POPULAR WIRELESS, November 4th, 1933 REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THIS WEEK—MORE ABOUT THE S.T.500

Radio Step-by-Step

Popular Wireless

HOLDER CONNECTIONS FOR THE NEW VALVES

No. 596. Vol. XXIV. November 4th, 1933.

EVERY WEDNESDAY PRICE 3D

TENS OF THOUSANDS BUILDING THE S.T.500!

Are You?

TWO PAGES OF RADIO WRINKLES

"MAN-MADE STATIC" etc., etc.

Best Results from the S.T.500

The following Dubilier Condensers and Resistances are chosen by Mr. John Scott-Taggart for the S.T. 500

Three Type B.B. non-inductive type fitted into moulded bakelite cases. 250 volts D.C. peak.
Two 1 mfd. 2/6 each.
One 2mfd. 3/6.

Three Type 4401 Tubular Paper Condensers.
Two ·005 mfd. 1/3 each. One ·0005 1/-.

One Type 670 Moulded Mica Condenser.
·00005 1/-.

Five Dubilier Metallized Resistances, one watt type. Two 5,000 ohms. Two 10,000 ohms.
One 250 ohms, 1/- each.

One Dubilier Grid Leak.
1 megohm, 1/-.

Dubilier Condensers and Resistances have been consistently specified over a number of years in connection with the famous circuits designed by Mr. Scott-Taggart.

DUBILIER
CONDENSERS AND RESISTANCES

The S.T.500 is no exception to this rule and a comprehensive range of Dubilier Condensers and Resistances are specially recommended by the designer for use in this circuit. Therefore, when you are buying your parts for the S.T.500, specify Dubilier Condensers and Resistances and you will be adopting the choice of the leading set manufacturers and designers and be certain of complete and lasting satisfaction.

DUBILIER CONDENSER Co. (1925) Ltd.
DUCON WORKS, VICTORIA RD., N. ACTON, LONDON, W.3

THE BIG SUCCESS!

J. SCOTT-TAGGART'S S.T. 500

make sure you use the only specified Condenser!

The ORMOND No 6 FRICTION CONTROL

The S.T. 500 deservedly won great popular acclaim when recently introduced. When you build **yours**, use the **only** condenser Mr. Scott-Taggart considered worthy of a place in his masterpiece. Thus you will be sure of getting the performance and dependability he approved, and furthermore, a fine value which **you** will appreciate.

A friction device is incorporated at the rear end of this condenser, giving a superb slow-motion movement with ratio of 50 to 1. Direct drive is obtained by means of Bakelite dial, engraved 0 to 180 degrees. Slow motion is controlled by the upper small knob. Fast enough for easy searching, it is yet slow enough for finest tuning.

Easy to mount. One-hole fixing. Terminals and Soldering Tags for connections. Complete with 2½-in. dial and slow-motion knob. **Cat No. R/493. Cap. ·0005. Price 7/6**

Also available in capacities ·00025, ·00035, ·00013. Price 7/6 each.

Ormond Components recommended include:—

Class B Moving-Coil Loudspeaker.	*Cat. No. R/475 C.T.*	*Price 38/6*
Three No. 8 Log Solid Dielectric Condensers ·0005.	*Cat. No. R/503.*	*Price 2/3 each*
·0001 Differential Condenser	*Cat. No. R/510.*	*Price 2/6*
·0003 Differential Condenser	*Cat. No. R/199.*	*Price 3/-*
L.F. Transformer	*Cat. No. R/531.*	*Price 7/6*
Two Push-Pull Switches.	*Cat. No. R/323.*	*Price 1/3 each*
Toggle Switch	*Cat. No. R/330.*	*Price 1/3*

ENGINEERING "ORMOND" COMPANY LTD

British Regd Trade Mark.

THE ORMOND ENGINEERING CO., LIMITED,
Ormond House, Rosebery Avenue, London, E.C.1.
Telephone: Clerkenwell 5334-5-6 & 9344-5-6.
Telegrams "ORMONDENGI ISLING"

RIGID·ROBUST·ACCURATE —BRITISH MADE

Positively the Last Time!

This announcement will not appear again

IF YOU WANT A COPY OF THIS WONDERFUL

Scott-Taggart VOLUME

FILL IN THESE FORMS TO-DAY!

So many requests have been received from readers to hold open our great presentation book offer for a few days longer that we have decided to repeat the conditions and reservation form for this week only. This is YOUR LAST CHANCE.

WHAT TO DO!

Look carefully at the two forms on this page. First of all you must write your name and address on Form 1, which is just an ordinary label, on which you must stick a ½d. stamp. Then fill in Form 2, which is your reservation form. Then send these two forms to POPULAR WIRELESS. When they are received in our office, you will be sent a Gift Voucher on which to qualify for your "Manual of Modern Radio."

There are eight spaces on this Gift Voucher on which you will have to stick eight Gift Tokens cut from the bottom left hand corner of the last page of the cover of POPULAR WIRELESS for eight consecutive weeks. You can begin NOW! When this Gift Voucher is complete—i.e., after eight weeks—you are asked to send a P.O. for 2/5 (2/- with 5d. stamp attached). This 2/5 is to cover the cost of carriage and delivery to your door, cardboard container for packing, and insurance. "The Manual of Modern Radio" can only be supplied to readers who complete the necessary Gift Voucher.

As this volume is only available to regular readers, if you have not placed a regular order for POPULAR WIRELESS you must do so at once. This Offer applies only to readers residing in Great Britain and Northern Ireland. Irish Free State readers should send their completed Gift Vouchers and P.O. to 73, Middle Abbey Street, Dublin—Standard Edition only 2/10.

Apply for your copy of "THE MANUAL OF MODERN RADIO" while there is STILL time. The demand is tremendous, and our great presentation offer must be withdrawn after this week. Don't miss this FINAL OPPORTUNITY.

Every radio enthusiast needs this book; it is a sure guide to knowledge and success in everything connected with the technical side of wireless, written by a man whose qualifications are unrivalled, the greatest living expert in set designing to-day.

It is seven years since Mr. John Scott-Taggart has found time to write a wireless book. His "Manual of Modern Radio" is a monumental work—a landmark in the literature of wireless technique. Within its pages he has brought the whole art of radio reception and the use of valves.

The Manual is "red hot" as regards recent developments. If you are interested in such things as H.F. Pentodes, Iron-Core Coils, the Double-Diode Pentode, Cathode-Injector systems, Metal Detectors, Class B Amplification, the Capehart Circuit, Metal Valves, Quiet Automatic Volume Control, the Pentagrid—here in this book will you find all you want to know.

But if, on the other hand, you are a novice who would like to know a little about "how the wheels go round," here again is the book for you. Scores of circuit diagrams are duplicated in pictorial form to help the beginner, and it has been assumed that the reader knows nothing whatever about electricity or science. All one needs is the ability to read.

"The Manual of Modern Radio" will occupy an honoured place on your bookshelf. Beautifully bound in green cloth and printed in clear type, it will form a treasure-house of facts and advice from which to draw upon.

A massive volume (completely devoid, of course, of any advertising matter), which would ordinarily be sold at a guinea, can become yours for a purely nominal expenditure, but only if you act at once. If you fail to seize this opportunity now it will be gone for ever.

Every word of the Manual is newly written by John Scott-Taggart, and every diagram has been specially prepared solely for this great compendium of the radio knowledge of to-day.

Our offer of John Scott-Taggart's "Manual of Modern Radio" is the bargain of a radio lifetime. We urge you to seize the opportunity now. Before Christmas the book will be yours.

Superbly bound in a rich shade of Green Cloth with a silken finish and containing

36 CHAPTERS - 424 PAGES - Over 500 DIAGRAMS and CIRCUITS - 40 PAGES OF ART PLATES

Complete Dictionary of Wireless Terms.
Thousands of Facts and Explanations.

1

½d. Stamp must be affixed here by YOU

Name.....

Full Address.....

.....

.....

2

POST AT ONCE

RESERVATION FORM

Applicants must complete label on left and affix halfpenny stamp in space provided. Fill in this Reservation Form and send with label to:

POPULAR WIRELESS Presentation Book Dept. (G.P.O. Box No. 184a), Cobb's Court, Broadway, London, E.C.4.

I hereby apply for GIFT VOUCHER and request you to reserve for me in accordance with your special offer the presentation "Manual of Modern Radio." I have given a standing order to my newsagent to supply POPULAR WIRELESS regularly each week.

Reader's Name.....
(State Mr., Mrs. or Miss)

Full Address.....

.....

Reader's Signature.....

Newsagent.....

Address.....

PLEASE WRITE IN CAPITAL LETTERS. YOU MUST FILL IN LABEL ON LEFT and send with the Reservation Form in unsealed envelope bearing halfpenny stamp.

For Office Use

POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
Technical Editor: C. V. DOWDING, Associate I.E.E.
Assistant Editor: P. ROBERT BIRD.
Managing Editor: N. F. EDWARDS.
Chief Radio Consultant: P. P. ECKERSLEY.
Assistant Editor: A. JOHNSON-RANDALL.
Chief of Research Dept.: K. D. ROGERS.

AN APPEAL FOR SPEAKERS
RELIEF TO TRADERS
BETTER TIMES AHEAD!
BLIZZARDS AND PENGUINS

RADIO NOTES & NEWS

THE NEW NO. 10
PRESERVING BEAUTY
ELASTIC AERIAL LEADS
HUNTING THE PIRATES

Old Loudspeaker Wanted.

OUR Mr. F. Briggs, who has lent the Science Museum a complete amateur transmitting station, has been asked by the Museum whether he can give or lend to it one of the original "Brown" loudspeakers.

He is unable to meet this request, and would be grateful if some kind reader who owns one of these speakers, *in working order*, would send it to him at Tallis House for presentation or loan to the Museum, which is trying to arrange a demonstration of the early types. Gentlemen, I thank you.

That Copyright Case.

ALTHOUGH the Court of Appeal has decided that to reproduce broadcast music in public constitutes an infringement of the copyright, the Performing Right Society has intimated that it does not intend to concern itself with such reproduction in instances when it is done by traders solely for the purpose of selling radio apparatus.

There is a wide difference between such performances and the use of wireless merely as an additional attraction in an hotel or restaurant, and the announcement of the P.R.S. must come as a great relief to wireless traders.

The Wireless League.

I HAVE received for review the Handbook of the Wireless League, price sixpence. The League, which was founded in 1925, has most desirable and praiseworthy aims and a distinguished backing, its chairman being the Hon. Sir Arthur Stanley, C.B.E., C.B., M.V.O.

The Handbook of thirty-six pages explains those aims and includes much other information pertinent to the keen listener and radio enthusiast. Very substantial, practical benefits are offered to members, either "Full" or "Associate." For details apply to 12, Grosvenor Crescent, London, S.W.1.

East Writes to West.

SIR OLIVER LODGE has received a letter from a Mr. Abdelnoor, of Cairo, who claims to have written the first book on radio in the Arabic language. In asking Sir Oliver for a photograph of himself he says: "I have very quickly, not only felt acquainted with the scientists who have contributed to the subject of wireless, but have accumulated an inner admiration and friendship towards them.

"This sensation of love and respect has made me venture to write and request to be honoured by a signed photograph of your honour." Yes, that's all right, but what puzzles me is why our appreciative friend's first name is "Edmund."

"P.W." LEADS!

As we go to Press with this issue we are informed by our Publisher that the circulation of "Popular Wireless" for week ending October 21st exceeded

242,500

Economy Note.

I FORGOT to mention that in this month's "Wireless Constructor" there are two especially noteworthy economy articles, and as economy is still the order of the day I shall do you a service by inviting your attention to them.

Firstly, Victor King has a lot to say, in relatively few words, about "The New Economy Circuits"—a provocative article which is well worth a radio club's time as the subject of a debate. You, in private, can chew it over and get all the "goodness" for yourself.

Next, you have a working article on the "Constructor's" Two, a model of inexpensive efficiency which incorporates one of the new iron-powder-cored inductance coils—the article tells you why.

Evidence of Recovery.

AT a jolly luncheon given by Exide's in connection with the Motor Show I was much cheered by a couple of glasses of—that is, I mean to say by the remarks of Mr. D. P. Dunne, the managing director, who stated that the mighty Exide works at Clifton Junction were fully occupied in spite of the number of cheap batteries available.

He added that the condition of their export trade indicated a very definite trend towards trade recovery. Unless Ruritania goes to war with Mars—I use these names at random—I think that Britain, having already regained its position as the world's financial centre, will be predominant in trade in five years.

"P.W." Slips Up.

SACKCLOTH and ashes! We beat our bosoms and scrape ourselves with potsherds! We nuzzle the dust! All because A. G. A. (Pembroke Dock) has convinced us that we have omitted to publish details of a most important circuit. He observed a "set," called the "Human Analyser," which for the sum of one penny would read the character of the penny-giver "in a hoarse voice." Inside the set he saw some "P.W." dual-range coils.

Hence he demands: "Why was the circuit not published in 'P.W.'?" A fair cop, guv'nor! But perhaps our Mr. Dowding will vindicate us by designing a character-teller which will deliver its verdict in his best valvonium tones.

(N.B.—Oh, A. G. A., I agree with you about the B.B.C., but if it's not the B.B.C. then it's earache or taxes or gas-bills!)

Broadcasts from the Antarctic.

THE Byrd Antarctic Expedition, which has recently sailed, proposes to try to link up with the Columbia Broadcasting Company and so broadcast voices of its members all over America. Hot stuff! If this project is successful it will be a triumph of radio engineering, for the power available at the start will be only 1 kw., plus blizzards and penguins.

The first step is one of 4,000 miles, to Buenos Aires. There the output will be stepped up and retransmitted to New York, whence the broadcast will be delivered.

(*Continued on page* 428.)

TENS OF THOUSANDS

LAST week I was discussing the reason why I did not use the latest types of coil in the "S.T.500."

The factory type of set has recently been helped by the introduction of iron-cored coils, which are very useful, but only, in my opinion, in certain directions.

Better than the Best

I tried out very fully the use of iron-cored coils. Probably many of you who are reading this article on the "S.T.500" expected an up-to-the-minute set to embody the latest type of coil. In the search for simplicity I even ordered a special coil to be made which was unsuitable for ganging owing to its high efficiency, but gives good results when tuned by a separate condenser. The results obtained, however, were totally inadequate. The ordinary air-inductance coil with reaction applied in the manner adopted in the "S.T.500" gave an efficiency 5,000 per cent better than the best iron-cored coil.

This improvement is terrific. The use of multiple reaction was first proposed in my British Patent 232,659, and the improvement in H.F. amplification technique has at last enabled the advantages from it to be fully obtained. Two stages of reaction were employed in my last set, the "S.T. 400," and the selectivity thus obtainable has been tried by constructors all over the country.

Where Losses Occur.

The results, however, are even more striking, both from the point of view of selectivity and signal strength, when the reaction is applied in the manner of the "S.T.500" circuit, where the reaction is not distributed between the two circuits, but is individually applied to each. Actually this makes for very much greater simplicity of operation and the reaction is smoother.

Since reaction on the anode coil was capable of producing all the efficiency there desired, my concern as regards iron-cored coils was simply for the aerial circuit. The greatest losses in the whole set occur at this point, and I proposed to try an iron-cored coil to see if this would remedy matters. The improvement obtained by the use of an iron-cored coil was small.

It may be pointed out that I was using a comparatively large unscreened aerial coil and the iron-cored coil, of course, shows up to its best advantage when compared with the small screened type of coil, essentially inefficient, which is favoured by most set designers both for commercial sets and for constructors' receivers.

EXPLODING A FALLACY

The S.T.500 is unique in its ability to combine high sensitivity with a large reserve of selectivity. Previously, designers have accepted as an inviolable law that selectivity can only be gained at the expense of sensitivity. Mr. Scott-Taggart has proved the fallacy of this contention, and explains to "P.W." readers the new revolution in radio and its application to the S.T.500. He tells you all about it here.

When I applied reaction to an ordinary air-cored coil the improvement was amazing. No one who has never tried out such a test with double reaction can appreciate the extraordinary increase in volume accompanied by amazing selectivity. No one who has tried the experiment would consider for a second the use of an iron-cored coil. To do so would simply be playing with the problem instead of solving it.

No one would use a putty knife to cut a thin slice of bacon, yet this is exactly what one does with an iron-cored coil. I readily admit that such coils, in circuits where no reaction is applied, are definitely better than the usual comparatively inefficient air-cored coils, but the overwhelming superiority of a coil with reaction applied to it is startling.

All of you know how on a det. and L.F. receiver signals and selectivity are enormously increased by the application of reaction. (The effect on such a set is more noticeable than when an H.F. stage is employed, because in the latter case some inherent reaction is probably already there.) It is just that improvement which is obtained in the

BUILDING THE S.T.500!

"S.T.500" on *the aerial circuit*, and also on the output side of the H.F. valve. The benefits of reaction are repeated. Is it any wonder that the "S.T.500" gives such highly selective and sensitive results?

Such results are only obtainable by the use of an extra reaction control. It is the simplest thing in the world to adjust it. It is done in exactly the same way as the ordinary reaction control, and anyone who can work this can adjust the aerial reaction when it is needed.

To obtain all the benefits of reaction twice over must, and actually does, give such vastly superior results that the little extra trouble in tuning is well worth while, and it is here that the home constructor can gain hand over fist over the factory-built set of the same general type.

But if you do not wish to use this control, no one on earth can make you do so! The mere sight of the knob on the panel is not going to disturb your equilibrium so much that you will be incapable of operating the essential controls, namely the tuning dial and the anode-reaction knob. A bicycle with a Sturmey-Archer gear is no worse and no more difficult to ride than an ordinary bicycle, even if the gears are not fully used. The full benefit of the gears will not be noticed perhaps until a hill is reached. There are plenty of hills to climb in radio.

I have spent thousands of words in explaining why different conditions require additional controls, and why new technical inventions can be employed when one departs from the simplicity frame of mind.

WRITE TO ME!

I am not simply describing the S.T.500 and leaving it at that. I want you to have very real service and to have the confidence that "Popular Wireless" will help you to the utmost to get the very best out of your S.T.500.

Owing to the great volume of correspondence I may not be able to deal with every letter personally, but I am in the closest contact with the "P.W." Service and Query department.

Write to me of your successes, I shall be as glad to hear of them as I have been to help you to achieve them.

JOHN SCOTT-TAGGART.

But I have said little as regards the need for reserves of selectivity. The invariable rule in radio receivers, except in so far as reaction is employed, is that as the selectivity is increased the volume is reduced. This unfortunate see-saw results in the design of sets so as to give a fair proportion of selectivity and a fair proportion of sensitivity. You can only increase one at the expense of the other. In the "S.T. 500" you can control both.

When Sensitivity is Needed.

The conditions which require sensitivity are:

(1) Poor aerial of small size.
(2) Daylight reception.
(3) Reception in remote districts.
(4) Reception in districts notorious for bad reception.
(5) Where the receiver is stationed a considerable distance from a B.B.C. station.
(6) When the foreign station to be received is on a part of the dial which is not subject to heavy interference from the B.B.C.
(7) Where a foreign station is flanked by comparatively weak neighbours.

In all these circumstances you can "let the set out" without any reaction at all; you can increase signal strength by turning aerial and anode couplers more to the right.

Baffled Set Designers.

This autumn you will have offered to you by the various wireless papers a variety of set designs each clamouring for your patronage. Some of these sets have already appeared. And I do not fancy the task of the average constructor in choosing his set. Although I have had a wider experience probably than any other designer in this particular field, I cannot claim to say what the average constructor regards as a desirable set.

Set designers themselves are baffled by the public's attitude. A designer once popular may suddenly find himself eclipsed, and his set a damp squib. If such a state has not befallen me, I think it is because I am not pre-occupied with wondering whether the set will be a success or a failure and whether the public will like or dislike it.

SENSITIVITY

The designer who panders to what he imagines is public taste will find that the wireless constructing public will most ungratefully throw him over unless he can continue to deliver the goods.

This may seem like erratic and capricious behaviour, but actually the wireless public, as far as home-constructors are concerned, is hard headed and will not tolerate a failure.

As soon as one begins wondering whether the public will like or dislike one's set, it is inevitable that sacrifices will be made in order to conform to what one thinks the public wants. Every now and again the wireless constructing public will turn and follow false gods. The designer who brings them back to a true, even though somewhat different faith, has the opportunity of achieving a great success.

The "S.T.100."

My own experience is that wireless constructors will always consider a closely-reasoned proposition, even though it may fly in the face of all their existing ideas of what is right and proper in a set. Those of you who have known my set designs since 1923, and the many circuits I published long before that date, will find no real link between the different phases, and current practice.

In February, 1919, I published in the "Electrical Review" the tuned-anode-with-reaction circuit which was to sweep the country in later years. It was several years before its time, but it brought alive an extremely useful arrangement in the face of a whole multitude of possible circuits. Certainly no commercial receiver or Service set embodied the circuit, simple as it was. Curious as it appears now, the aperiodic H.F. amplifier was then the vogue.

In 1923, the "S.T.100" was the first of the nationally-built broadcast receivers for home construction. It was built in such huge numbers that it must have been of considerable influence in popularising broadcasting. The circuit arrangement was of the reflex type, a circuit quite unlike what everyone who had a wireless set was using.

