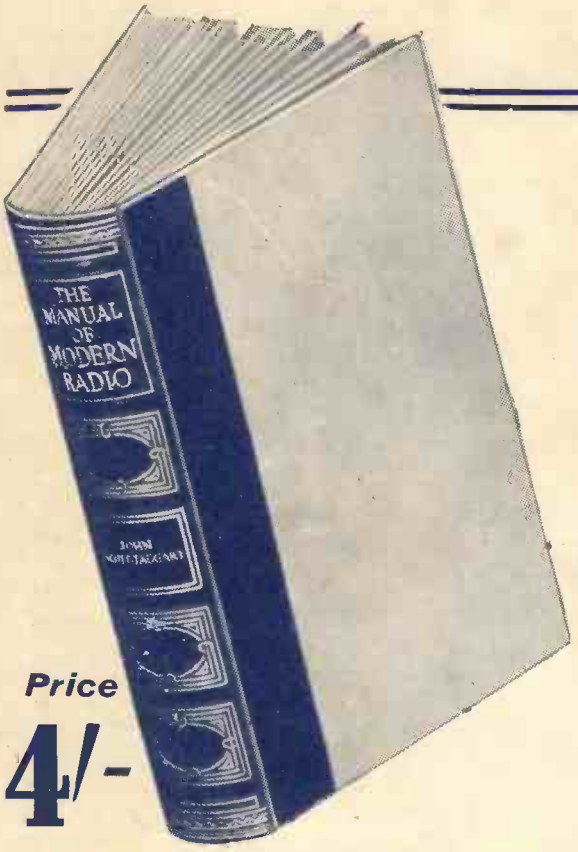

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