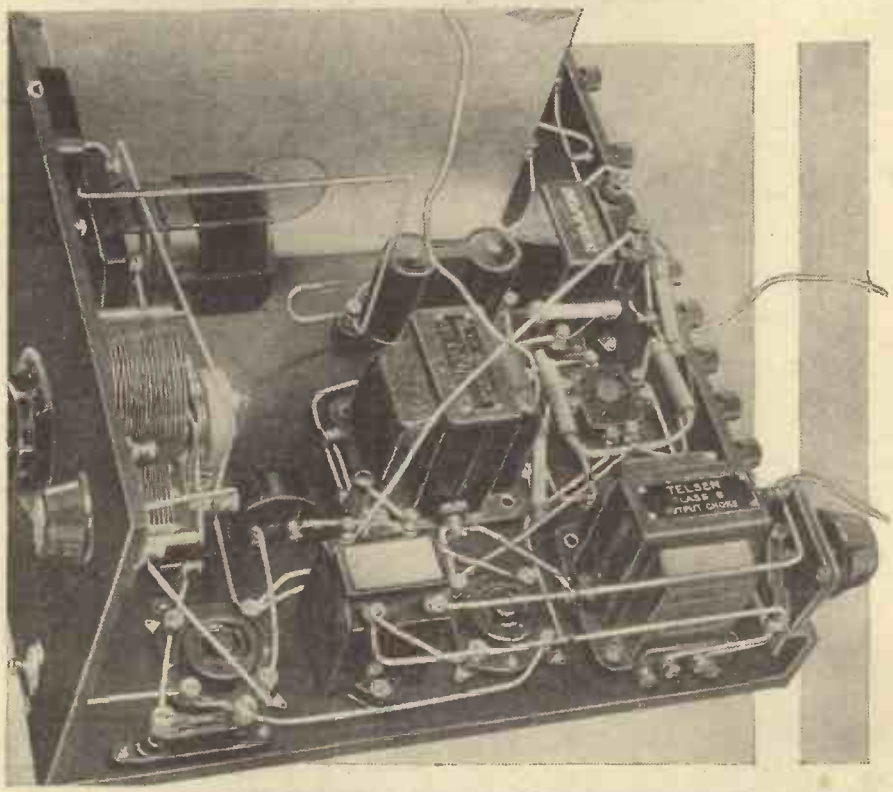
In 1925 and 1926 was perfected the Neutrodyne circuit which was embodied in two famous receivers, the "Elstree 6" and the "Solodyne," which were first developed by my Elstree Laboratories. The one-knob vogue dates from the introduction of the "Solodyne." When, on January 15th, 1932, I introduced the "S.T.300" after a long absence from radio journalism, everyone was astonished to find that I, who had been the high priest, so to speak, of simplified control, should go to the other extreme and produce a multi-knob receiver. Those who saw the set before publication shook their heads.

"You'll never get the public to take to the idea of a lot of knobs. They will be scared stiff of them. What the public wants is something to work and easy to look at."

I was not intimidated. I was aware, of course, before I designed the "S.T.300" that there was a section of the public who wanted simplicity at all costs and a set at no cost. How else could one explain the enormous popularity of cheap, simple reaction receivers of the kind which were regarded by me as so definitely obsolete that I was prepared to lose large sums in support of my principles?

The extraordinary success of the "S.T.300" is common knowledge, while the "S.T.400" enjoyed an even greater success. This receiver was taken by me on a tour of Great Britain, during which I visited the whole country from Land's End to John o' Groats. Probably many of you have read about it in the "Wireless Constructor." The set was tested in different zones round the B.B.C. stations, and you are —in the "S.T.500"— profiting from the experience gained in constructors' own homes.

ASTOUNDING VOLUME DUE TO PERFECTED CLASS B



An outstanding feature of the "S.T.500" is that it can deliver glorious volume without a trace of distortion. Perfected Class B and a good layout of the L.F. stages are the secret.

Double Reaction.

The keystone to the "S.T.500" as regards its selectivity is double reaction. A master patent for this invention was taken out by me on February, 1923, at a time when there was comparatively little interference and when the underlying idea could not be carried out to the best advantage because screened-grid valves were not introduced. Later the popularity of one-knob control and so-called simplified sets ruled out immediately the possibility of introducing reaction into more than one circuit.

During the last eighteen months, I have concentrated on the development of my original invention and by up-to-the-minute modifications have developed it out

The S.T.500 Defies the Coming Ether Chaos

of all recognition. Reaction has probably proved a greater friend to the wireless constructor than almost any other invention in connection with the valve. Stations which normally are inaudible can be built up to great strength by applying reaction, the principle being that the incoming oscillations are amplified, the amplified oscillations being then fed back on to the original ones in such a way as to strengthen them. The new strengthened oscillations are then amplified and again strengthened, and the process is repeated until very strong signals indeed are produced; the effect is actually practically instantaneous.

Building Up Signal Strength.

If the reaction is increased too far, the circuit will oscillate of its own accord independently of any incoming signals. "Oscillation" represents the extreme point of reaction and the efficiency of the adjustment depends on how near one can get to oscillation without oscillation actually taking place. Smooth reaction is therefore essential to the obtaining of the maximum benefit, but even under the most crude conditions of operation, reaction will increase signal strength of weak signals several hundred times.

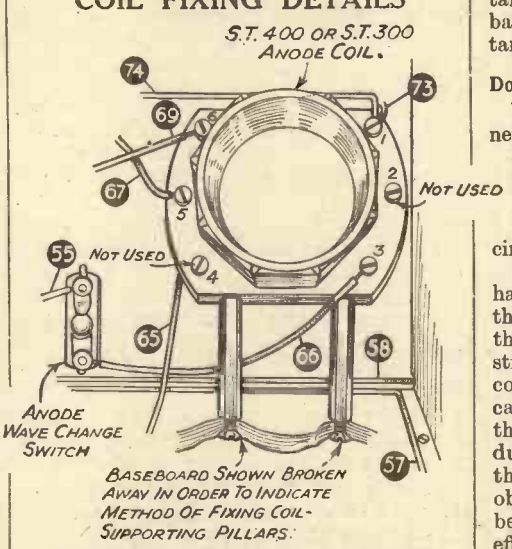
The benefits of reaction, however, are not limited to the building-up of signal strength. An even greater advantage is that selectivity is improved. In all tuned circuits there are losses in the inductance and in the condenser, particularly in the former. A resistance of 10 ohms, representing the high-frequency losses, will cause a big reduction in signal strength and selectivity.

Increasing Coil Efficiency.

The electric currents swing backwards and forwards in a tuned circuit in much the same way as the pendulum of a clock or the balance wheel of a watch. The effect of a rusted suspension may well be imagined. If we could mount a pendulum so that there were no losses, if a tap were given to it, it would go on swinging for ever. We cannot do this, but we provide a pivot with as little friction as possible, and we can lubricate it. Since, however, a pendulum would very soon come to rest, we have to keep it moving by giving it regular little taps and this is done by means of the mechanism of the clock or watch.

In a wireless tuned circuit we can increase the selectivity and signal strength to some extent by increasing the efficiency of the coil; we can increase the surface area of the wire, space the wires, use a low-loss former, and make the coil of generous size.

More recently, we have wound the coil on a core of powdered iron which enables



The anode coil is supported by pillars, which are fixed by screws passing through the baseboard.

us to use a smaller amount of wire, although losses are increased in other directions, but not to the same extent as the improvement. Iron-cored coils are about half as efficient again as air-cored coils of about the same size, but are little better than the best air-cored inductances.

Before reaction was invented, the design of efficient coils was of paramount importance, but the most elaborate struggles to increase the efficiency of a coil pale into insignificance when compared to the vastly greater effectiveness resulting from the application of even a small amount of reaction.

Improving the coil is like oiling the pivot of a pendulum, while reaction is like giving a knock now and again to the pendulum to keep it swinging. Since one is going to keep the pendulum swinging by applying energy from a local source there is little point in taking elaborate precautions to reduce losses in the pendulum; it is so easy to balance them out.

Where no reaction is employed, as in the case of most band-pass tuners, the iron-cored coil possesses distinct merit, but when reaction is applied resistance losses tend to disappear altogether. Reaction introduces what is known as negative resistance into a circuit, and may be made to balance out the positive or ordinary resistance of the circuit.

Don't Be Caught By a Catchword.

When the resistance is completely neutralised, the valve will oscillate, so that in the state immediately preceding oscillation the resistance of the circuit has been kept down to an extremely small fraction of an ohm and the circuit has become highly selective.

The manufacturers of iron-dust coils have, on the whole, been quite moderate in their claims and have made no attempt to throw some of the dust in the eyes of constructors. Although the words "iron core" are going to constitute the new catchword in radio, it is to be hoped that their readers will not be caught. The introduction of an iron-core is merely a drop in the ocean compared to the benefits to be obtained from reaction, even if the reaction be applied in the clumsiest and most ineffective manner.

Since reaction is only applied on one circuit in the usual set, there is plenty of scope for the most efficient types of iron-cored coils. A hundredth part of a loaf is better than no bread. Since I am giving you the whole loaf in the "S.T.500," the *relatively* insignificant advantages of iron-cored coils are comparable to holding up a candle to the sun.

Discrediting a Useful Invention.

Using iron-cored coils in the "S.T.500" would have been like giving a ham sandwick to an alderman ten minutes before a banquet at the Mansion House.

If you like, you can use iron-cored coils in the "S.T.500," but if you do I shall regard you as the type of person who would push behind a steam roller in order to help it along.

Some astonishing claims have been made for simple reaction sets using the iron-cored

A Signal-building Scheme that Improves Selectivity!

coils. I am very much afraid that those who encourage such a fallacy will bring discredit on quite a useful invention. Meanwhile, what coil manufacturer has thought it possible to leave off a reaction winding on an iron-cored coil? The use of an iron-core may necessitate a slight decrease in the amount of reaction used, but reaction currents are cheap enough in all conscience. They are normally a waste product.

Double Reaction's Double Benefits.

The extraordinary benefits of reaction are frequently under-estimated in the case of sets using a stage of H.F. amplification. This is because there is always some inherent or latent reaction effects which result in there being considerable reaction even with the knob intentionally at zero; under these circumstances, there is less scope for improvement when the reaction is increased. The best type of set in which to prove the benefits of reaction is the simple detector and reaction valve, followed by one or more stage of L.F. amplification.

Reaction is nearly always applied by the detector valve in a modern set to the tuned circuit preceding the detector. The multiple reaction system, however, applies all the benefits of reaction, not only to one tuned circuit, but to the others as well.

In a two-circuit receiver, it is customary to find that the aerial circuit tuning is flat, while the anode circuit can be made comparatively sharp by the aid of reaction. This is because circuit losses in the aerial circuit are left to do their worst, while in the anode circuit they are greatly reduced by reaction.

S.T.500 ACCESSORIES

LOUDSPEAKERS.—Blue Spot, W.B., Rola, R. & A., Epoch, Celestion, G.E.C., Atlas, Marconiphone, H.M.V., Ferranti, Ormond, Magnavox, Amplion. All above should be models suitable for Class B output valve used. In this case no output choke is needed in the set. Speakers only suitable for triode output necessitate the output choke in the set.

BATTERIES.—H.T.: Lissen, Ediswan, G.E.C., Ever Ready, Siemens, Pertrix, Marconiphone, Drydex, Hellesens, or Block H.T. accumulators.
G.B.: Ediswan, Siemens. Ever Ready, Lissen, Pertrix, Marconiphone, Drydex.
L.T.: Block, Lissen, Ediswan, Pertrix, Exide, Oldham.

OPTIONAL AERIAL AND EARTH EQUIPMENT.—Electron Superial, Goltone Akrite, Radiophone "Receptru" down-lead, Bulgin lightning switch, Graham Farish Filt earthing device.

This flat tuning is also experienced on all double circuit arrangements where reaction is applied to the second circuit. One designer even justified this flat tuning in the aerial circuit by saying that it assisted the search for foreign stations!

This is, indeed, making a virtue of necessity. It is actually possible to design a set without tuning at all! It is extremely simple to operate. No fiddling knobs, no adjustments to make, no reaction. It has only one disadvantage: all stations come in at the same time.

The overall selectivity of a receiver is due to the cumulative effect of the various tuned circuits. One can only use a large number of tuned circuits of ordinary selectivity or a very few with very high selectivity. The latter type of circuit possesses very many advantages as far as the home constructor is concerned. Hitherto, with the exception of my own receiver, the "S.T.400," a very mediocre amount of selectivity on the aerial circuit has been attained.

Converting the Sceptic.

The merits of applying reaction to the aerial circuit are so easily demonstrated on both the medium and long-wave bands that no one who has seen the effect would hesitate a second before fitting the extra control necessary. The most hardened sceptic will be the most enthusiastic user of this control on the "S.T.500."

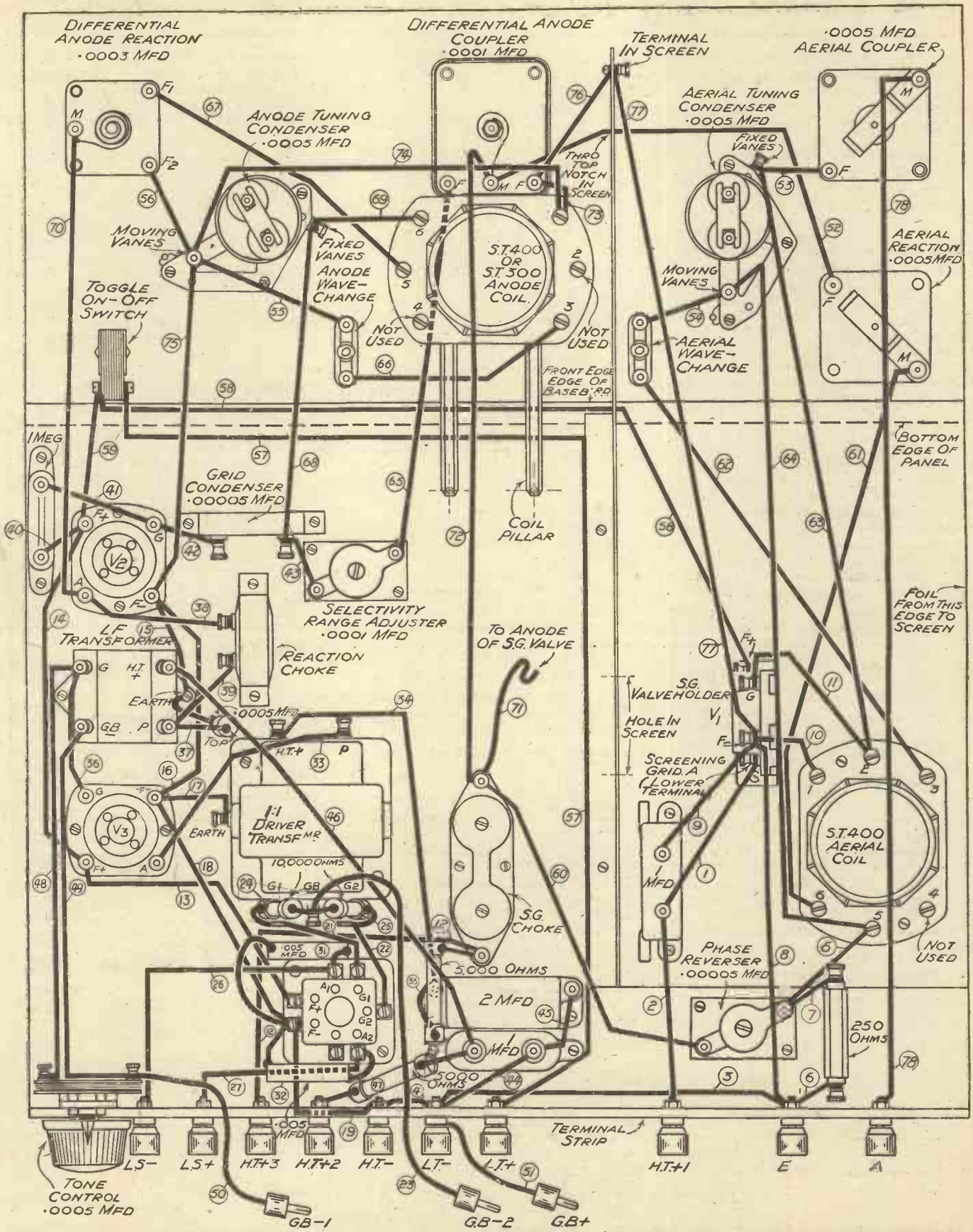
The ability to improve selectivity at will *while actually enhancing sensitivity* is bound to appeal to every class of listener.

J.S.-T.

COMPONENTS AND ALTERNATIVES AS OFFICIALLY APPROVED BY MR. JOHN SCOTT-TAGGART

Component	Makes used by Designer	Alternative makes of suitable specification recommended by Designer
2 S.T. 500 coils (same as S.T. 400 coils)	Colvern	Telsen, Wearite, Ready Radio, Lewcos, Sovereign, Goltone
2 ·0005-mfd. tuning condensers	Ormond, type R.493	Graham Farish, Polar, J.B., Utility, British Radiogram, Telsen, British Radiophone
3 ·0005 solid dielectric (preferably log mid line) variable condensers	Graham Farish "Litlos" log mid line	Polar, Telsen, Ready Radio
1 ·0001-mfd. differential reaction condenser	Telsen, type W.353	Graham Farish, British Radiogram, J.B., Polar, Igranic, Ready Radio
1 ·0003-mfd. differential reaction condenser	Polar	Graham Farish, British Radiogram, Telsen, J.B., Ready Radio
1 baseboard preset, ·0001 mfd.	J.B., type 1088	Graham Farish
1 baseboard preset, ·00005 mfd.	J.B., type 1087	Graham Farish
1 Class B driver transformer	Telsen, ratio 1 : 1	R.I., Lissen, Ferranti, Varley, Benjamin, Wearite
1 Class B output choke	Telsen	Ferranti, R.I., Lissen, Varley, Wearite, Multitone
1 L.F. transformer	Varley "Niclet," type D.P.21	Lissen "Hypernik," Ferranti. Telsen, Lewcos, L.F.T.6A, R.I. "Hypermite," Tunewell, Igranic, Multitone
1 S.G. choke	Telsen, type W 74	Graham Farish, Wearite, Lewcos, R.I. "Dual Astatic," Ready Radio, Bulgin S.5, Sovereign Super Amplion binocular
2 4-pin valve holders	Benjamin "Vibrolder"	Graham Farish, W.B., Telsen, Lissen
1 5-pin valve holder	W.B. "Universal"	Graham Farish, Lissen
1 7-pin valve holder	Graham Farish	Ferranti, Wearite, W.B., Benjamin
1 H.F. choke	Lissen, disc type L.N.5092	Graham Farish, Lewcos, Igranic, Telsen, Wearite, Amplion
1 1-megohm grid leak	Ferranti, synthetic type S.	Graham Farish, Dubilier, Erie, Ready Radio, "Thermion"
1 holder for same	Ferranti	—

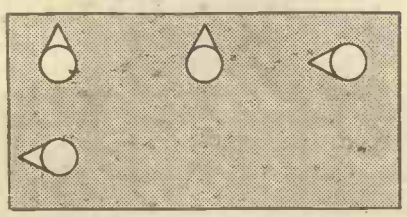
Component	Makes used by Designer	Alternative makes of suitable specification recommended by Designer
2 5,000-ohms resistances	Dubilier 1-watt metallised	Graham Farish, Erie
2 10,000-ohms resistances	Dubilier 1-watt metallised	Graham Farish, Erie
1 250-ohms resistance	Graham Farish "Ohmite"	Dubilier, Erie
1 2-mfd. fixed condenser	Igranic	Graham Farish, T.C.C., Dubilier, Telsen, British Radiogram
1 1-mfd. fixed condenser	T.C.C., type 50	Graham Farish, Dubilier, Telsen, Igranic, British Radiogram, Ferranti
1 1-mfd. fixed condenser	Dubilier, type BB	Graham Farish, T.C.C., Telsen, Igranic, Ferranti
2 ·005-mfd. tubular condensers	T.C.C., type 300	Graham Farish, Telsen, Dubilier
1 ·0005-mfd. tubular condenser	Graham Farish	Telsen, T.C.C., Dubilier, Igranic
1 ·00005 mica condenser	Lissen	Graham Farish, Dubilier, T.C.C.
2 push-pull on-off switches	Lissen, type L.N.5070	Telsen, British Radiogram, Benjamin, Wearite, Tunewell, Bulgin, W.B., Ormond, Sovereign, Ready Radio
1 toggle on-off switch	Bulgin S.80	—
1-ply baseboard (16 in. × 12 in.) with Metaplex section	Peto-Scott	—
1 panel, 16 in. × 7 in. × ⅛ in.	Peto-Scott	Permcol, Goltone
1 S.T.500 screen	Peto-Scott	Magnum
1 terminal strip	Peto-Scott	—
1 bracket for ·0005-mfd. variable condenser (tone control)	British Radiogram	—
10 terminals	Belling-Lee, type R	Igranic, Clix, Bulgin
3 wander-plugs (G.B.)	Clix	Igranic, Belling-Lee, Eelex
4 wander-plugs (H.T.)	Belling-Lee	Clix, Eelex, Igranic
2 spade terminals	Clix	Belling-Lee, Eelex, Igranic
Connecting wire (glazite 20 S.W.G.)	Lewcos	—
Flex, screws, etc.	Peto-Scott	—
1 anode connector	Belling-Lee	—
Special cabinet	Peto-Scott	—



Constructors who build the "S.T.500," and decide, at the same time, to equip themselves with a new loudspeaker, should purchase a special Class B type. It is then unnecessary to include in the set itself the output choke shown in the original blueprint. To make absolutely clear the alterations required when omitting the choke, this black and white reproduction of the original blueprint is given. It differs from the blueprint only in regard to the omitted choke. On page 437 you will find the necessary alterations to the Rapid Construction Guide (published in the October 21st number) when the design is to be modified in this way.

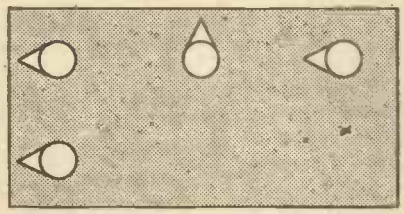
THE AMAZING FLEXIBILITY OF THE S.T.500 SIMPLY EXPLAINED

★ Aerial Coup'er. ★ Anode Coupler. ★ Anode Reaction. ★ Aerial Reaction.

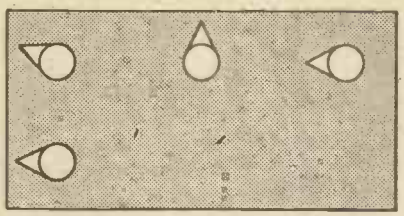


(1) All knobs at "normal." Loud signals; selectivity medium. Suitable for first tests, "local" reception and totally inexperienced users. Both reactions are at zero.

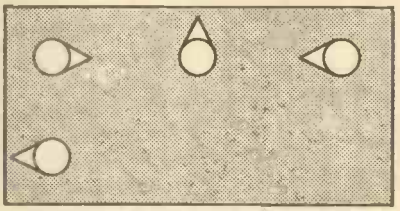
On the opposite side of this page are shown the names given to the controls. Wave-change switches are not given; they are pushed in for "Long" and pulled out for "Medium."



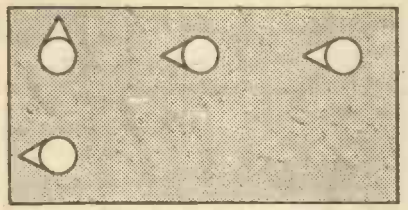
(2) Aerial selectivity is high, anode circuit selectivity medium. Signals weak. Aerial coupler has reduced volume. Both reactions are at zero.



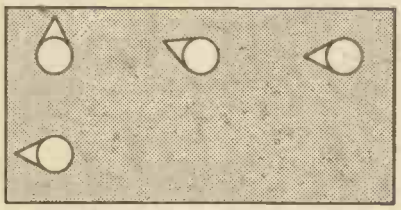
(3) As (2), but signal strength is greater because aerial coupler is increased; selectivity of aerial circuit slightly lower. Reactions still at zero.



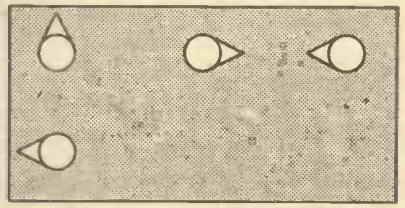
(4) Stronger signals than (3). Aerial selectivity poor. Suitable for daylight reception or very poor aerials. Reactions still at zero.



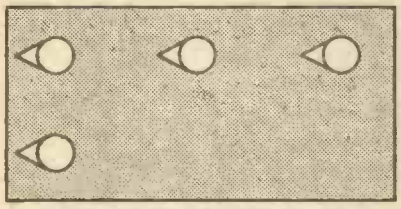
(5) Anode circuit selectivity good, but signals weak because anode coupler at zero. Rarely used. Extremely stable. No reaction used.



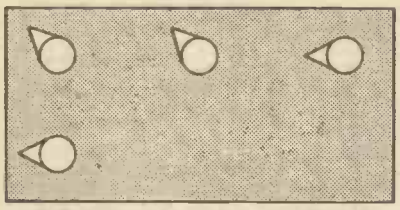
(6) As (5), but signals louder but anode selectivity rather less. Very useful for preliminary tests, local reception and totally inexperienced users.



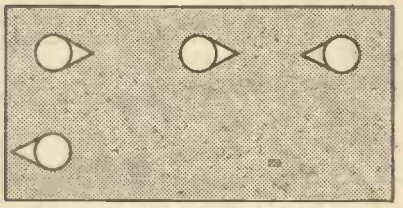
(7) As (6), but signals louder and anode selectivity at its worst. Set may be unstable with anode coupler at maximum. (Selectivity range adjuster may be reduced.)



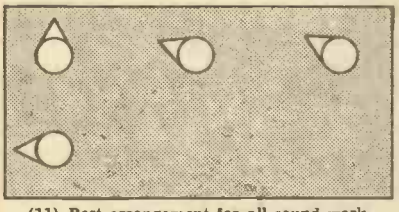
(8) Maximum selectivity (without reaction) and minimum signal strength.



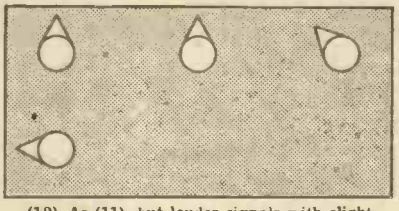
(9) Probably most usual best position of controls before applying reaction. Gives good selectivity and signal strength.



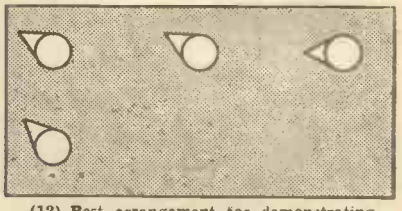
(10) Maximum signal strength before using reaction. Suitable for daylight reception, receiving long waves when little interference, poor aerials, etc. Set may be unstable owing to maximum position of anode coupler.



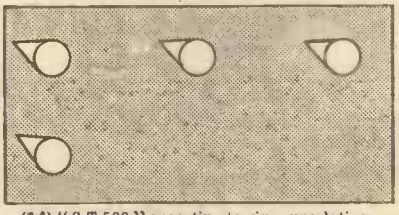
(11) Best arrangement for all-round work. High selectivity and signal strength. Anode reaction is in use. Control volume by aerial coupler.



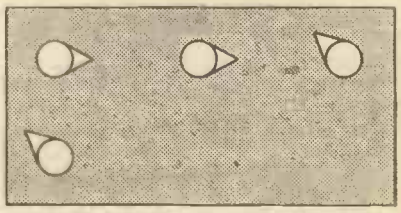
(12) As (11), but louder signals with slight reduction of anode selectivity.



(13) Best arrangement for demonstrating amazing effect on selectivity and signal strength of aerial reaction. Both couplers are kept partly to the left. Anode reaction is at zero.



(14) "S.T.500" operating to give superlative results as regards signals and selectivity. Double reaction is in use. Coupler positions may be tried a little more to right. In daylight, aerial coupler may be full right.



(15) Theoretical maximum signal strength obtainable with set. Anode coupler too far to right may, in some cases, impair smoothness of reaction.

82 STATIONS RECEIVED ON THE S.T.500

Below Mr. Scott-Taggart gives the dial readings of the aerial tuning condenser on the S.T.500 for 82 long- and medium-wave stations. The wavelengths and kilocycles quoted were those actually in use at the time the dial readings were noted.

LONG WAVES

Wavelength	Kilocycles	Name of Station	Aerial Dial	Wavelength	Kilocycles	Name of Station	Aerial Dial
1875	160	Huizen	144	1411	212·5	Warsaw	94
1725	174	Radio-Paris	130	1354·4	221·5	Motala	86
1635	183·5	Deutschlandsender	121	1191	252	Luxembourg	60
1554·4	193	Daventry National	112	1153·8	260	Kalundborg	53
1481	205·5	Moscow	101	1083	277	Oslo	40
1445·7	207·5	Eiffel Tower	98	1000	300	Moscow (T.U.)	23

MEDIUM WAVES

Wavelength	Kilocycles	Name of Station	Aerial Dial	Wavelength	Kilocycles	Name of Station	Aerial Dial
574·7	522	Ljubljana	173	325	923	Breslau	88
550·5	545	Budapest	168	322	932	Göteborg	87
542	554	Sundsvall	165	312·8	959	Genoa	82
533	563	Munich	163	309·9	968	West Regional	80
525	572	Riga	161	304	986	Bordeaux-Lafayette	78
517	581	Vienna	158	301·5	995	North National	76
509	590	Brussels No. 1	156	296·1	1013	Hilversum	72
500·8	599	Florence	153	288·5	1040	Scottish National	68
488·6	614	Prague	150	281	1067	Copenhagen	64
480	625	North Regional	147·5	279	1076	Bratislava	63
473	635	Langenberg	145	276·5	1085	Heilsberg	61
465·8	644	Lyons (La Doua)	142	273·7	1096	Turin	59
459	653	Beromunster	141	272	1103	Rennes	58
441	680	Rome	134·5	269·8	1112	Bari	57
436	689	Stockholm	133	267·6	1121	Valencia	55
424·3	707	Madrid	128	265·4	1130	Lille	54
413	725	Athlone	125	263·8	1137	Moravská Ostrava	53
408	734	Katowice	123·5	261·6	1147	London (Western) Nat.	51
403	743	Radio-Suisse Romande	121	259·3	1157	Frankfurt	50
398·9	752	Midland Regional	119	257	1166	Horby	48
389·6	769·9	Leipzig	116	255	1175	Toulouse P.T.T.	47
385	779	Toulouse	115	253	1184	Gleiwitz	45
381	788	Lwów	112	252	1193	Barcelona (Ass. Nat.)	44
376·4	797	Scottish Regional	111	249	1205	Juan-les-Pins	42·5
372	806	Hamburg	109	247·7	1211	Trieste	41·5
368·1	815	Seville	107	242·3	1238	Belfast	38
364	824	Algiers	105	240	1250	Radio Beziers	36
360·5	832	Stuttgart (Mühlacker)	104	239	1256	Nurnberg	35
356	843	London Regional	102	237·2	1265	Bordeaux-Sud-Ouest	34
348·8	860	Barcelona	99	235·5	1274	Christiansand	33
345	869	Strasbourg	97·5	227·4	1319	Flensburg	26
342	878	Brno	95·5	225·9	1328	Fécamp	25
338·2	887	Brussels No. 2	94	217	1382	Königsberg	17
331·5	905	Milan	91	214·3	1400	Aberdeen	15
328·2	914	Poste-Parisien	89	211·3	1420	Newcastle	12

THE MIRROR OF THE B.B.C. By O. H. M.

MR. LLOYD GEORGE TO BROADCAST

Mr. Churchill's grievance—A new attitude with talks—Vernon Bartlett's talk—Selling programmes to advertisers.

MR. LLOYD GEORGE has promised to broadcast on behalf of the "Wireless for the Blind" Fund from Churt on Christmas Day. It will be interesting to see if Mr. Lloyd George can bring in more money for this cause than Mr. Winston Churchill or Lord Snowden did on similar occasions.

Mr. Churchill's Anger.

I hear that Mr. Churchill is so annoyed at not being included in the special five minutes' disarmament series that he has told the B.B.C. that he will not accept any invitation to appear in debates on India and other subjects which Broadcasting House have been planning. It looks as if the B.B.C. has made a permanent enemy of Mr. Winston Churchill.

Adjusting the B.B.C.

The process continues of dividing the staff of the B.B.C. between "creators" and "executives." It is not as easy as it seemed on paper, the chief reason being the very human one that people who originate ideas do not lose interest in their application or the desire to be given credit for the ideas. I think we shall see before long a considerable revision of the new organisation at Broadcasting House. The alternative, of course, is that the B.B.C. will become enmeshed in the toils of a bureaucracy to which there is no parallel in any Government department.

Humanising the Talks.

I was gratified and not a little surprised to hear on good authority the other day that the whole system of B.B.C. talks is likely to be recast with a view to making it more human and full-blooded. It was interesting to know that Mr. Tom Clarke, ex-editor of the "News-Chronicle," may be given the task of overhauling the whole of the spoken word of broadcasting. I hope to hear this confirmed because there is no one else better qualified than Mr. Clarke for this great work. Incidentally, it is high time that a professional editorial mind was brought to play on programme building.

The Vernon Bartlett Talk.

No event since the episode of Poland has caused so much discussion in broadcasting circles as Mr. Vernon Bartlett's comment on the withdrawal of Germany from the League of Nations and the Disarmament Conference. The man on the spot who arranged the talk at very short notice was Mr. Lionel Fielden, the originator of the "News Reel" feature.

B.B.C. Recorded Programmes.

The B.B.C. has sanctioned an important departure from policy in order to try to get a sale for its recorded programmes overseas. In the past these recorded programmes were not allowed to be associated with commercial transmissions.

They are now thrown open to sponsors —that is, in other countries. It will be interesting to see whether the American advertiser, for instance, will care to take up the B.B.C. programmes to push his wares and services.

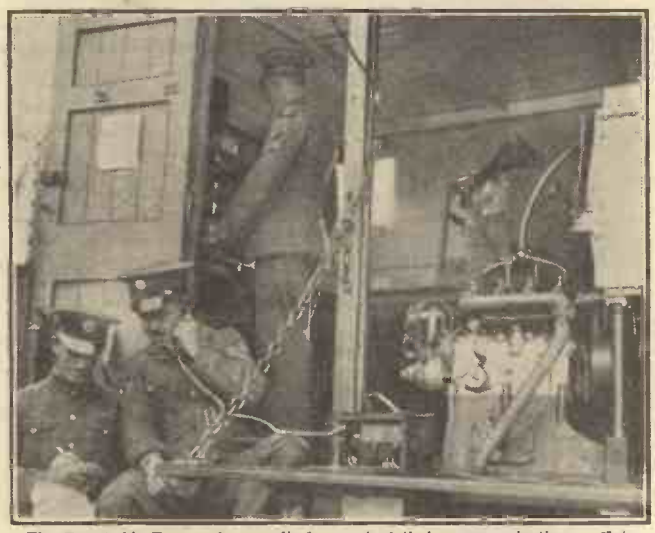
A Talk on St. Kilda.

The lonely island of St. Kilda, which was evacuated some time ago because the few inhabitants of this rock in the Atlantic found it impossible to endure the hardships and privations, or even to support themselves, is to be the subject of an interesting discussion between Mr. Colin G. Hamilton and Mr. Neil Gillies before the Scottish Regional microphone.

Mr. Gillies was an original inhabitant of St. Kilda, and this summer held the post of bird watcher on the island for the Earl of Dumfries.

Mr. Hamilton joined him for a few weeks, and together they lived alone, meeting with some interesting adventures and experiences, some of which they will recount for listeners under the title of "The Last Men to Leave St. Kilda."

RADIO IN THE ROYAL AIR FORCE



The Royal Air Force rely on radio for most of their communications. Not only are all 'planes fitted with suitable equipment, but they have a fleet of "radio lorries" which are used for emergency ground stations. It is one of these that you see above.

Organ Recital by Dr. Lowery.

Nothing but the works of northern composers will be played by Dr. H. Lowery, the organist at the Manchester College of Technology, in his broadcast recital for North Regional listeners on Wednesday, November 8th.

Some of these composers are no longer alive, but of those who are there will be works by Mr. T. W. Hanforth, organist of the Cathedral and City Hall, Sheffield; Sir Edward Bairstow, organist of York Minster; Mr. F. Wood, organist of the Parish Church, Blackpool; and Norman Cocker, sub-organist of the Manchester Cathedral.

Those dead include Charles Avison, a native of Newcastle-on-Tyne and an eighteenth century organist of repute; W. T. Best, who was born at Carlisle and spent most of his life as organist at St. George's Hall, Liverpool; and A. L. Pearce, who succeeded him in that position. Another Liverpool organist whose work will also be included is William Faulkes, who died only this year.

There is much to be said for linking programmes with personalities in this way.

(*Continued on page* 433.)

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes and on microphone personalities of the moment.

A CORRESPONDENT writing to "The Times," tells an amusing story of an attempt some years ago, during a plague in India, to broadcast by distribution (for it was before the days of broadcasting) a certain professor's address on the efficacy of inoculation. The address was translated into 40 different dialects, and "plague officers" were requested to distribute these in the several districts of the affected provinces. An immense labour! But all they got from the inhabitants for their pains was the derisive remark, "We don't believe it!"

* * *

I feel, somehow, that we may be prompted to say the same to Mr. Howard Marshall if he exposes many more stretches of country similar to the Bournemouth-Portsmouth stretch. I know this stretch well. It has often given me a pain. Otherwise I might suspect a little exaggeration on Mr. Marshall's part. It is magnificent (and depressing) work Mr. Marshall is doing. Good luck to him and to vanishing England!

* * *

The crisis in Germany provided some momentous speeches before the mike; in one case with commendable promptness. It is when the B.B.C. acts in this way that it proves itself a really vital institution possessing both courage and imagination. Mr. Bartlett's talk must have been heard with universal interest. It was, as usual, a very lucid talk.

* * *

I am a little surprised at the opposition that has been raised to it. Every one knows Mr. Vernon Bartlett and whom he represents (or does *not* represent). If listeners choose to associate him with anyone but himself they have only themselves to blame if they are misled. Mr. Bartlett's comments on world affairs ought to be quite understood as being his own by now.

* * *

Mr. Bartlett never approaches the mike with the same purpose as Herr Hitler, for instance. He never appears in the rôle of a dictator, but rather as an ordinary citizen with the extraordinary gift (this is my estimate of him) of being able to present a vivid picture of world affairs as seen through his eyes. In this unofficial capacity he is probably doing as much as anyone to cause listeners to view world affairs with an understanding that is free from bias and prejudice.

* * *

The part broadcasting played during the German crisis brought home to everyone the enormous power of this new weapon—a power for evil, if abused: for good, if used aright.

* * *

Mr. S. P. B. Mais' second talk, although not entirely free from atmospheric disturbances, wasn't as interfered with as his first was. But interference or no interference, nothing could seem to damp Mr. Mais' enthusiasm or *joie de vivre*. When so many talks nowadays demand such serious concentration, it is refreshing to be able to relax a little and listen to something

(*Continued on page* 434.)

Better 'Class B' *with..*

MARCONI

G. Marconi

Marconi B21 brings better 'Class B' performance to all battery sets because of these important features:

- **It operates with grid bias. Hence quality is better because the anode current cut-off is less sharp and the currents in the two halves overlap. This reduces spurious oscillation and gives less distortion at low output levels.**
- **For the same reason and also because two grids are used in each half, the sensitivity is higher, because the input impedance is higher and less power is needed from the driver valve.**
- **Greater overall magnification, because it is possible to use driver transformers having a higher ratio than those allowable with the zero bias type of valve.**
- **Shaped bulb and rigidly interlocked electrode system with top support means greater accuracy of matching —important in push-pull.**

B21

PRICE **14/-**

MARCONI VALVES FOR USE WITH B21

Marconi VP21	— The first Variable-Mu battery H.F. pentode, for all up-to-date circuits	**15/6**
Marconi S24	— High Efficiency straight screen grid	**15/6**
Marconi VS24	— High slope Variable-Mu screen grid	**15/6**
Marconi HL2	— Non-microphonic triode detector ...	**7/-**
Marconi L21	— High Efficiency Class B driver for normal use	**7/-**
Marconi LP2	— Power valve and Class B driver for sets where full output is needed ...	**8/9**

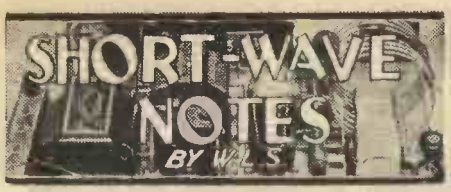
For full details and lists send this coupon to The Valve Department, The Marconiphone Company, Ltd., 210-212 Tottenham Court Road, London. W.1.

Name .....

Address .....

P.W. 4-11-33.

MARCONI VALVES
the choice of the experts



All the interesting news and views of current short-wave practice.

THE new receiver has been well and truly "run in" during the week. After one or two small adjustments had been made I was completely satisfied, and it is now used for the mere purpose of *listening!* I have sworn a solemn vow that this state of affairs shall continue, and that any experimental work that I want to do shall be carried out on other sets.

The present line that interests me most is the use of an ordinary output pentode as detector, resistance-coupled to an L.F. stage. So great is the signal strength that there is no need for the latter; but it is so difficult to match impedance when using a pair of headphones with a pentode.

Pentode Detectors.

Readers will probably remember that I rather decried the idea of pentode detectors a little while back, when "A. B. T." wrote to me on the subject from West Africa. At the special request of several readers I have taken the subject up again, and the result will, I hope, be a two-valver that is something out of the ordinary.

A set of this type, using two pentodes, would make quite a good loudspeaker receiver. Possibly a third pentode, used as an H.F. stage, would liven things up a bit. But where are all our triodes going?

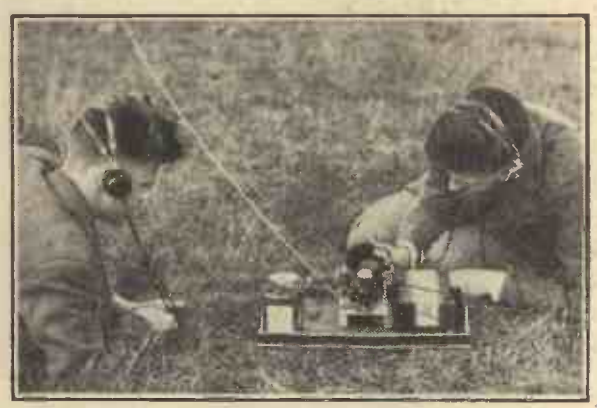
A long and interesting letter from "G. S. C." (C. for Canada!) has reached me from South Africa. G. S. C. uses tapped coils, with stud-switches both for grid and reaction coils, and appears to be very pleased with the arrangement. The chief merit of G. S. C.'s arrangement is that the two coils are compact and mounted in such a position that leads are quite short.

To be exact, the coils are mounted on the back of the front panel, just above the tuning condensers—an excellent arrangement. I can't say that I am particularly enamoured of the general principle of tapped coils for short waves, but I certainly admire G. S. C.'s way of doing the job.

The Upper Bands.

Being rather old-fashioned and conservative by nature (?), I don't trust dead-ends very far. But we mustn't turn anything down without trying it, and G. S. C., who is apparently quite a critical man, appears to like it very much.

GETTING DOWN TO FIVE METRES



The accusation that wireless as a hobby keeps its devotees indoors does not apply to 5 metres, which offers large scope for such "field" work as our picture illustrates. The two amateurs are operating their home-built portable 5-metre receiver.

One or two readers, notably "J. W.," of Edgware, send in logs of amateur transmissions on the 160-metre and 80-metre bands. The latter, by the way, is quite interesting nowadays. There has been a sort of swing of the pendulum in the amateur world.

For Local Work.

"Hams" in this country who have suffered from a surfeit of long-distance work on 20 and 40 metres have found themselves getting out of touch with their own neighbours, so to speak. The result is that the British amateurs use 80 metres largely as a rendezvous for meeting "locals."

I had hoped that the 5-metre band would eventually be "tamed" sufficiently to be used for this purpose, but we seem to have a lot more work to do yet.

The whole trouble with 5 metres at the moment seems to be location. If a couple of stations are favourably situated it is comparatively easy to work over a distance of 20 miles or more; but if screening is bad and the transmitters are working under unfavourable conditions, nothing on this earth will make communication possible.

This, at least, is the position as we know it to-day. What to-morrow will bring nobody really can tell.

A Good Station.

Returning to the world of broadcasting, there is not much to say except that W 2 X A D (19·56 metres) still holds his position as the "brightest star." In the early evenings he is usually exceptionally good, and his programmes are sometimes quite entertaining, if a little incomprehensible. Next to him the best station is certainly W 8 X K on 25·27 metres.

The Europeans continue to be so loud as to be a bit of a nuisance sometimes, but we can't have it both ways.

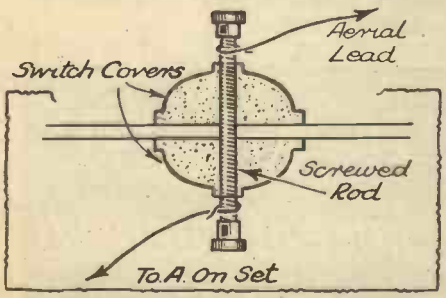
A WATERPROOF LEAD-IN.

AN exceedingly efficient waterproof lead-in can be very simply contrived from two covers from bakelite lighting switches. All that is required, in addition, is a length of screwed rod, two nuts and a couple of terminal heads.

A hole is drilled through the wall or roof of sufficiently large diameter to allow the screwed rod to pass through without touching the sides. Then pass the rod through the hole, place the switch covers on as shown in the sketch, and tighten up with the two nuts.

The aerial lead itself and the lead to the set

SIMPLE AND EFFICIENT



The simple materials required to make an efficient lead-in are to be found in most experimenters' "junk" boxes.

THREE TIPS FOR CONSTRUCTORS

Leading in the aerial—Ensuring good connection—A drilling hint.

are then clamped under the terminal heads on their respective sides of the lead-in.

POINTS ON CHASSIS CONNECTION.

WHEN using metal chassis finished with cellulose enamel great care should be taken to clean the cellulose off at any point where a connection is made to the chassis. If this precaution is not taken results may be very seriously affected.

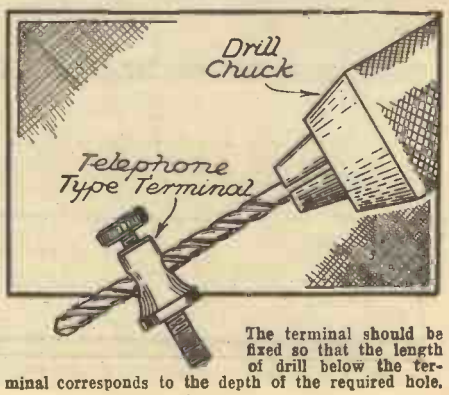
This point is also of importance when using other components, such as coil units or gang condensers which are cellulosed. For instance, the base of a coil unit should have the cellulose removed where it touches a metal chassis.

A USEFUL DRILL STOP.

A PROBLEM which often confronts the home constructor is to drill a hole *into* (as distinct from through) a piece of material. If an attempt is made to stop "just in time," the almost invariable result is that the drill goes right through owing to misjudgment of the depth to which the drill enters with each turn of the brace.

A method of preventing this is to employ a "telephone-type" terminal fixed on the drill as shown in the accompanying sketch. It will then be found impossible to drill a hole deeper than the length of the drill below the terminal. Such length should, of course, be the depth of the hole it is desired to drill.

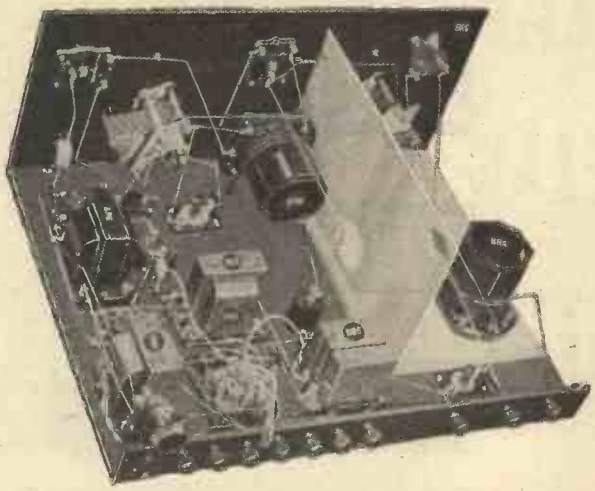
PREVENTS DRILLING ERRORS



The terminal should be fixed so that the length of drill below the terminal corresponds to the depth of the required hole.

B.R.G. S.T.500

EASIEST TO ASSEMBLE . . . EVERY PART GUARANTEED



Build Mr. John Scott-Taggart's greatest Triumph with a B.R.G. S.T.500 KIT expertly selected, guaranteed and tested.

COMPRISES: High Grade Tested Components, including Colvern, W.B., Graham Farish and Erie; all Terminals, Connecting Wire, Plugs, Screws, Metaplex Baseboard, Ready-drilled Ebonite Panel and Terminal Strip **with S.T.500 issue of "Popular Wireless," and Full-Size Blue Print.**

COMPLETE KIT *(Excluding Valves and Cabinet.)* **£4-10-0**

COLVERN COILS IN EVERY B.R.G. S.T.500 KIT

READ THIS AMAZING S.T.500 OFFER

Every Sealed **B.R.G.** S.T.500 Kit contains a coupon which entitles you upon request to a **B.R.G.** Guaranteed Long Life 2-volt Accumulator.

Take your Dealer's word . . . he has satisfied himself. He recommends the **B.R.G. S.T.500 Kit** because **he** knows B.R.G. stands for the biggest, keenest and most experienced group of Radio Experts catering for the Home Constructor today, men whose reputation depends upon the 100% efficiency of every sealed Carton carrying their name. By expert selection, matching and testing, your satisfaction and success is assured **before** the Carton is sealed—that is why the wise home constructor will build the new and wonderful S.T.500 with a **B.R.G. KIT.** Know that your S.T.500 is right. You cannot go wrong with a **B.R.G. KIT.** For S.T.500 reception at its absolute best, accept no other. **Let there be no regrets . . . refuse substitutes.**

B.R.G. S.T.500. S.T.300 to S.T.500 - Price 37/6
CONVERSION KITS. S.T.400 to S.T.500 - Price 45/-

B.R.G. S.T.500 SPECIFICATIONS

Type 29 Fixed Condenser.
1-mfd. - - - 2/-
2-mfd. (29/1) 2/6

Type No. 25 Slow-Motion Condenser.
·0005-mfd. - 6/6

Differential Reaction Condensers.
·0003-mfd. - 2/6
·0001-mfd. - 2/6

Type 49 Push-Pull Switches.
Two-point - - 1/-

B.R.G. Components stocked by all dealers. In case of difficulty write direct.

BRITISH RADIOGRAM

BRITISH RADIO GRAMOPHONE CO. LTD., PILOT HOUSE, CHURCH STREET, STOKE NEWINGTON, LONDON, N.16. *Clissold 6287/8*
Wholesale Distributors for PILOT AUTHOR KITS: METAPLEX BASEBOARDS: TELSEN PRODUCTS

Your dealer has B.R.G. Kits in Stock. In cases of difficulty forward us the coupon at once, together with his name and full address.

POST THIS COUPON

To BRITISH RADIO GRAMOPHONE CO. LTD., Pilot House, Church St., Stoke Newington, London, N.16.

Dear Sirs,—I wish to obtain immediately a B.R.G. S.T.500 KIT.

My Dealer is (NAME).....

(ADDRESS).....

MY NAME.....

MY ADDRESS..... P.W. 4.11.33.

ECKERSLEY EXPLAINS-

Many people are inclined to think that broadcasting must necessarily be carried out by "wireless"; but, as Eckersley explains, the use of wire to link listeners' homes with the studio is gradually becoming complementary to the radio method.

THE Dutch are very enterprising people. Certainly, if they were not *the* first, they were among the first to do broadcasting. Chelmsford was working in 1919, and the American adventure at Pittsburg was almost contemporaneous; but P C G G was, if my memory serves me, almost certainly transmitting before that time.

M. Braillard tells me he had a telephony station in Brussels or Liége or Paris (I forget which) before the war. I heard speech coming over the air in 1906—before the days of the valve. It was done by means of spark. But P C G G was really the first regular broadcasting station in Europe.

And now, in Holland, they are pioneering another new development—what I have called "Rediffusion," and many call "radio relay," and what other Europeans call "Centrales."

Making a Start.

Ten years ago a very young man, A. V. Bauling, got an amplifier, a receiver and some pieces of wire, and he wired up a few subscribers in a town just outside Amsterdam (I can't pronounce the name of the town, much less can I spell it!). From that small beginning has sprung a big industry.

There are 7,000,000 people in Holland. There are 600,000 people who listen to radio (estimated). Of these 300,000, or 50 per cent, get their radio via a wire from a central amplifier; they do not use sets.

A typical town has *x* houses, and of these half are wired for rediffusion—that is, 50 per cent of the houses. Fairly remarkable, I think.

I went to Deventer recently for an official "opening." It is "Mr. Bauling's town." He has the concession to operate rediffusion in that town. There are 4,000 houses wired, and the listener has a choice of *five programmes*.

All the main-feeder wiring is underground. The cable contains not only rediffusion conductors, but conductors for interconnecting sub-stations and for fire-brigade alarm purposes.

Their Own Studio.

In Holland people are allowed, with reservations, to initiate their own programmes. Thus gramophone concerts are given. Also, Mr. Bauling has a good-sized studio at his headquarters. The local unemployment committee were proposing to raise funds by giving a concert over the Deventer Centrale network.

The amplifier and feeder-board system was very interesting and beautifully "presented"—that is to say, it was nice to look at and, incidentally, very impressive. A total low-frequency power of over a kilowatt will be eventually legislated for, meaning that if every subscriber came on at once their loudspeakers would each have a power of 300 milliwatts available from the supply.

The B.B.C.'s Attitude.

Of course, rediffusion has not developed anything like so much here as in Holland. Firstly, it started later; but, secondly and more importantly, it has had most people's hands against it. The B.B.C. have said definitely that they are not in favour of the idea unless they control it, and I can perfectly sympathise with their point of view, given their job, outlook, etc.

Nor, probably, are you, as a wireless experimenter, particularly in favour of a system which does not depend upon wireless. Of course, I do not think that in England at the moment the wireless interest need fear the wire development terribly. Wireless must hold the whole field for a long time and a part of it always.

Britain has actually the biggest single unit of rediffusion in the world at Hull. There are more subscribers in Amsterdam than in Hull; but there are over 100 different companies in Amsterdam, while only one company in Hull is responsible for a service for, I think, about 13,000 people.

It is, I think, very interesting. I thought as "wireless" enthusiasts you would like to know something of how the art of broadcasting is developing. In any case, I do not think there is any necessity for people to make such a fuss about the terrible rivalry between rediffusion and the wireless set.

A Legitimate Field.

There is, obviously, as has been proved in Holland, a legitimate field of expansion for rediffusion; but, on the other hand, a competent authority told me that he thought that rediffusion probably reached its saturation when 50 per cent of the houses in a town were wired. Rediffusion in its present form, at any rate, cannot have much application in country districts.

So it seems as if, as usual, wire and wireless each have their separate functions and should be allowed to develop so that each of them serves the community in the way best suited to that community's needs.

The present chaos in the ether, which, so far from becoming better, looks like becoming much worse, is brought about because politicians, not technicians, are trying to force "technics" to give results which, in the nature of things, they cannot give. If a wide recognition of the facts about wire broadcasting took place officially as well as unofficially, there would be a new light brought to bear upon the at present unsolvable problem of wavelength allocation.

Looking Ahead.

I imagine a sane future in which wireless broadcasting is achieved by a relatively few high-powered long-wave stations separated in frequency by 20 kilocycles at least; while the urban districts are given the facility of choice between many really first-class-quality programmes in terms of the wire.

As I am continually emphasising, the long waves are greatly superior to the medium waves for consistent reception at a distance. Fading, the bugbear of long-distance medium-wave reception, would be eliminated, and the minimum station separation of 20 kcs. would ensure A1 quality.

Those listeners living in or near towns would have the programmes at their disposal, via rediffusion, without the bother of having to instal and maintain a radio receiver.

A NATION'S RECEIVER

The German Ministry of Propaganda is equipped with special receiving apparatus with which it keeps a watch on the ether so that anti-German broadcasts may be answered without loss of time.

RECEIVERS of RENOWN

THE TELSEN "464" RECEIVER FOR A.C. MAINS.

A REALLY good mains receiver for less than ten pounds. Not an unreasonable request in these days, but, nevertheless, one which is not too readily granted. But no radio enthusiast, constructor or listener has ever looked in vain to the Telsen Electric Company; so that it is not surprising, though none the less gratifying, that the "less-than-ten-pounds" request has been met this season by the provision of a new receiver, designed in accordance with the most recent developments, and called the Telsen "464" Receiver.

Built to Give Service.

Here is a set which has been built for a purpose. One might talk a great deal about "built up to a standard, not down to a price," or "quality comes before cost," or other such well-used phrases. But it is far more satisfactory to say that the Telsen "464" is the result of designing for the man who can afford a battery receiver, an all-mains instrument which is more than adequate for modern stringent conditions. The manufacturers make no extravagant claims for this new model. Some of their claims, in actual fact, are too modest, as we found when we tested the receiver. They put it forward as a thoroughly good set, and it is backed with a thoroughly reliable name. Its own merits act as its best publicity agent.

The Telsen "464" is a three-valve receiver, of the table type, for A.C. mains. Its indirectly-heated valves comprise an H.F. pentode, a detector and an output pentode, with, of course, a rectifier. The circuit includes a tuned H.F. transformer with reaction and a parallel-fed L.F. transformer coupled to the pentode which drives a powerful moving-coil speaker. It is interesting—and important—to note that iron-cored coils are used throughout.

Single-control ganged tuning operates an illuminated dial calibrated in wavelengths, about which we have more to say later. There is a selectivity control, a volume control and a tone control, the wavechange switch being the other control on the front of the set. The mains switch is at the back.

An Outstanding Set.

Those are the bare facts about which one can hardly sound enthusiastic. A very different state of affairs accompanies the performance of the "464."

We have no hesitation in saying that we know of no other receiver of this type, selling at less than ten pounds, which achieves such remarkable selectivity or boasts such extreme sensitivity. This we say as the direct result of exhaustive tests under actual working conditions. On an ordinary evening we found that no less than twenty stations (often more than this) could be depended upon for real programmes. And the joy of it is that the calibrated wavelengths on the dial correspond *absolutely* with the wavelengths of the stations. While testing many sets in this way we have had to make use of a wavemeter. The "464" was not the slightest trouble, and it was possible to check even the German relay stations.

The wavelength range seems to be extremely wide. On the long waves, for instance, Croydon can be received with quite a bit of the dial to spare, while the range goes well up above 2,000 metres.

The principal features of the "464"—for in these sophisticated days provision for extra speaker, pick-up terminals, trimmer and selectivity controls are taken as a matter of course, and are naturally incorporated—are the tone control and the design of the cabinet. The tone control has very wide limits and cuts off sufficiently to eliminate any heterodyne interference. The quality of the set—which is, quite frankly, above what one might reasonably expect—can be toned to any individual requirement.

TECHNICAL SPECIFICATION OF THE TELSEN "464."

All-Electric Table-Model Receiver for A.C. Mains, 200/250 volts, 40/100 cycles. Consumption 48 watts. Four indirectly-heated valves: H.F. Pentode, Detector, L.F. Pentode and Rectifier.

CIRCUIT.—Loosely coupled Aerial with selectivity adjustment. Tuned H.F. Transformer with reaction. Parallel-fed L.F. Transformer coupled to a Pentode Output Valve operating a powerful built-in Moving-Coil Speaker of the energised-field type. Iron-Cored Screened Coils used throughout.

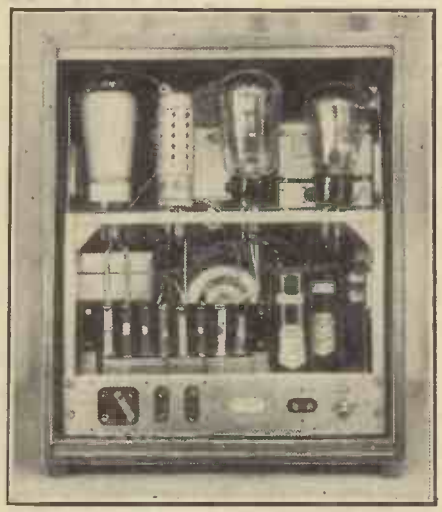
CONTROLS.—Single-Control Ganged Tuning with Trimmer, operating an Illuminated Dial calibrated in wavelengths. Selectivity or "Separator" Control. Volume Control, Tone Control, Wavechange Switch. Mains Switch at back.

AERIAL.—Indoor, Outdoor or Mains.

OUTPUT.—2·5 watts (undistorted). Provision for extra Loudspeaker and Gramophone Pick-up.

CABINET.—Table Model, finished walnut, lined in black, with sloping top for ease of tuning.

PRICE.—£9 9s. complete.



The features to notice in this back view of the "464" are (1) the Catkin valve, second from the left at the top; (2) the arrangement of the resistances below; and (3) the mains aerial switch and pick-up and additional speaker sockets at the bottom left-hand side.

Unique Cabinet Design.

As for the design of the cabinet, this is both æsthetically and practically as perfect as it could be for a set of this type. The sloping front, which enables the dial readings to be seen with unusual and most commendable ease, is a new departure which might well become standard on table-model instruments. The walnut finish, lined in black, makes the "464" a worthy addition to the designs of 1934.

The question of hum in a mains set is one which has, without doubt, given rise to some qualms in the minds of prospective purchasers whose previous experience has been confined to battery sets. Consequently, in the "464" what is known as a "hum adjuster" has been provided. This is rather a "hum minimiser," and in certain cases would prove most useful. In our own tests, however, we never found the least need to use this refinement. Although the set was tested on mains which have proved troublesome in other cases, there was never the least trace of hum.

Provision for Mains Aerial.

Finally, the mains aerial must have a word to itself. The utility of a mains aerial lies chiefly in its convenience in circumstances where an external aerial cannot be used or when it is desired to use the set in different rooms. It is not intended as a substitute for a proper aerial under ordinary conditions. At the same time, we found that it could be used to bring in almost all the British National and Regional transmitters, as well as several programmes from the Continent.

In a year when the whole trend of design has been revolutionised it takes no little courage for a manufacturer to stake his reputation upon one single new model, and that a model which depends for its success not upon spectacular novelties but upon the inherent quality of its design. But Telsen have had the courage of their convictions and have produced an instrument which is worthy of all the traditions of a famous firm.

The price of the Telsen "464" is £9 9s. As value for money it is unexcelled. But, in addition, it is a receiver which follows modern practice both in design and in its suitability for the all-exacting requirements of the listening conditions of to-day.

"MAN-MADE" STATIC

With the rapid growth of the grid system of distributing electricity throughout the country, more and more listeners are experiencing interference from electric fans, motors and so forth. Unfortunately it is not always possible to tackle the trouble at its source, but much can be done at the receiving end as explained below.

By L. H. THOMAS.

OF all the blessings conferred upon mankind since the introduction of radio it is hard to find one more universally agreed upon than the extension of A.C. lighting and power mains to every corner of the country. The famous "grid" scheme is now practially complete, and before long it will probably be difficult to find a village without electric light.

For every good thing, unfortunately, we have to pay in some way or other, and the mains have brought along their little trials and tribulations with them. Quiet little backwaters that used to be ideal for radio reception owing to the quiet background and complete absence of "man-made static" now make their own little welkin ring in no uncertain fashion with vacuum cleaners, electric fans and (horrid thought !) dirty switch contacts.

A Noisy Fan.

In many of these cases the harassed owner of a receiver is quite helpless, unless he happens to be a philanthropist, until the G.P.O. takes the matter up. By this I mean that he can't cure the trouble at *his* end, but has to go round to the owners of the offending pieces of apparatus and fit them (the pieces of apparatus, not the owners) with "silencers."

My own eyes were opened in this way when I listened one morning quite recently and heard a most horrible racket. Nothing below 50 metres could be heard through it ; it was a continuous scrape-cum-buzz, with a slight rhythmical tendency, obviously produced by a very sick electric motor.

I lost no time in rigging up my receiver in the car, complete with "fishing-rod" acrial as used for five-metre work, and trying to locate it. After driving up and down the road several times I could tell that it was louder at the "south" end.

Going into the road that runs at right angles to my own at the south end, I repeated the procedure. To cut a long story short, by the "getting-warmer" method I eventually traced it to a block of shops *half a mile from home.* After interviewing several shopkeepers, I found on the counter of a grocer's store a small electric fan running suspiciously slowly.

The Use of "Suppressors."

A loose brush was the trouble, and the consequent sparking was what was playing havoc with the short-wave ether in my neighbourhood.

Now there is an excellent object-lesson for you. A small fan at half a mile, if undetected, would have been the end of my short-wave career ! It was out of order, it is true, but a fan at a tenth of that distance and working properly may have its effect upon the quietness of the background.

As I have often said, a law compelling the use of "suppressors" on electrical apparatus that is capable of radiation is long overdue. Till it arrives, what can we do ? First and foremost, we must see that our own end—the receiver—is above reproach.

This is particularly the case when it is run from the mains. Fig. 1 shows a filter circuit that is more than sufficiently good to look after things. Two H.F. chokes in series with the mains, and two by-pass condensers in series, with the centre-point earthed, are used.

Making the Chokes.

It is *important* to see that the chokes are wound with wire of a gauge sufficient to carry the full current taken by the eliminator in use, and that the condensers are of a reputable make capable of working at about 150 volts A.C. With two in series this gives a reasonable margin of safety.

I have always found chokes of the long, thin variety most efficient. Wind them on a length of wooden dowel, about 1 in. in diameter, or, if possible, a cardboard former with a diameter of 1 in. or 1¼ in. The usual small receiver and power supply will generally consume something of the order of 30 watts at the very most, so that the current we have to allow for is only of the order of ·15 amp.

If we wind our chokes with No. 20 or No. 22 enamelled wire we have allowed a good margin of safety, and we shall not have dropped the voltage to a measurable extent, because, fortunately, the turn numbers need not be very high.

Don't Take Liberties !

Two chokes of 50 turns each on a 1-in. former are, I find, excellent for the job. The whole filter should be neatly made and wired up with insulated wire or stiff wire covered with sleeving. Don't take liberties or be untidy when dealing with the mains ! Mount it somewhere out of the way, where screwdrivers and other instruments can't fall across the terminals !

Remember that the purpose of the filter is not to stop H.F. from the set from going down the mains, but to stop H.F. in the form of "man-made static," which is travelling along the mains, from finding its way into the set.

Battery-set users in general will find less trouble from "man-made static," but they, too, can take certain elementary precautions against it. For broadcast receivers the screened lead-in is, of course, a very valuable asset. For sets of all kinds a good, direct earth lead with a business-like connection at the far end is essential.

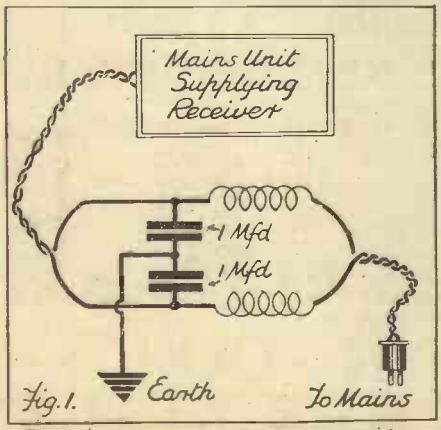
Unfortunately for short-wave listeners, the screened aerial lead-in is not often a success, as much of the "mush" that they receive is actually picked up on the top part of the aerial, and it doesn't matter much whether the lead-in and the set itself are screened or not.

Remember that "man-made static" can be divided into two very definite categories : that which is really radiated into the ether, and will, therefore, be picked up on the aerial, however high and clear that aerial may be ; and the more insidious kind that does a kind of "wired-wireless" performance along the mains. Even a battery set may be affected by that kind, if the mains are in the house.

Tests for its presence may easily be made by switching off at the mains. This, too, will show up any dirty contacts or "power leaks" in the house wiring.

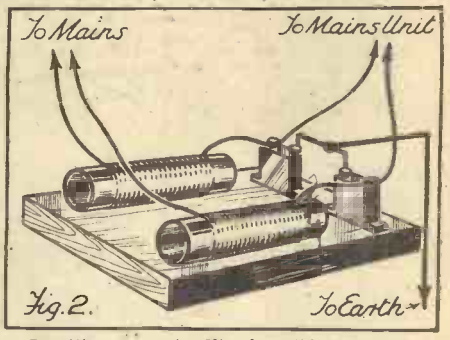
Interference that cannot be improved, whatever one does to the receiver, aerial or earth systems, however, is by no means rare, and this must be tackled at the "transmitting" end. How it is done I hope to show in a future issue.

AN H.F. MAINS FILTER



If troubled with noisy reception when drawing power from the mains, relief may often be obtained by "filtering" the mains supply.

WIRING THE CHOKES

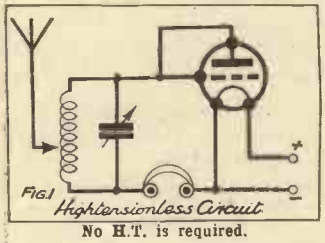


In setting up a mains filter, long, thin chokes are generally most satisfactory.

RECOMMENDED WRINKLES

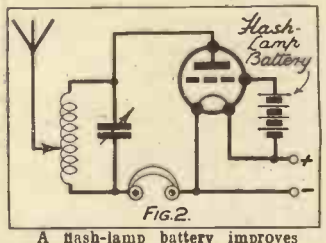
IMPROVING A CRYSTAL SET

THE crystal set is more or less a bother to use owing to the frequent adjustment of the crystal. In place of the crystal a valve can be used in the following manner :



No H.T. is required.

The valve is inserted between the top of the tuning-coil and the phones in the same way as a crystal. The electrons from the filament serve to rectify the oscillating current set up in the coil. The plate and grid can be joined together as shown, but little difference will be observed if the plate is left unconnected.



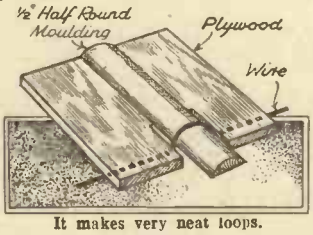
A flash-lamp battery improves results.

Any valve seems to serve if it has a fairly high impedance. A ·06-amp. detector gives economy of filament consumption. Using a rheostat and running the valve at ·05 amp., a 20-amp. accumulator will last a long time.

No H.T. is used and the strength obtained is crystal strength. To get greater power, obtain a flash-lamp battery and put the positive terminal to the grid, the top of the tuning-coil to plate, as in Fig. 2.

NEAT BENDS.

HERE is a rough drawing of a little gadget I made for looping wire when it has to cross another lead. It is made of plywood and a piece of half-inch, half-round moulding; it is quite simple and needs no explanation.



It makes very neat loops.

The wire is looped over the projecting end of the moulding, then passed along into the slots and bent up under the base, giving a very neat loop.

RECORD REPRODUCTION WITHOUT VALVES.

THIS wrinkle is intended primarily for those readers who possess a battery radiogram and, in addition, a pair of headphones. It occasionally happens that one's L.T. battery will give out unexpectedly and a fresh one is not available. There is no need to be without music, however.

The simple expedient of connecting a pair of headphones in parallel with the pick-up leads will, provided the phones and pick-up are reasonably sensitive, provide excellent reproduction of gramophone records in the headphones.

Perhaps the best method is to equip the 'phone leads with crocodile clips so that they can be clipped on to the pick-up leads quite easily.

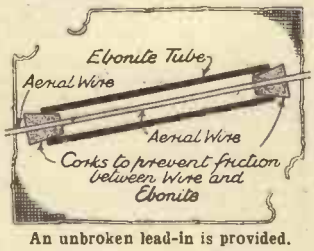
If the pick-up is provided with a built-in volume control, the latter should be turned to the position which gives maximum volume.

AN IMPROVED LEAD-IN.

A VERY useful little dodge for an aerial lead-in can be rigged up simply in the following manner :

Instead of the usual ebonite lead-in tube complete with brass rod, with the connecting nuts at the end, I use only the ebonite tube in conjunction with two corks.

The sketch shows roughly the idea of things—the point being that the two corks stop all friction between



An unbroken lead-in is provided.

the wire, or in some cases, the wire's insulation, and the ebonite. In my own case, I have heavily taped over the two joints, and on top of that there is a nice heavy layer of battery pitch.

The beauty of this idea is that one is able to have a really efficient *unbroken* lead-in.

FITTING KNOBS.

PRACTICALLY every radio experimenter has at some time found himself faced with the problem of fitting a knob having a ¼-in. hole on the shaft of a component whose size is ⅛ in. If a split metal liner is available of the correct size, the fitting of the knob becomes child's play.

When, however, it is necessary to pack the knob with tinfoil, the result is usually a knob which operates eccentrically or which is not true with respect to the panel.

This can usually be overcome by wrapping round the shaft a length of copper wire of correct size.

In most cases it will be found that No. 28 S.W.G. will serve the purpose, and this should be wound tightly round the spindle and the ends cut off neatly.

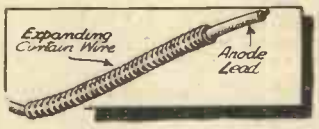
It will be found that the grub-screw, especially if it is pointed, will force its way between the turns of wire and grip on the component shaft, whilst the wire will serve to hold the knob in a central position.

If desired, bare wire can be used, which can be tinned after shaping it round the shaft, forming an excellent liner.

SCREENED ANODE LEADS.

WHEN making up a screened-grid three I experienced great difficulty in obtaining a screened anode lead of sufficient length, so I bought a small expanding curtain wire which I found ideal for the purpose.

I used an ordinary piece of connecting



The screening is made from curtain wire.

ONE GUINEA FOR THE BEST WRINKLE !

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others will be paid for at our usual rates.

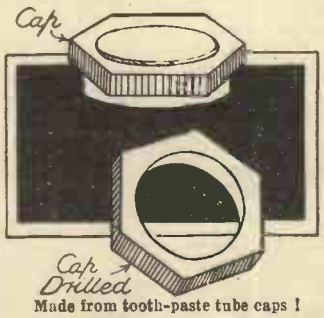
Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear ?

The best Wrinkle last week was sent by Mr. F. N. Bedwell, Rosemont, Evesham Road, Stratford-upon-Avon.

NOVEL BUSHES.

IT is not commonly realised that the bakelite or composition caps from various makes of tooth-paste and shaving-cream tubes make excellent insulating bushes if carefully drilled with a hole the proper size.



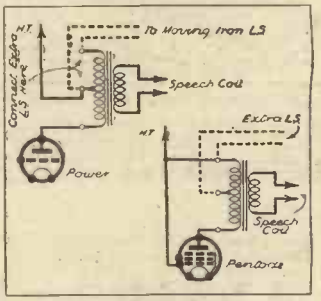
Made from tooth-paste tube caps !

The two sketches make the method quite clear. One shows the type of cap and the other the cap drilled.

The panel should be drilled so that the narrow portion of the cap will just slip into the hole.

THAT EXTRA LOUD-SPEAKER.

IF one possesses a receiver of the console type, employing a moving-coil loudspeaker, it is sometimes desirous to run a moving-iron speaker externally. If this is connected either in series or parallel with the primary of the moving-coil loudspeaker, a drop in quality is generally experienced.



A simple method of adding an extra loudspeaker.

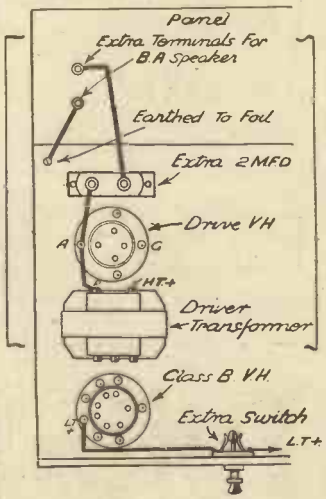
This can very easily be overcome, if the moving-coil transformer has a primary split for power or pentode, by connecting as shown in the diagram. I have employed this circuit and have never noticed any change in volume or quality of reproduction from the moving coil.

SWITCHING OUT CLASS B.

HERE is an idea I use which works well with the Class B Four. Perhaps many readers (like myself) do not always require the very great volume this set gives and would at certain times like to switch out the Class B valve and use a balanced-armature speaker.

The sketch shows the very simple extra wiring and parts required, which are : one 2-mfd. fixed condenser, two terminals, and one L.T. switch, and one screw for earthing a terminal to the foil.

To switch out Class B valve and use B.A. speaker, push in switch on terminal strip and connect B.A. speaker tags to terminals on panel. To switch in and use Class B, pull out switch and disconnect *both* L.S. tags from terminals on panel.



The Class B valve is switched out when not required.

The driver valve becomes an ordinary output valve to which the B.A. speaker is choke-filter coupled, the transformer primary being the "choke."

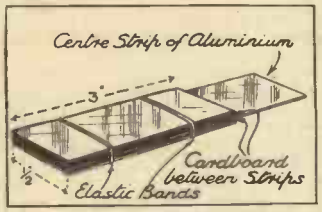
(Continued on next page.)

RECOMMENDED WRINKLES

(Continued from previous page.)

A SELECTIVITY DEVICE.

ALL that is required are three pieces of aluminium, 3-in. long and ½-in. broad; 2 pieces of cardboard, 3-in. long, and ½-in. broad; two elastic bands.



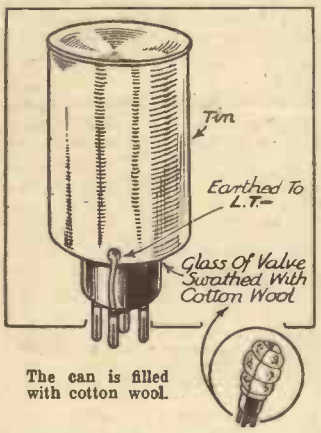
For improved station separation.

Place cardboard between strips of aluminium and bind with elastic. Pull out centre strip of aluminium and connect to aerial lead (which is disconnected from set for the purpose). The two outside strips of aluminium are connected to aerial terminal on set. When set is switched on selectivity is varied by pulling out or pushing in the centre strip.

AVOIDING MICROPHONY.

THE following is a good cure for microphonic valves:

Wrap the glass part of the valve in cotton wool and bind with cotton or



The can is filled with cotton wool.

something similar to keep the wool on. Then place over this an empty cocoa tin. Earth this in the usual manner, viz. to valve's negative pin.

STRONGER JOINTS.

TO avoid breaks between flex and soldering tags the following scheme is useful: Instead of cutting

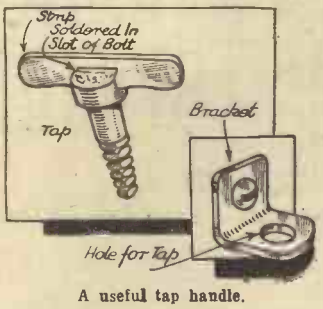
When finished bind with insulating tape.

off the insulation, slit it about the length of the tag shank, solder wire and tag, replace joint in insulation, tape tightly, leaving only ring showing. This method receives the benefit of the strength of the insulation.

THOSE PANEL TAPS.

PANEL taps, made from brass or steel bolts which are to be found in many radio constructors' tool kits, can be made much nicer to handle by the fitting of short strips (metal) to the bolt heads, soldering being best, as is illustrated.

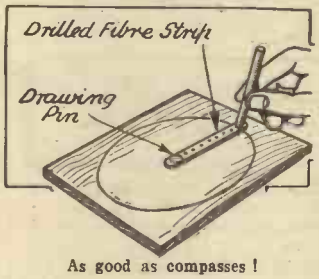
To carry these taps in the tool cabinet small brackets can be made.



A useful tap handle.

FOR LARGE CIRCLES.

ENTHUSIASTS who make their own plywood loudspeaker frets, and who do not have a pair of compasses with extension leg handy for marking out circles of large radius, will find an efficient substitute can be made from a strip of fibre, drawing pin, pencil and ⅛-in. drill. Along the fibre strip, which should preferably be ⅛-in. thick by 9-in. long by ½-in. wide, is drawn a centre line, and at



As good as compasses!

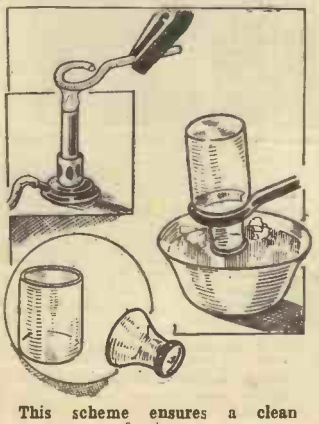
½ in. from one end of the strip on this line is drilled a ⅛-in. hole; this forms the "centre" hole. At distances 2 in., 2½ in., 2½ in., etc., from this hole other holes ½ in. are drilled along the line, increasing by increments of ¼ in.

The strip is placed over the plywood to be marked and a drawing pin inserted in the "centre" hole of it and pressed into the wood, the strip being free to rotate. The point of the pencil is inserted in the hole of required radius from the pin, and on the simultaneous pressing of the pencil and rotation of the strip the required circle results.

HOME-MADE H.T.'s.

WET H.T. batteries may be made up cheaply if a number of small bottles are treated in the following manner to remove the tops cleanly:

Make up an eyepiece from three-eighths iron to suit the top of the bottle. Make it red hot and place it in the position shown on the bottle. Leave it for a minute or so, and then plunge the bottle into cold water top downwards. Square-shaped bottles can be treated in the same manner by making the eye or loop square and

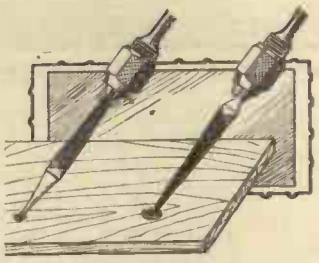


This scheme ensures a clean fracture.

using in the same way. This provides a use for small bottles which could not be disposed of otherwise, and reduces the cost of making up the battery.

MAKESHIFT DRILLING.

AN easy and quick way of drilling and enlarging holes in ebonite and wood panels, without a drill, is to get an 8-in. three-corner taper or half-round taper file and a carpenter's brace.



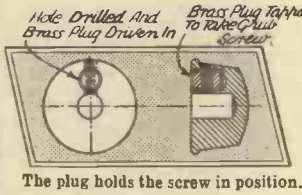
If you want to make a hole in a hurry, try this idea.

Start by putting the taper end of file into the chuck of the brace (after sharpening the point of the tang of file) and drill hole with the tang of file. When through up to the end of the tang of file, pull out and reverse the file by putting the tang of the file into the chuck.

Then you will be able to make a ⅜-in. hole very easily. Do not put too much pressure, as it cuts very quickly. Remove rough edges with sandpaper. It can also be used for enlarging holes in copper sheet and cast iron. Larger holes can be made by using larger files.

REFIXING GRUB SCREWS.

THE attached sketch shows a method of securing a grub screw in a bakelite knob in which the thread



The plug holds the screw in position.

has been stripped. It consists in drilling a hole parallel to the spindle hole and inserting a brass plug which is afterwards drilled and tapped in position to take grub screw. The sketch is self-explanatory.

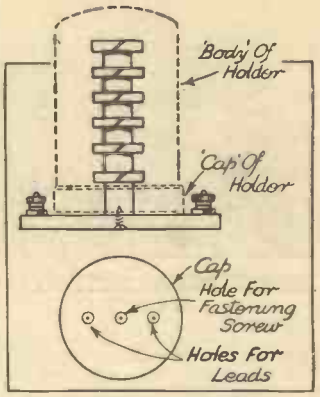
ANOTHER USE FOR CHATTERTON'S.

THIS very simple dodge will be found very useful when inserting screws in awkward positions: Heat a small piece of Chatterton's Compound in a match flame and place on the tip of the screwdriver blade. When tacky insert the blade in the slot of the screw and the two will adhere quite firmly. The screw can now be inserted in any position required. Chatterton's Compound is useful for a variety of purposes, such as filling in holes in ebonite panels, and can be obtained at any electrician's.

SCREENING AN H.F. CHOKE.

AT the present time many readers will be wondering whether a screened H.F. choke will improve their sets. Here is an idea which will enable them to find out without spending any unnecessary money, providing they already have a choke of the type shown in the diagram. The idea consists in enclosing the choke in an aluminium shaving-stick holder, which the majority of readers will have lying about.

First take the "cap" of the holder and drill three holes in it; the centre hole to take the screw which fastens the cap and choke to the ebonite base and the remaining two holes to pass the leads from the choke through the base to the terminals. With the cap

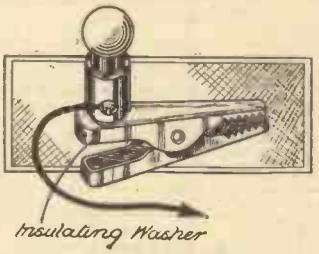


Screened with a shaving-stick tin.

fastened between the base and choke it only remains to push the body of the holder into the cap and you have an efficient screened choke.

A CLIP-ON LAMP.

THE accompanying sketch shows a crocodile clip with the connecting screw replaced by a slightly longer one passing through the base of a bulb holder (cheapest type).



Always ready when needed.

From the side of the holder a flex lead goes to the L.T. terminal that is *not* earthed. Then by clipping on to any earth wire you get a light; you can thus test any earth lead for continuity (providing the L.T. is connected to the set).

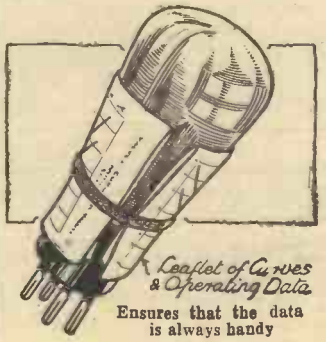
Also it makes a useful little lamp for use inside the set while working. Painted in black wax, there is no danger of a short with any other wire.

KEEP THOSE CURVES.

IT is generally conceded that a receiver is built around its valves and that the most efficient set is only that which utilises their properties to the fullest extent, yet in *operation* valves are rarely treated fairly.

Every valve which leaves its factory is accompanied by a leaflet of curves and operating data, such as voltages and currents necessary, anode load, etc., and for the best results such instructions must be closely followed. Despite this, most curve leaflets soon reach their ultimate destination, the wastepaper basket—which is hardly surprising, for it *is* difficult to find a safe and yet convenient place to keep them, isn't it?

A very simple and practical solution is to just fold the curve leaflet around its valve, slip on an elastic band—and they are inseparable companions this time.

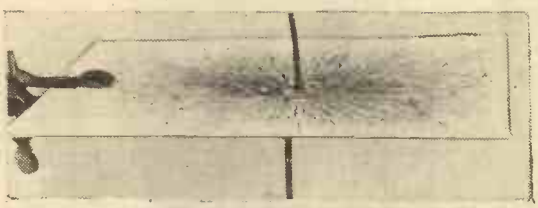


Ensures that the data is always handy

RADIO STEP-BY-STEP

OUR SPECIAL SUPPLEMENT for BEGINNERS

MYSTERIES OF MAGNETISM



Some important processes fascinatingly described.

MAGNETISM is a force which plays a very important part in radio and in electricity generally.

Practically everybody has handled the familiar horseshoe magnet so beloved of the schoolboy. How many listeners are there who haven't, at some time or another, used one of these small toy-shop magnets for picking up steel articles such as needles, screws or tacks?

An Interesting Experiment.

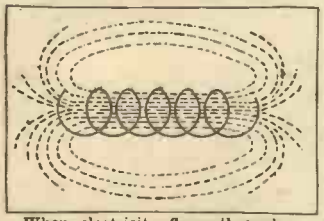
What is it that causes the magnet to pick up pieces of steel? Undoubtedly some force must be exerted across the space separating the magnet and the article it picks up. Otherwise why does the said article (incidentally it must be made of iron or steel) suddenly decide to move towards the magnet and adhere to it.

An interesting experiment is to take a bar magnet (a straight magnet as opposed to the type shaped like a horseshoe) and a compass. Not an expensive compass, but one you can buy for a few pence.

Slowly bring one end of the bar magnet nearer to the compass needle. You will notice that the needle swings on its pivot, perhaps moving towards the magnet, possibly away from it, as if repelled.

The fact that the needle moves proves that some force must be present to produce the movement.

LINES OF FORCE



When electricity flows through a length of wire a magnetic field is created which consists of lines of force spreading out in all directions.

Exerting a Force.

Another experiment can be carried out with the help of a quantity of iron filings. These filings can easily be "manufactured" by the industrious amateur from a lump of iron and a fairly coarse file.

Take a piece of thin cardboard and place it on one end of the magnet. Then scatter some of the filings over the surface of the cardboard. Tap the cardboard gently until the filings take up a fixed position, when you will notice that they follow a well-defined pattern.

If you look at them closely you will see that they have arranged themselves in radial lines converging on a common centre, viz. the magnet.

Now, we know that a magnet exerts a force, which force could, if necessary, be measured and translated into fractions of a pound or ounce, pull or push.

Field of Influence.

But we are not concerned with the magnitude of the force. It doesn't matter from the radio point of view whether the magnet will lift a ton or a thousandth of an ounce.

All that concerns us is the fact that a force is radiated from the magnet so that it affects neighbouring steel objects.

The iron-filing experiment proves that the magnet has the power to make the filings take up a definite position. An inspection shows us that the filings tend to arrange themselves along lines which converge towards a certain point, viz. the magnet pole or poles.

These lines are called *lines of force*. When an object is brought within the influence of the lines of force it is said to be within the *magnetic field*.

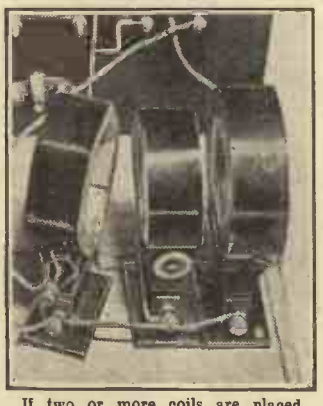
The number of lines of force in a given area is called the *flux density*, magnetic flux being another way of saying magnetic field.

So far we have only mentioned the simple bar and horseshoe magnet. These are known as permanent magnets.

There is another form known as an electro-magnet. This is a bar of iron (not necessarily solid; it may consist of a number of strips or sections called laminations) surrounded by a coil of wire.

Making a Magnet.

If the two ends of the coil are joined to a battery or other source of electrical power the iron bar or core will become a magnet, and will exhibit all the properties of a permanent magnet.



If two or more coils are placed together, as shown above, it is possible to transfer energy from one to the other by taking advantage of the properties of magnetic fields.

If the core is of steel it will, in fact, remain a permanent magnet and retain its magnetism when the source of electrical power (in our case a battery) is removed.

If, on the other hand, a *soft* iron core is employed the magnetism will cease to exist when the battery is removed.

In practice a permanent magnet is one which exerts a force and possesses a magnetic field without the assistance of a battery or other external source of power.

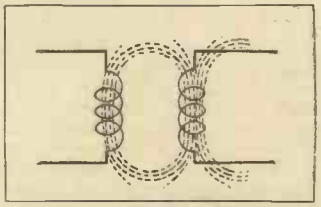
Permanent-magnet loudspeakers, for example, do not have to be connected to the mains before they will work; but loudspeakers of the energised type employ electro-magnets, and will only work when joined up to a source of power such as the mains.

Dispensing With Iron.

Does the existence of a magnetic field and of magnetic lines of force depend upon the presence of iron or steel? The answer is *no!* Any electrical conductor (a length of copper wire) can be made to produce a magnetic field if it is joined to a battery. The flow of electricity from one end of the wire to the other produces a magnetic field, and this field is similar in its characteristics to that produced by the permanent or electro-magnet.

The flow of electricity along the wire will affect a compass needle and cause it to move just as the magnet does.

MAGNETIC INDUCTION



The magnetic field set up by a coil of wire can generate a flow of electricity in a second coil.

But it is interesting to note that lines of force are set up much more readily in iron than in air; and if a length of wire is wound round a piece of iron the lines of force will tend to concentrate themselves in the iron, because it offers an easier path for them than the air.

Meaning of Permeability.

This conducting or carrying power of the iron is called its *permeability*, which is described as the ratio of the flux density of the iron to that of air.

The permeability of a metal is given as a number. Air is one, while iron may be a thousand.

(*Continued on next page.*)

Special Beginners' Supplement—Page 2.

MYSTERIES OF MAGNETISM.

(*Continued from previous page.*)

In other words, if one line of force passes through one square centimetre of air a thousand (or more) lines will pass through the same area of iron.

The question of permeability is of great importance in the design of certain radio components, because it enables the full use to be made of the lines of force set up by the flow of electricity round a coil of wire. Later on in the series we shall deal with this point more thoroughly.

Generating Electricity.

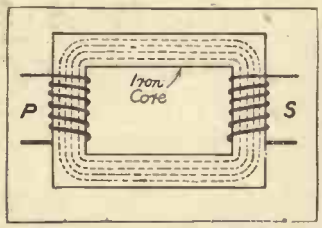
Now, a magnetic field, due to a magnet or a length of wire, has the power of affecting other things apart from iron filings, compass needles or steel articles.

If we take a second length of wire, wind it into a coil (a coil is not essential, by the way) and then place it in a magnetic field a flow of electricity will be induced in the coil.

We can generate electricity in a length of wire simply by moving it across a magnetic field. This is the principle of the dynamo.

But electricity will only be generated in the wire when the wire is moved at an angle to the lines of force.

USING A CORE



When two coils are wound upon an iron core the lines of force flow through the iron. Any lines due to the coil P will act on the coil S.

Suppose we took two bar magnets and placed them on supports so that their north and south poles were an inch or so apart. Lines of force would fill the gap between the two poles, because in magnetism unlike poles attract and like poles (south to south or north to north) repel each other. Magnets are usually marked so that the north pole can be distinguished from the south.

If we joined a loop of wire to a sensitive measuring instrument such as a galvanometer (to detect the flow of electricity) we should notice that the needle moved as the wire passed through the gap between the magnet poles.

Reversing Polarity.

If, on the other hand, we moved our loop of wire from one pole to the other so that the wire was always parallel to the lines of force and never permitted to cut across them, there would be no flow of electricity around the loop and no indication on the measuring instrument.

Incidentally, we would mention that when a magnet is used to pick up a steel object the effect of the magnetic field is to make the object into a magnet of opposite polarity. The north pole of a magnet, if placed near a needle, would cause the needle to behave as a south pole and so attract it.

If the needle was already a north pole of similar strength to the bar magnet one would repel the other and the magnet would not pick the needle up. But a strong north (or south) pole could overcome a weak north (or south) pole, reverse its magnetism (polarity) and so make it a south (or north) pole and thus attract it. In radio, however, we have to consider the magnetic fields—that is, the lines of force—set up by coils of wire rather than those due to magnets.

ROTATING COILS

The extent to which the magnetic field set up by one coil can affect another depends upon the relative positions of the coils. By arranging for one coil to rotate within the other the effect of the field can be infinitely varied.

Transferring Energy.

One of the most important factors is that a coil of wire carrying electricity can, by reason of its magnetic field, produce a flow of electricity in a neighbouring coil.

The magnetic field carries electricity through space, but its effect is much greater when the two coils are close than when they are well separated.

When air is the conducting medium or carrier for the lines of force they tend to spread out, and only a few have any effect upon the coil into which they are inducing a flow of electricity.

Electricity which is generated in this way is said to be produced by *induction*, because it is induced by the magnetic field or flux of the first coil.

If we want to get the maximum effect from the lines of force we use a carrier having a higher permeability than air.

For instance, if we wind the two coils on a core of iron we find that a much greater quantity of electricity is generated in the second coil than is the case when air is the carrier. This, of course, is assuming that the amount of electricity in the first coil is the same in both cases and that the two coils are the same distance apart.

Avoiding Waste.

The high permeability of the iron provides an easy path for the lines of force, and nearly all of them pass through the second coil. With air, the lines which spread out and fail to pass through the second coil are wasted.

At this stage we would point out that electricity is only generated in the second coil when the number of lines which pass through it are varying.

This means that the flow of electricity only occurs when the magnetic field is formed or when it collapses. The field, is formed when the battery or source of power is connected to the first coil, and it ceases to exist when the source of power is removed.

Alternatively the magnetic field may be kept constant and the second coil moved to and fro so as to cut the lines of force at right angles. This is what happens in a dynamo.

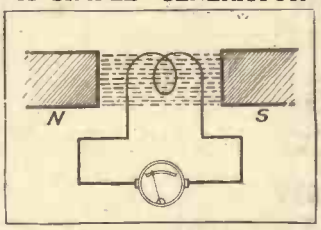
How It Works.

A coil (or number of coils) of wire called the armature rotates in a strong magnetic field, and all the while the armature is rotating electricity is generated in the wire. Directly the armature stops the flow of electricity ceases.

In a practical dynamo the magnets which produce the lines of force for the armature to cut are not of the ordinary permanent type. They are energised magnets which possess sufficient residual magnetism to start a flow of electricity through the armature.

In other words, they have just enough permanent magnetism

A SIMPLE GENERATOR



One method of generating electricity is to move a length of wire across the gap between two magnet poles. This is the principle of the dynamo.

to cause some lines of force to cut the armature winding. This is enough to start a flow of electricity when the armature is just rotated.

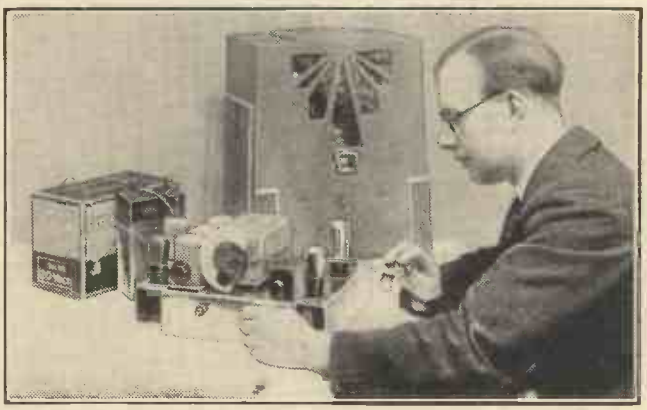
After this, part of the electricity flowing in the armature is diverted through the magnet windings (called the field windings), thus strengthening the magnetic field and so increasing the amount of electrical energy in the armature winding.

Hence once the dynamo is running it creates its own magnetic field; but if it wasn't for the existence of a small degree of permanency in the magnets the dynamo would not work, because there would be no lines of force for the armature to cut during its first few revolutions.

Ensuring Efficiency

The armature is wound on an iron core, and the gap between the armature winding and the magnet poles is kept small—just sufficient for the armature to revolve freely. This ensures that the maximum number of lines of force cut the armature winding, since they naturally take the easy path through the iron core.

WHY COMPONENTS ARE SCREENED



Metal screens are often employed in modern receivers. This is to prevent the magnetic fields set up by the different components from affecting others near by. The particular receiver shown above is an example of very thorough screening.

S.T.500

PILOT AUTHOR KIT
EXACT TO SPECIFICATION

"Notears with a Pilot Author Kit"

SEE OUR PREVIOUS S.T.500 ANNOUNCEMENTS. Oct. 21st and Oct. 28th issues.

CASH — C.O.D. OR YOURS FOR **9/6**

Balance in 11 monthly payments of 9/6.

£5-5-0

KIT "A" Comprising Mr. John Scott-Taggart's Kit of FIRST SPECIFIED Components, including Telsen "Class B" output Choke, Peto-Scott Metaplex Baseboard and Ready-drilled Panel and Terminal Strip. Less Valves and Cabinet. With FULL-SIZE Blue Print and copy "Popular Wireless," Oct. 21st. Cash or C.O.D. Carriage Paid. **£5-5-0**

KIT "B" As Kit "A" but including 4 Specified Valves. Cash or C.O.D. Carriage Paid. **£7-10-3**
or 12 monthly payments of 13/9.

KIT "CT" As Kit "B" but including Peto-Scott Specified Walnut Table Cabinet.
Cash or C.O.D. Carriage Paid. **£8-9-9**
or 12 monthly payments of 15/6.

All Kit and Finished Instrument Prices exclude batteries. Recommended "S.T.500" Battery Equipment: 120-volt Drydex, Orange Triangle, Triple Capacity; 9-volt Drydex G.B. Battery and Peto-Scott 2-volt 45 amp. L.T. Glass-cell Accumulator. Cash or C.O.D. Carriage Paid, £1-11-3; or add 3/- to First and each Monthly Payment.

KIT "CC" As Kit "B" including Peto-Scott Specified Walnut Consolette Cabinet. Complete with Baffle Baseboard Assembly, but less Speaker. Cash or C.O.D. Carriage Paid. **£8-18-9**
or 12 monthly payments of 16/3.
If Peto-Scott Permanent Magnet Speaker required add 15/- to Cash Price or add 1/3 to each monthly payment.

S.T.500 STRUCTAKIT

CASH or C.O.D. Post Free. **7/6**

Comprising Peto-Scott Baseboard with Metaplexed Section; Ready Drilled Panel and Terminal Strip; "S.T.500" Screen; B.R.G. Mounting Bracket with Free copy of "Popular Wireless."

S.T.500 CONVERSION KITS

CONVERTS YOUR S.T.300 into the new S.T.500

Comprises: 1 Peto-Scott Baseboard; 1 Colvern S.T.500 Aerial Coil; 3 G.F. ·0005 mfd. Condensers; 1 Polar ·0003 mfd. Diff.: Condenser; 1 J.B. ·0001 preset; 1 J.B. ·00005 mfd. preset; 1 Telsen Driver Transformer; 1 Telsen Choke; 1 G. F. 7-pin Valve holder; 2 5,000 ohm 1 watt Resistances; 2 10,000 ohm 1 watt Resistances; 1 G.F. 250 ohm 1 watt Resistance; 1 Igranic 2 mfd. Condenser; 2 T.C.C. Condensers; 1 G. F. ·0005 Condenser; 1 Lissen ·00005 mfd. Condenser; 1 Bulgin S80 switch. 1 B.R.G. bracket—Wire. screws, flex etc., WITH COPY OF "POPULAR WIRELESS"—21/10/33 AND BLUE PRINT.
or 6/- Deposit and 9 monthly payments of 5/6.

CASH or C.O.D. Carriage Paid. **51/-**

H.P. TERMS: Complete Kit with Valve—12 monthly payments of 6/-.

CONVERTS YOUR S.T.400 into the new S.T.500

Comprises: 1 Peto-Scot Baseboard; 3 G. F. ·0003 mfd. Condensers; 1 J. B. ·0001 preset; 1 J. B. ·00005 preset; 1 Telsen Driver Transformer; 1 Telsen Output Choke; 1 G. F. 7-pin valve holder; 2 Dubilier 5,000 ohm 1 watt Resistances; 2 Dubilier 10,000 ohm 1 watt Resistances; 1 G. F. 250 Ohmite Resistance; 2 T.C.C. ·005 mfd. Condenser; 1 G. F. ·0005 mfd. Condenser; 1 Lissen ·00005 mfd. Condenser, 1 T.C.C. 1 mfd. Condenser; 1 B.R.G. Bracket; Wire, screws, flex, etc, WITH COPY OF "POPULAR WIRELESS," 21/10/33, AND BLUE PRINT.
or 5/- Deposit and 8 monthly payments of 5/3.

CASH or C.O.D. Carriage Paid. **42/-**

H.P. TERMS: Complete Kit with Valve—12 monthly payments of 5/3.

IMPORTANT *Parts, Kits, Miscellaneous Components, 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 all Post Charges Paid.*

FINISHED INSTRUMENTS

"S.T.500," complete in Peto-Scott Walnut Table Cabinet, exact to Mr. John Scott-Taggart's FIRST Specification. Aerial Tested. Complete with Valves.
Cash or C.O.D. Carriage Paid. **£10-0-0**
or 12 monthly payments of 18/3.

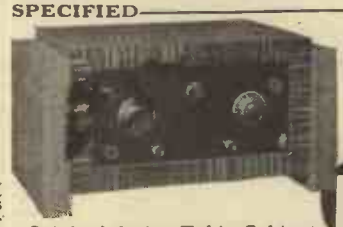
"S.T.500," complete in Peto-Scott Walnut Consolette Cabinet, exact to specification. With Peto-Scott Moving-Coil Speaker. Complete with Valves. Ready to Play. Aerial Tested.
Cash or C.O.D. Carriage Paid. **£11-5-0**
or 12 monthly payments of 21/-.

PETO-SCOTT S.T.500 CABINETS
EXCLUSIVELY SPECIFIED

Consolette Model. An outstanding example of cabinet craftsmanship. Hand French polished. Veneered Macassar and Walnut finish by experts.

Regd. Design No. 787.010 Cash or C.O.D., 25/-. Carr. & Packing 2/6 extra, *or 6/- Deposit and 4 monthly payments of 6/- (including carriage and packing).* Baffle-Baseboard Assembly, 3/6 extra.

25/-



Regd. Design No. 78,011.

19/6

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.)

Send to-day for copy of 1934 Cabinet Catalogue.

PETO-SCOTT CO. LTD. 77 CITY ROAD, LONDON, E.C.1. Telephone: Clerkenwell 9406/7.
West End Showrooms: 62 High Holborn. W.C.1. Tel: Holborn 3248.

Dear Sirs,—Please send me CASH/C.O.D./H.P.: S.T.500 KIT "A" S.T.500 KIT "B" S.T.500 KIT "CT" S.T.500 KIT "CC" with/without SPEAKER.

for which I enclose £.....s.....d. CASH/H.P. Deposit.

NAME.....

ADDRESS.....P.W.. 4/11/33.

ANY ITEM SUPPLIED SEPARATELY—ORDERS OVER 10/- SENT C.O.D. CARRIAGE AND POST CHARGES PAID

The MEANING of WAVELENGTH

WHEN, for example, a broadcasting station is said to be using "a wavelength of 300 metres" it means exactly what those words say. The station is creating waves in the ether of 300 metres in length. (That is, about 325 yards.)

A complete wave consists of a trough (condition of pressure) and a crest (the equivalent of the lumping up in a water wave).

Later on we shall tell you how the wireless wave is formed in the ether, but first we must discuss the relation between Wavelength and Frequency.

Easy to Understand.

These related terms are very widely used in radio, and it is essential that they should be understood before the beginner tackles tuning and other things.

It should not be hard to grasp the fact that a wave has a definite length. (See Fig 1.)

The next fact to remember is that ether waves, whether of light or radio, are always radiated at a constant speed or Velocity. This is 300,000,000 metres per second (approximately 186,000 miles).

It doesn't matter where the radio station is when it transmits or what power or wavelength it employs: the Velocity of the waves radiated from its aerial remains the same—300,000,000 metres per second.

A Fixed Factor.

As this factor is absolutely fixed it follows that there must be a definite relation between the length of the waves and the number of waves that are created in a given time.

TRAINS OF WAVES

This picture shows how a train of waves is set up by a central source of disturbance.

This last is known as the Frequency, and the unit of Frequency is the Cycle—one complete operation, as it were. In this case each radio wave is a "cycle."

A succession of waves, such as ripples outwards through the ether from a broadcasting station, is styled a Train of Waves. Actually, of course, as you will appreciate, there couldn't be just one wave: there must always be a series of them

As the waves radiate through space at 300,000,000 metres per second the number which pass a given point in the same time (one second) tells you the length of the wave.

A simple analogy will make this point clear.

Supposing railway trains always travelled at exactly the same speed (Velocity). Let us say 50 metres per second, to use units which are similar to those employed in radio.

If ten carriages passed a signal-post in one second, what would be the length of each carriage, providing they were all of the same length and were very closely coupled? (See Fig 2.)

Obviously, 5 metres. The train travels 50 metres in a second; ten carriages whip by in that amount of time; each must clearly occupy a length of 5 metres.

Let us look at it from another viewpoint. We know the length of the carriage. Call it 10 metres. How many will pass in one second? In other words, what is the Frequency?

Something to Memorise.

The Velocity is 50 metres per second; the length is 10 metres. There will be a Frequency of 5 per second. That should be plane-sailing. Now think of the string of railway carriages as a train of radio waves (which maintain the fixed velocity of 300,000,000 metres per second) and the analogy is complete.

In the form of an equation the relationship between Wavelength and Frequency is:

Velocity = Wavelength × Frequency.

To discover the Wavelength when the Frequency is known you merely divide the Frequency into 300,000,000. Alternatively, knowing the Wavelength, the Frequency can be discovered by dividing the Wavelength into 300,000,000.

The Frequency of a transmission on a wavelength of 300 metres is 1,000,000 cycles. The Wavelength of a station transmitting with a Frequency of 1,500,000 is 200 metres.

Numbers having lots of noughts are clumsy to handle, and so usually the Frequencies of radio stations are given in Kilocycles. A Kilocycle is a thousand cycles. Thus we can more conveniently refer to 1,000 kilocycles than to 1,000,000 cycles or 500 kilocycles than to 500,000 cycles, and so on.

SIMPLIFYING A FUNDAMENTAL RADIO FACT

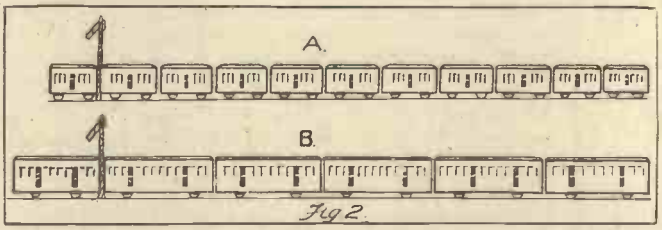


Fig 2.

This will help you to understand wavelength and frequency. Both trains proceed at the same speed. A larger number of coaches will pass the signal-post in a second in the case of A, as A's coaches are shorter than B's.

Kilocycles Preferred.

But calculations must be made in cycles, for that is the unit. To reduce Kilocycles to Cycles all that has to be done is to multiply by 1,000, and, as we have seen, Kilocycles are obtained by dividing the figures in cycles by one thousand.

Perhaps some of you are wondering why it is necessary to use that term "Cycle" and why Wave cannot be employed instead.

The reason is that Frequency applies to other things than ether waves, and, therefore, its unit must be more widely applicable.

It might be very convenient to have "glass" or "cup" as a unit of liquid measurement in a refreshment establishment; but it would hardly apply to calculations of swimming-bath or petroleum-tank capacities. The pint and gallon are clearly superior.

A COMPLETE CYCLE

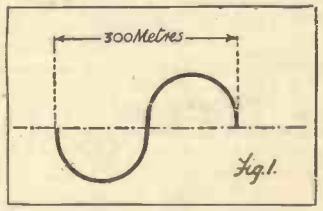


Fig 1.

A complete wave consists of a trough and a crest, the distance from the beginning of one to the end of the other being the wavelength.

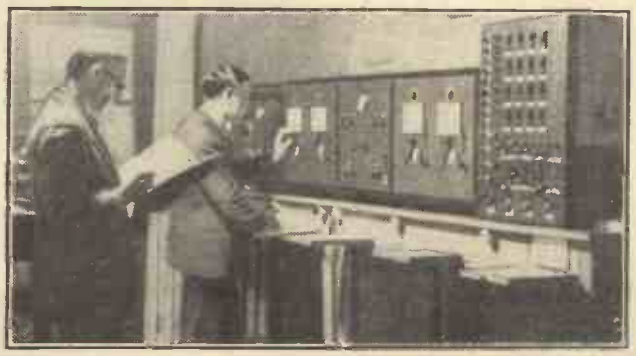
This is perhaps going rather far afield for a simile, but it does, we hope, convey the idea.

Anyway, Frequency, as with Capacity, is applied to various things. But you need not fear that it changes its character. It always is used to indicate the number of repetitions of operations or events occurring in a certain time. (One second is employed as the unit of time in electricity.)

In the transmission of radio energy a wave is a Cycle, and, when you come to think of it, this is perfectly descriptive.

There is a compression in the ether followed by a rarefaction, then another compression followed by another rarefaction, and so on. There is a repetition of a CYCLE of events. The term, you see, is perfectly logical, though we fear that cannot be said of all terms used in wireless!

THE POLICEMAN OF THE ETHER



Transmitting stations are allowed to disturb the ether at certain specified frequencies only. The lengths of the waves they create are checked by the authorities at a listening post in Brussels.

TELSEN

'S.T. 500' COILS

for Mr. John Scott-Taggart's

P.W. 'S.T. 500'

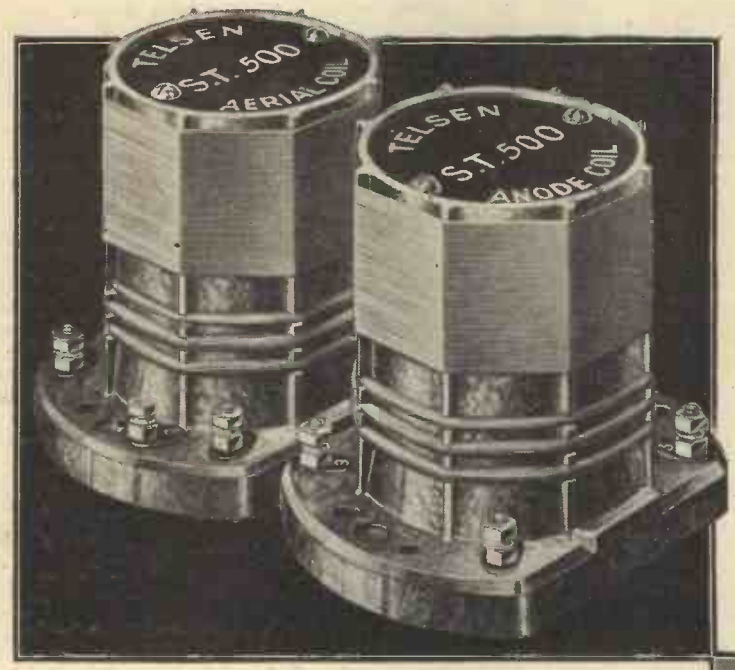


Illustration below shows the position occupied by the Telsen 'S.T. 500' Coils in a built-up 'S.T. 500' Receiver.

RECOMMENDED for use in the S.T. 500 by Mr. John Scott-Taggart, the Telsen S.T. 500 Coils have been specially designed for their purpose, to ensure immaculate performance with enduring efficiency. The Aerial Coil consists of plain long and medium wave windings connected in series, with a separate reaction winding, the Anode Coil having a larger reaction winding connected to the earth end of the main winding. The Anode Coil is supplied complete with two brackets and the necessary screws for mounting.

Price per pair **8/-**

TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

A UNIVERSAL MAINS UNIT

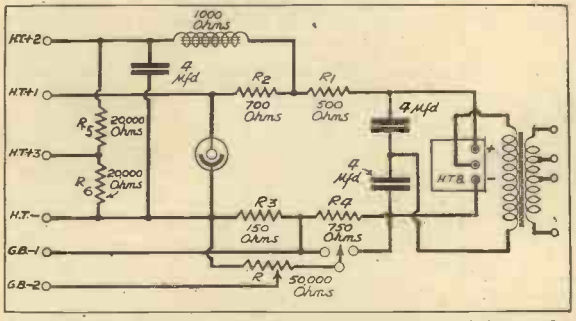
By KRYPTON

Greater flexibility in the design of mains units is the plea put forward by our contributor. He discusses in detail all the factors which a satisfactory arrangement should incorporate, and combines his conclusions in an interesting and practical specification which constructors can build for themselves. It has tappings suitable for all types of output valves, and also provides automatic grid bias.

DON'T you think it is about time we developed some new ideas in mains-unit design? The average eliminator is becoming rather too "stodgy" an affair for those of you who experiment with modern circuits, while it is incapable of supplying the widely fluctuating anode current of Class B and Q.P.P. stages at the constant voltage so necessary for the best results.

There are, of course, special Class B eliminators now available, but these, in my opinion, are hardly flexible enough for all your requirements. What we really need is a new type of unit, a universal design, capable of meeting the power-supply requirements of the various types of modern receivers and of receivers of the near future.

FLEXIBLE AND STABLE



Provision is made for a stable voltage supply to the output stage, and unstabilised outputs are available for other stages. Variable grid bias is also a feature.

We may not all agree about the design of a universally useful mains unit, but I don't think you would be disappointed in the following general specification: A compact unit, metal rectifier, and inexpensive smoothing equipment.

It has a special power supply suitable for Class B, Q.P.P. or ordinary output stages at a *constant* H.T. potential of some 125 volts; a second power supply at 150 volts for other valve stages; a tapping at 70 volts or so for screen potentials or detector; and last, but not least, as many fixed or variable-grid bias voltages as you require.

You might imagine that all this would lead to a rather complicated circuit arrangement, but in actual practice the design can be worked out on quite simple lines.

By No Means Complicated.

The accompanying diagram, which introduces my idea of a universal unit, is by no means complicated. On the right we have the usual mains transformer and rectifier; either metal oxide or valve rectifiers can be used equally well. Next follows the neon stabiliser circuit, which provides such remarkable voltage regulation that the voltage at H.T.+1 remains almost constant whether the load is 40 ma. or zero.

The series resistance required for the neon tube is distributed round the circuit in such a way that it performs three functions at the same time—the section R_1 R_2 provides a higher voltage at H.T. + 2, the section R_3 R_4 free grid bias, and both together the current limitation for the stabiliser circuit.

The Smoothing.

You may wonder what has happened to the normal smoothing equipment for the H.T. + 1 feed. There isn't any, for the simple reason that the neon tube and associated resistors give you all the smoothing you want with Class B, Q.P.P., push-pull and ordinary amplifiers, no hum at all being audible.

This, of course, is a real economy, as the smoothing choke and condenser for the secondary H.T. feed are relatively inexpensive components. Incidentally, this secondary feed is designed to give up to 10 ma. at 150 volts, which should be ample for the earlier stages of the receiver. Any desired subsidiary voltage at H.T.3 can be obtained by choosing appropriate resistors for R_5 R_6. Another point of interest is that, except for the voltage-doubler circuit of the metal rectifier, high-voltage test condensers are unnecessary, as the neon tube itself prevents an excessive voltage rise on switching on the unit.

Free G.B. Supply.

One of the most convenient features of this unit is the adaptability of the free grid-bias supply, as up to 45 volts negative is available. In the diagram you get 7½ volts bias at G.B.1 and either 0–7½ or 0–45 variable bias at G.B.2, according to the connection of the potentiometer R.

Any other fixed voltage required can be got by including more or less resistance between H.T. — and the grid-bias tap, remembering that the value of this resistance is obtained here by multiplying the desired bias volts by 20. Thus, for 15 volts fixed bias, the required resistance is 300 ohms. Of this R_3 provides 150 ohms, so that R_4 must be tapped or divided into 150- and 600-ohm resistors, the desired 15 volts being picked up where the two latter are joined together.

It should not be forgotten that some decoupling of these grid-bias feeds will, in nearly every case, be required. This is not shown in the eliminator diagram, as such decoupling is more conveniently incorporated in the receiver itself.

High Maximum Voltage.

The grid-bias arrangements should be sufficient for all present and future requirements in view of the high maximum voltage available and the ease with which different bias volts can be got. The variable bias at G.B.2 can be altered to control a short-base or a normal variable-mu valve.

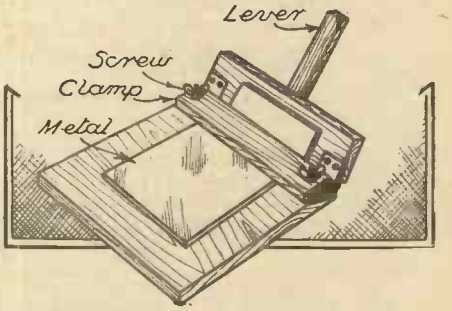
In conclusion, I would suggest the provision of a 4-volt secondary on the mains transformer.

BENDING SHEET METAL

A neat arrangement which overcomes the bending difficulties met with in making metal chassis.

ALUMINIUM is ideal material for small boxes for mains units or for the chassis-built type of receivers. But it is sometimes difficult to bend the metal quite accurately and neatly.

GIVES NEAT ANGLES



Sheet metal is easily bent to any angle.

A very simple device, however, can be made up from odd pieces of wood in a few minutes, which will prove very satisfactory for obtaining neat angles. The scheme is shown in the sketch.

AN A.V.C. UNIT

MANY constructors seem unable to understand why it is that automatic volume control does not upset the balance of a musical item. They argue that if the control keeps loud transmissions down to a certain fixed-volume level, then, surely, there will be a tendency for the varying volume levels of any one given programme to be tampered with.

For instance, the loud passages of an orchestral item subdued, the beating of a drum made to sound like fairy footsteps, and so on.

But A.V.C. does not fall down on so elementary a snag as that. Let me try, in a few words, to convince you of this.

You know that the prime essential for good-quality reproduction from an ordinary stage of L.F. amplification is that the H.T. current should retain a constant level.

A milliammeter is used to check this. It shows a steady reading. On loud passages, on quiet passages that needle should not move.

In much the same way the D.C. output of a detector valve maintains a steady average value, but in this case this steady average value differs with different stations in accordance with their strength.

In fact, it is the carrier-wave of the station and not the modulation of the carrier by speech and music which determines that average D.C. output. And it is this last which can be applied to A.V.C.

A comparatively simple and perfectly satisfactory method of applying it is to use a Westector "cold valve."

The Wearite "Autotrol," a useful little unit for providing automatic volume control using a Westinghouse metal rectifier.

This ingenious and highly useful device forms the basis of the Wearite "Autotrol" unit, which incorporates a Westector and the necessary condensers and resistances.

The "Autotrol" enables A.V.C. easily to be added to an existing set of a suitable type, and it is also a conveniently compact assembly of the required parts for a new set.

The price of the "Autotrol" is only 10s. 6d., and I doubt if the separate components in it could be bought as cheaply.

Inasmuch as its connections and the methods of application advised for it are based upon perfectly standard and straightforward practice its effectiveness can be taken for granted. But, of course, we tested it and, as anticipated, it worked decisively and without trouble.

A USEFUL GANG

A two-gang condenser, complete with a slow-motion drive, panel fittings and scale light, for 10s. 6d. is what Messrs. Burne-Jones are able to offer.

The condensers are of the solid dielectric type, and the whole affair is very compact. Nevertheless, it cannot be dismissed as anything but a component which deserves the closest attention of constructors.

For compact band-pass sets of many types it is a serious alternative to the higher-priced air dielectrics. How can the sections possibly be accurately matched? I can hear many asking.

This is satisfactorily accomplished by providing a vane-rocking adjustment for the one section. This is a liberal adjustment, and is controlled by a small knob concentrically arranged on the main tuning knob. No trimming is necessary: that is, trimming of the ordinary kind. This subsidiary panel control is really a trimmer.

And while it is rather subversive to the one-knob tuning ideal it allows closer matching to be obtained than with the majority of expensive precision gangs.

This, obviously, may largely offset the losses occasioned by the introduction of solid dielectric, so on balance the Burne-Jones gang emerges, as I have said, as a component meriting commendation on all counts.

It is very well made, and its drive is beautifully smooth.

Priced at 10s. 6d., this Magnum double-gang solid-dielectric condenser, made by Messrs. Burne-Jones, Ltd., represents excellent value for money.

AN ALL-WAVE TUNER

It is a long jump from the separate plug-in coils of, say, the famous "P.W." "Magic" set to an "all-wave" tuner. Long in a technical sense, that is, but not in time.

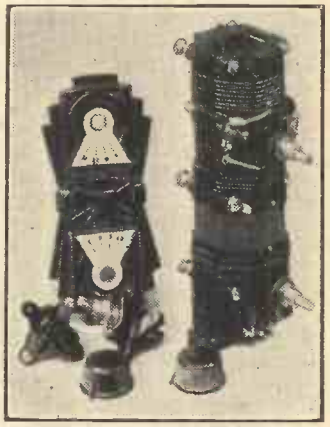
Actually it is not so very long ago, even, that the idea of combining short and long wavebands in the one set was first introduced. The above-mentioned "old Magic," as it is affectionately termed by hosts of constructors, was instrumental in bringing short waves and "ordinary" broadcasting together.

And now "all-wave" tuners are as freely obtainable as "dual-banders"! There is, for example, the British General unit, which covers no less than four wavebands.

This is a particularly compact component, and its wave ranges are controlled by two switches set in an artistic panel escutcheon.

One of these switches adjusts the aerial coupling in accordance with the frequency, and is a refinement which contributes considerably to the successful operation of the device.

With this tuner you can roam from 12 to over 2,000 metres with no other switching than with the switches I have just referred to.



By means of simple switching, this British General Tuner covers four bands of wavelengths and tunes down as low as 12 metres.

You would not expect colossal selectivity with any det. L.F. or det. 2 L.F. type of set, but with this B.G. tuner a very good performance indeed is achieved, and the short-waves are free from flat spots and other such blemishes.

It is certainly an attractive proposition, particularly at the very reasonable price of 9s. 6d., which, is less than the price of some dual-wave coils.

On test I found it quite free from the usual faults encountered in many of the ambitious tuning units that from time to time are offered to the public.

For example, there isn't an overwhelming break-through of the medium waves into the territory of the long-wave stations.

A very common fault, that, and yet I cannot remember having received much correspondence from constructors on the subject.

I wonder if "break-through" is accepted as inevitable by most of them? It should not occur in a serious manner if the tuner is properly designed.

The LINK BETWEEN

BY G. T. KELSEY

Weekly jottings of interest to buyers

A PARTICULARLY gratifying aspect of the new season's tendencies is the amount of attention that is now being given by the commercial set manufacturers to battery-operated receivers.

For long enough I have stressed in my notes the inadequate number of models available, bearing in mind that well over half of the total number of homes in this country are still unwired for electricity. But now the manufacturers have really got down to it, and a survey of the market shows that the proportion of battery to mains models is much more in keeping with the potential demand.

One particularly outstanding model which I have had an opportunity of testing is the new Ekco Model B.74.

For those who are interested I am able to pass on the news that a complete report of this particular instrument is to appear in an early issue of "P.W." Meanwhile, from my own personal experiments I have no hesitation in saying that I consider it to be one of the leading battery designs of the present season. It worthily upholds the traditions of a famous name.

Please, Mr. X.!

I have an uneasy feeling that before very long a certain "P.W." reader living in Northampton will be writing to me to complain that, despite the fact that he enclosed a 2d. stamp, he has not received literature Nos. 51, 53 and 54. If "Mr. X., Northampton," is an adequate address, then I take back my remark. If not,

(*Continued on page* 434.)

VALVES AND THEIR CONNECTIONS

By H. CROSS

The recent introduction of valves having as many as seven electrodes has created a need for multiple-socket valve holders, and our contributor follows up his previous article on valve connections by explaining how the new holders are employed.

DEVELOPMENTS in valve design, particularly as regards the multiple types, have been so rapid that many are still regarded as something of a curiosity.

Such valves, however, are being employed with increasing frequency in commercial and home-constructed designs. The multi-electrode type, too, are becoming more and more popular, and there is more than an indication, in fact, that the simple three- and four-electrode valves may be entirely displaced in time.

It is as well, therefore, to be conversant with the purposes for which the more common are intended, as well as with the actual connections of the electrodes of these valves to their base pins.

A Popular Type.

In what may be termed the multiple type the Class B valve will be by far the best known to our readers, as this extremely useful valve has been incorporated in quite a number of our battery designs recently.

This valve consists really of two triodes mounted in the same bulb, operated usually

THE DOUBLE-DIODE TRIODE

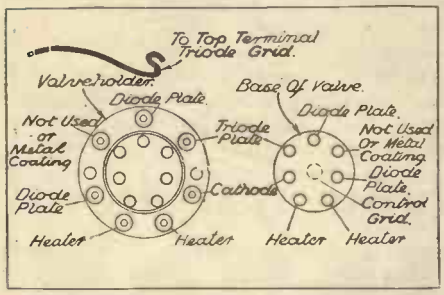


Fig. 2. With a mains-driven double-diode triode the terminals of its holder assume the functions indicated in the sketch.

with zero bias, although in some cases a small negative bias is required.

It affords exceptionally large volume for low-power consumption, a maximum of about 2 watts being available with suitable operation from standard H.T. batteries.

Almost every manufacturer is now listing a Class B valve. As these vary in the maximum power output permissible and current requirements, suitable types are available for practically all needs. The connections for the Class B valve are shown in Fig. 1.

It Provides A.V.C.

Next is the double-diode triode, the chief purpose of which is to provide combined rectification, automatic volume control and L.F. amplification simply and inexpensively.

As the name implies, the valve consists actually of two diodes and a triode section in the same bulb. Many variations in the circuit arrangements are possible with this multiple valve, but the usual is for one diode to be used as a simple detector, the second diode for providing a rectified voltage for biasing previous multi-mu H.F. stages, and the triode section as a first-stage L.F. amplifier.

The elements of the A.C. model are connected to the base pins as shown in Fig. 2.

FOR CLASS B

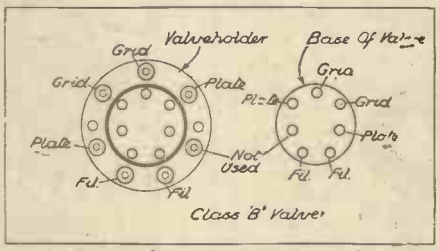


Fig. 1. The disposition of the terminals on a seven-pin valve holder when a Class B valve is used is clearly shown above.

It should be observed that the triode control grid is taken to the terminal in the top of the bulb.

The double-diode multi-mu pentode is somewhat similar to the above valve in its purpose, but the pentode section enables post-detector as well as pre-detector automatic volume control to be obtained. In this valve the top terminal is connected internally to the pentode anode.

High-Frequency Pentodes.

In the new class of multi-electrode valves the H.F. pentode is probably most familiar. This is quite similar to the ordinary S.G. valve, but an additional element is included.

It is claimed that this type of valve has greatly increased voltage-handling capabilities and high voltage amplification. These valves are available both for mains and battery operation in multi-mu and ordinary type.

We have here shown the connections for a mains H.F. pentode of the type having a

H.F. PENTODES FOR MAINS

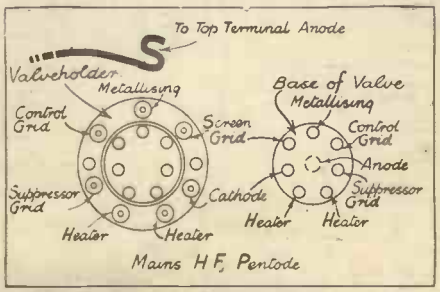


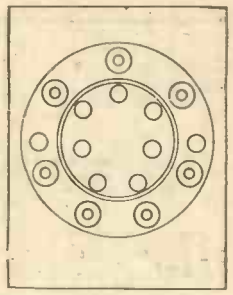
Fig. 3. Mains H.F. pentodes require to be connected into circuit in the manner shown by the terminal indications of this diagram.

* * *

STANDARDISED

The new seven-pin valve holder is standardised to take various types of multi-electrode valve and its termina's are not marked, as their purpose varies with each different valve.

* * *



seven-pin base. The connections of the battery H.F. pentode are similar, but the cathode terminal is not used.

In addition to those mentioned, a valve which has no less than seven electrodes has recently been developed primarily for super-heterodyne receivers.

It will be noticed in one or two cases that all seven pins are not employed. The seven-pin holder, however, has been accepted as standard for all the valves mentioned, since it would be pointless to necessitate more than one new holder.

The New Holder.

The terminals of the valve holder may appear a trifle confusing at first glance, since there is no very clearly defined disposition of sockets as with the more usual type. Unfortunately, also, the terminals cannot be definitely marked, in view of the variety of connections called for.

In practically all diagrams of reference, however, the holder is regarded as held in such a position that a line from the viewer through the centre of the holder bisects it

USING A D.-D. PEN.

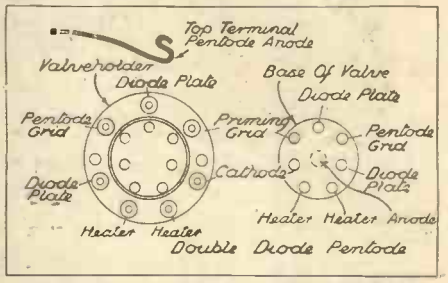


Fig. 5. The connections to be made to the various valve-holder terminals for a mains double-diode pentode can be ascertained from this diagram.

into two symmetrical halves, as shown in fig. 4. The filament terminals are then always the two at the bottom.

The valves dealt with here cover practically all those most commonly used in modern circuits, and it is interesting to note the manner in which valve design has developed.

Two quite distinct directions are clear: (a) the use of an increasing number of electrodes applied to the fundamental and simple triode valve; (b) the incorporation of two or more complete valve units in a single bulb. These are exemplified in the H.F. pentode, and the double-diode triode respectively.

In the case of the valve in which additional elements are used, the purpose is usually to modify the valve's characteristics in such a manner as to permit higher amplification or greater voltage-handling ability. The multiple type of valve provides a means for utilising multi-valve circuit arrangements in the simplest way possible.

THIS "TIDINESS" COMPLEX

Some useful hints for all radio enthusiasts.

By W. L. S.

Lack of time, or an eagerness to try out a new circuit are among the many things that sometimes make us neglectful of the appearance of our wireless gear. But does it pay? To this, our popular short-wave expert answers an emphatic NO, and points out how greater efficiency can invariably be expected as the reward of tidiness.

EVERYONE who dabbled in radio in the pre-B.B.C. days must have heard of the old saying that "the more untidy a thing was, the better it worked." Some folk, to judge by the nasty messes one sometimes sees nowadays, believe in it still.

But it isn't true, now, any more than it was then, except in one or two particular ways. Believe me, the "untidy" gentleman pays out more for accidentally burned-out valves and similar calamities than he saves on anything else.

The Amateur Transmitter.

Take our old friend, the amateur transmitter. His gear used to spread in a nonchalant fashion from one end of a bench to the other. My own, in 1922, had to be seen to be believed.

Water grid leaks in jam-jars of revolting appearance; "scrambled" coils suspended by bits of string from the window-frame; condensers like bird-cages; all lashed up by odd bits of wire with twisted joints at intervals of a foot or so. I confess, most humbly, that *that* was what my "station" looked like.

Experimental Rigs.

Now there is some excuse for this sort of thing when a job is still in the very earliest of the experimental stages. Before one quite knows what form the final arrangement is going to take, there is no objection to spreading things about a bit. But when one has decided on the constants and the circuit arrangement, it is a most slovenly habit to fall into. Make the thing up properly, and it will work just as well, or better, and will not fall to pieces every time the window is opened!

This applies just as much to the simplest short-wave receiver as it does to the more ambitious gear of the transmitter. The 1933 listener's motto ought to be "If a thing is worth doing, it's worth doing well."

Two Good Examples.

The two photographs on this page might be taken as the two extremes. The American owner of the untidy gear will, I am sure, forgive me for reproducing it, as he describes it himself as "the junk-heap." The model of tidiness is the station of G 6 F N in Scotland, and the results obtained are good enough to squash the old adage about the advantages of untidiness for ever.

How can we tidy up our receivers? Quite a lot of them seem to leave no room for improvement in this respect; but what about the "extras"? Under this heading come such things as accumulators, H.T. batteries and power packs, to mention a few.

How often does one see a neat receiver rigged up on a bench and surrounded by straggly leads, dirty accumulators with mouldy terminals, H.T. batteries oozing "juice," and the other undesirable oddments?

Why not clear the place up and give the receiver a treat? L.T. batteries, in particular, too often receive a shabby deal by being placed a long way from the set and connected up with antique flex of doubtful reputation. Use good thick wire, preferably rubber-covered single flex, and place the L.T. supply as near to the set as possible, and directly underneath it, if it can be managed.

Aerial lead-in methods, too, leave a lot to be desired. Remember that your lead-in is probably the weakest link in the whole aerial, and treat it with as much care as you do the insulation of the far end.

Those "Fading Signals."

Then bring your wire straight to the set, keeping it off the wall as far as possible, and *do* provide for keeping it rigid. Half these tales of "fading signals" that one hears are accounted for by something inside the house.

As far as the set itself goes there is not very much to be said. At least, there *shouldn't* be! But the wise words so often uttered by the sages who write in "P.W." seem to need a sledge hammer to drive them home.

One sees, almost daily, sets on which no single component is held down by more than one screw (and many are not held at all), wired up in the crudest fashion with thin D.C.C. wire and twisted joints. The marvel to me is that some of 'em work at all, unless their owners possess the power of hypnotism.

Soldered Joints Best.

If you can't solder, I should advise you to do one of two things; (a) learn to do it; (b) learn to make tight joints without solder, and use a pair of pliers.

I think an instrument for measuring the total unnecessary resistance of all the connections in a set would give some of us a fright, but it would be very useful. I have known cases of L.T. voltage being 4 at the accumulator terminals and 3·2 at the valve-legs, thanks to bad leads, dirty connections, a poor L.T. switch, and still more bad leads!

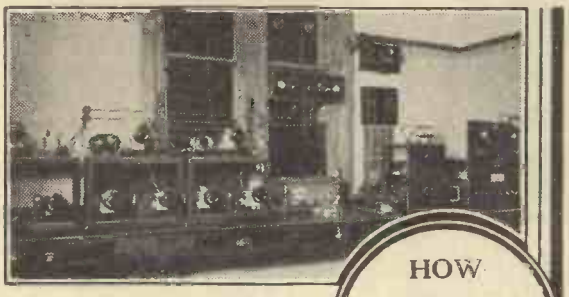
Look after details like this, and you will, in nine cases out of ten, be more than surprised at the all-round improvement in the performance of your set, whether you be a short-wave expert, or a "local-station enthusiast."

A Real Test.

I am going to make two sets to the same design one of these days. I shall make one of them as well as I know how (and perhaps that's not saying much), and the other to an imitation of some of these Heath-Robinson contraptions. Probably, in the long run, I shall only find that the untidy set works better than the other one, but that's hardly the point! If that is the case, it will only be that something unforeseen has cropped up.

Let it be a matter of pride with you that your set, and all its associated gear, is tidy enough to stand in the drawing-room, even if it is going to be tucked out of sight in your own little private "shack," and I think you will find yourself amply repaid. If it does not work any better, you will at least have a set that is good to look upon.

THE WAY IT SHOULD BE DONE



HOW NOT TO DO IT

To prove his contention that the owner of a "tidiness" complex can expect adequate recompense for his efforts, W. L. S. gives these two photographs as examples. The picture above shows the arrangement of the gear at station G 6 F N, and even if W. L. S.'s assurance of the excellence of the results which are obtained were not true, it can be well imagined that such exemplary neatness must accord G 6 F N immense personal satisfaction and certainly should provide for efficiency. The American owner of the subject of the lower picture himself refers to his station affectionately as "the junk-heap." But is affection sufficient recompense for a risk of bad results?

COMPLETE VARIABLE CONDENSER KIT

for the S.T.500

Components approved by Mr. John Scott-Taggart

Why not save yourself time and trouble by purchasing the Complete Variable Condenser Kit for the "S.T.500" and secure all the advantages of J.B. Precision Instruments. No other variable Condensers necessary. Your local dealer will give you immediate delivery.

PRICE, complete 33/-

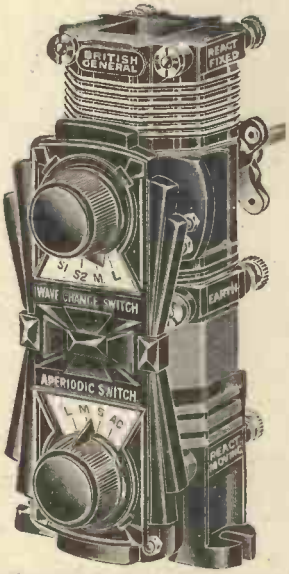
PRECISION INSTRUMENTS

REG. TRADE MARK

Advertisement of Jackson Bros. (London) Ltd.
72, St. Thomas Street, London, S.E.1. Telephone: Hop 1837.

CONVERT YOUR SET INTO AN ALL WAVE SET

for **9/6** only **9/6**



All wavelengths from 14·5 to 2,000 metres covered by this British General All-Wave Tuner.

Free wiring diagrams showing how you can build or convert your set supplied Free. State circuit when ordering.

From all dealers or direct from the manufacturers:

BRITISH GENERAL

MANUFACTURING CO., LTD., Brockley Works, London, S.E.4

THE NEW "LANGMORE" No. G1.
FOR YOUR S.T.500

RADIO-GRAMOPHONE CABINETS in FIGURED OAK. Size overall, 3 ft. 6 in. high by 21 in. wide by 15 in. deep.
THE TOP SECTION. Size 4½ in. high by 18 in. wide by 14 in. deep.
THE CENTRE SECTION. Size 10 in. high by 18 in. wide by 14 in. deep, to take a panel either 18 in. by 7 in. or 18 in. by 8 in.
THE BOTTOM SECTION. Size 16 in. high by 18 in. wide by 13⅜ in. deep. With "GALLEON," as illustrated, or "CATHEDRAL" Fret Fronts.
Wooden panels to fit, with oval aperture, 12 in. by 5½ in., 2/- extra.
The whole of the back is enclosed by double doors, so that all parts are easily accessible. ALL are fitted with hinged top, heavy platform to take a 12-in. turntable for the Gramophone, and a substantial baseboard for the Wireless Set. ***Beautifully Finished Jacobean Oak.***

PRICE **49/6** Each

NEW ILLUSTRATED CATALOGUE FREE.

THE MISCELLANEOUS TRADING CO., LTD., 13 & 17, NEW OXFORD ST., LONDON, W.C.1. 'Phone: Holborn 4894. ***Trade Inquiries Invited.***

Packed FREE and sent Carriage Paid to any address in Great Britain.

THE
World's Best Stories!

The ARGOSY offers a splendid variety of really first-class fiction. Every story sets a standard of excellence, for the policy of this magazine is to print those stories which are indisputably great, and written by acknowledged masters of the past and present day.

The ARGOSY
MAGAZINE

At all Newsagents. Monthly, **1/-**

VIBRATION INSULATION

At times a shortcoming of the all-in type of receiver is the risk of a noisy background being caused by the close proximity of the loudspeaker to certain parts of the set. There are, however, simple remedies to overcome this trouble, and they are described below.

By V. A. GILLIAN.

WITH the coming of the compact, self-contained type of receiver some year or two ago the wireless amateur and manufacturer alike found in this new principle of construction many problems confronting them from which the older type of receiver had been comparatively free.

Tracing the Trouble.

Now, when a wireless set and its attendant loudspeaker find themselves in a cabinet they seldom succeed in working amicably together. What invariably happens is that the purely mechanical vibration set up by the loudspeaker and baffleboard finds its way to delicate parts of the receiver.

A background of noises caused by vibration varies in intensity from a slightly woolly interpretation of some sounds to a din of whistles and hootings that would do an election meeting justice.

Therefore we will view the elimination of microphonic effects and other troubles having their root in vibration from the position of the home constructor, and consider the means available for the suppression of this form of interference.

The Loudspeaker to Blame.

The root of the trouble, then, seems to be the loudspeaker, so it will be well to start at its attachment to the baffleboard and to try to insert some form of vibration-smoothing material here. This may be carried out in various ways, two of which are given here.

One method is to cut a ring of felt of diameter slightly larger than the loudspeaker chassis, which can be inserted between the chassis and baffleboard, as shown in Fig. 1.

An alternative method is to make a number of washers in felt or rubber which may be threaded on to the screws securing the loudspeaker chassis to the baffleboard, so that when the loudspeaker is attached the washers come between the speaker chassis and baffleboard. The sketch in Fig. 2 will make this clear.

If anti-microphonic valve holders are not at hand the rigid type may be mounted on felt or rubber rings, the method being shown in Fig. 3.

Next in importance to valve holders come the valves themselves.

A Simple Cure.

Fortunately, modern valves are seldom troubled in this manner, being designed with a view to avoiding microphonic effects. In spite of this, however, you do come across a microphonic valve sometimes, and the trouble can often be cured, or at least alleviated, by putting a wrapping of felt round the offending valve or valves and securing the same with thread, as is also shown in Fig. 3.

Another frequent source of trouble from vibration effects can often be traced to the moving vanes of variable condensers, especially if the condensers are mounted on to the same board as the loudspeaker.

The trouble arises through the moving vanes of the condenser having only one rigid support, namely the spindle, and the unsupported extremities of the vanes vibrating in accordance with any other vibration that may be present.

There is an effective cure for this which can be easily carried out. The method is to solder a piece of stiff wire across the edges of the condenser's moving vanes; this is not very difficult, as Fig. 4 will show.

In conclusion I may say that vibration is frequently the cause of noises in reproduction for which atmospherics and man-made static often receive the blame.

DEALING WITH THE SPEAKER

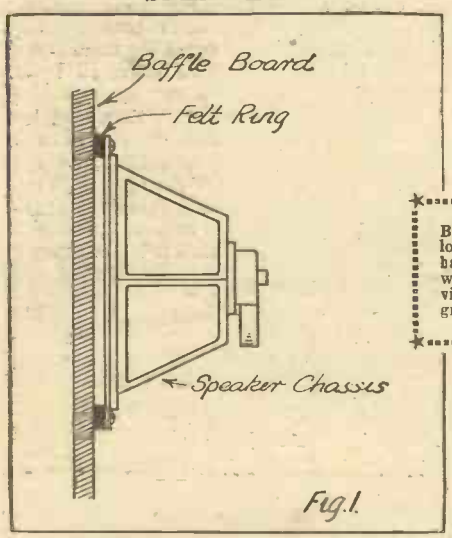


Fig. 1.

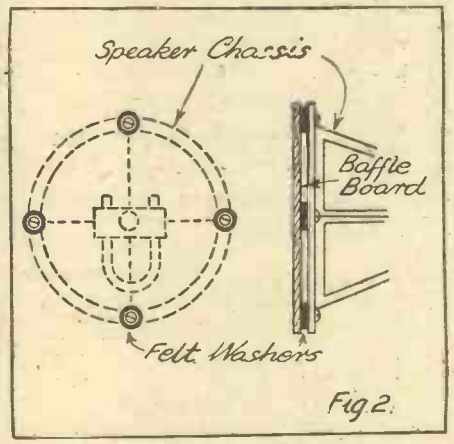


Fig. 2.

By interposing a felt ring, or several felt washers, between the loudspeaker and the baffle, as in Figs. 1 and 2, vibration of the baffle is prevented. Mounting a valve holder on a felt disc and wrapping the valve in felt is a good way of suppressing valve vibration (Fig. 3), and the expedient shown in Fig. 4 imparts greater rigidity to the moving vanes of a variable condenser.

PREVENTS MICROPHONIC HOWL

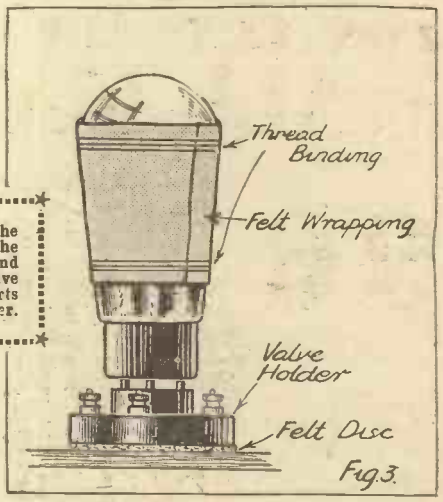


Fig. 3.

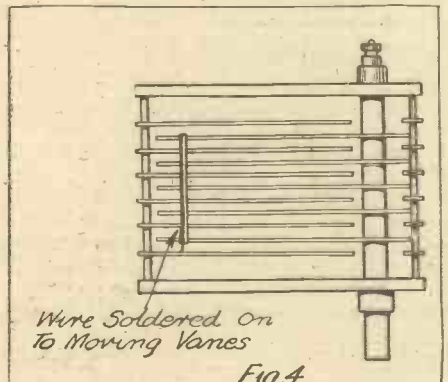


Fig. 4.

ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

(*Continued from page* 391)

That practical dreamer, Marconi, has pronounced the transmission to be feasible, so that readers who specialise on U.S.A. stations may hear the attempts.

Let the World Know !

THE proprietor of a local shop, who appears to be a wireless enthusiast, put this notice outside his door the other day: "We are receiving beautiful rabbits!" Well, it is a relief to know that the rabbits he receives are distinguished by their pulchritude, and it might be a better world if this inspired us to keep folk in general similarly advised.

For example: "We are getting beautiful signals from Barcelona," or "We are now enjoying Konigswusterhausen." After all, if you receive a beautiful rabbit, why keep the fact locked in your bosom ? Goodness knows how many men with lovely rabbits are sneaking about, chortling in secret !

The Champion Key-Pounder.

APROPOS my report about the Morse sending record of 57·3 words a minute which was set up by Mr. W. J. Chaplin, R. W. (Worksop) suggests that I might point out that the feat was not accomplished with the ordinary straightforward type of Morse key, but with what they call in America a "side-swiper" or "bug."

I do not know what type was used, but in any case the speed attained indicates superb manipulation. R. W. apparently has a poor opinion of our amateurs' sending and of our ship operators' also, and blames bad Morse keys. I myself always thought our English keys too heavy.

Egypt is Coming On.

TO the horror of King Tut, the Sphinx, etc., there is the distinct possibility that express trains in Egypt may be equipped with broadcasting receivers. Nay, it is even mooted that trains de luxe will be fitted with telegraph offices. That's a nasty one for Isis, Osiris & Co. Worse follows !

There is a proposal on foot to link up Egyptian villages with radio-telephone services. Some people have no respect for mummies ! What would the Sacred Cat of Thotmes say ? I know ! "Not quite so much of 'The Book of the Dead,' there, and a little more cat's-meat !"

Lost Spirits.

SPIRITS used to materialise at the bidding of those super-tricksters, the Maskelynes, at St. George's Hall. But that is all over now, for the B.B.C. is to take over the hall in order to replace the studio in the river warehouse, which is to be demolished.

The lease of the hall is said to cover a licence for the sale of drinks, and Sir J. Reith is said to have fainted twice and then transferred the licence to the Queen's Hall. So "spirits" will *not* materialise in St. George's !

You must be content with sucking peppermints—a form of "debauchery" which, according to Sir James Barrie, is carried on in kirks by Scottish folk.

The New York Radio Show.

AFTER all, they had a ten-day Radio-Electrical Exposition in New York this year, and report sayeth that the business done was worth $1,500,000. The total attendance was over 200,000. The "trade" predicts a successful selling season ; I sincerely hope they may get it.

SHORT WAVES

The pronunciation of "margarine" with a soft "g" is advocated by the B.B.C.
Perhaps it would be fairer to have it soft in summer and hard in winter.—"Punch."

* * *

"What's the scandal at the broadcasting studio ?"
"The whispering tenor wants more hush-money."

* * *

Newspapers may make readers' eyes start from their sockets, but the dear B.B.C. cannot allow its listeners' tender ears to burn.—"Newspaper World."

* * *

A MODERN ELEGY.

· · · Now all the world to busy life awakes,
The village street is filled with petrol fumes,
A bus blares by, a lumbering lorry shakes
The roofs, and reaches me among the tombs !

A distant driver harshly grinds his gear ;
A motor-bike appals the countryside ;
While from each cottage casement I can hear
The nasal tones of wireless—amplified !

'Tis more than human fortitude can bear,
And now at last I wish that I could creep
Beneath those rugged elms—or anywhere
The rude forefathers of the hamlet sleep !

These mute, inglorious Miltons never quake
At motor-cars, no Hampden knows the thrill
Of radio—but were they to awake
The rude forefathers might be ruder still !

"Daily Mirror."

Cheerfulness At All Costs.

RED-HOT report from San Diego (Cal.) to the effect that a firm of morticians (undertakers !) have contracted for a year with K F S D for a weekly series of programmes, musical and poetic.

In all conscience, it is ghoulish enough when firms of this calling use radio for advertising ; but when I recall how common the practice of *embalming* is in America I reel mentally and shrink a little physically to read that this series is entitled, "Beauty that Endures" !

Muddy Methods.

ACCORDING to Sir J. Reith, if an applicant for a job with the B.B.C. cannot say that he would rather join the B.B.C. at £500 per annum than go elsewhere for a larger salary, that applicant's chances of being appointed are doubtful. Singular lack of worldliness on the part of "the first Director-General" !

Again, Sir John is reported to have said that he asks the applicant: "Why do you want to come to the B.B.C. ?" Of course, the reason couldn't possibly be that the poor fellow had failed to get a job anywhere else !

New Menace to Radio.

THIS floor-polishing is a curse. It has long been a blight because it causes the mat to slide under the foot of the unwary; but when it arouses zeal in the bosom of the "domestic" it is —what I said.

Last night my set was dumb, and investigation showed that the aerial and earth leads had been wrenched from their terminals. The housemaid, anxious to polish that part of the floor on which the set stood, had just shoved the obstruction aside. Probably she thought that the leads were elastic.

I have, therefore, invented a lead which has a section which is made of wire coiled like a spring, covered with a strong rubber tube which will stretch.

Steady March of Radio.

DEPRESSION, heat-wave, the "pips," the "doomp," Dinwiddies, Dawnays and lady announcers combined fail to stem the steady flow of licences. It really is amazing. During August the total issued licences in Great Britain mounted up to 5,654,400.

It might have been more than that but for the Jolly Rogers who, during the same month, had 219 of their crew prosecuted and fined in all £198. So profitable and exciting does the Post Office find this hunting that there are rumours of a great Drive. What a pity that it is necessary !

More Faith Wanted.

WHAT we lose for lack of a little faith ! Years ago I could have bought a real golden quid on London Bridge for a shilling, but I was too wide-oh ! This is rubbed in by the news that a Salford radio dealer put in his window a ticket for the Manchester United–Burnley League football match, with the following notice: "It's yours for the asking."

Hundreds of passers-by looked, read—but did not ask, and eventually the office boy got it. I hope that this story will not make you rush to buy the next gold brick which is offered to you.

Electronic Music.

A new radio musical instrument, working on a hand-capacity principal, is being played for H.M.V. recording. It is called the Electronde.

ARIEL.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos

Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so

QUESTIONS AND ANSWERS

WHEN THE PROGRAMME SUDDENLY DROPS TO A WHISPER.

R. V. M. (Billingshurst).—"I cannot understand what is the matter with my set (three valves, H.F., detector and low-frequency). It will be playing splendidly, and then all of a sudden drop almost to a whisper.

"After a few seconds, sometimes longer, it will burst forth into full volume again. What is the reason?"

You don't give us much assistance in the way of information about the set, do you, R. V. M.? To be able to help you in detail we should like to know a lot more about it, and also about the fault.

For instance, has the trouble been there ever since the set was put into action, or has it appeared after a period of good working?

Did you alter any of the wiring or leads just before the fault was noticed? And does this sudden silence occur when everything in the room is still, or only when somebody is walking about or moving near the set? Any little points about *how* and *when* the trouble appears would help us in diagnosing it.

Failing that, and any information about the receiver itself, we can only say in a general way that this type of fault is nearly always due to a faulty contact somewhere—possibly in the set, but may be in the battery, aerial, earth or loudspeaker lead.

To test, you must make a systematic examination. Start with the loudspeaker, and look carefully at its terminals to see that they are making firm connection. If there seems nothing wrong with the instrument itself, have a good, leisurely look along the leads which run to it.

Don't hurry over the job. Take a foot or so of the wire in your hands and examine its insulation, and then bend and wriggle it about a bit to see if moving that particular section seems to have any effect upon reception. If not, pass along to the next section of the wire, examine that with similar care, and so on.

Then examine the battery leads in the same careful fashion. Don't be satisfied because a wire *looks* all right at first glance, but test it. Insulation can cover a multitude of sins.

And when you arrive at the battery itself, examine that with equal suspicion. If it is the L.T., make sure that the spade tags or other connectors are tightly gripped by the terminals.

Undo the terminals and look at the hidden surface which actually makes contact with the connector. Is it clean and bright, or would a good rub-down with sandpaper or emery cloth improve it?

Remember that if the battery consists of separate 2-volt units the connecting bars between these must be as firm and as clean as any other part of the equipment. If not, they may give rise to exactly the kind of intermittent contact which is causing your trouble.

Go for the H.T., G.B. and aerial earth leads in the same thorough manner, keeping the set switched on all the time, and noting if any movement of yours seems to affect the fault.

If you cannot find anything wrong outside the set, open the lid and very carefully investigate the internals with a wooden penholder or some such convenient non-conductive prod. (Don't use metal, or you may make an accidental connection somewhere and cause a burn-out or no end of trouble.)

Look with especial care at all flex leads, such as those which go to coil tappings. Sometimes nearly every flexible strand gets broken through, and thus contact becomes very "chancy"; so moving the

(*Continued on next page.*)

DO YOU KNOW—

the Answers to the following Questions?

There is no "catch" in them; they are just interesting points that crop up in discussions on radio topics. If you like to try to answer them, you can compare your own solutions with those that appear on a following page of this number of "P.W."

(1) Which of the big B.B.C. stations is to be replaced by improved equipment of greatly increased power?

* * *

(2) How does the B.B.C. use the Blattnerphone apart from the re-broadcasting of past items?

* * *

(3) What great change in European broadcasting is due to take place early in 1934?

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

lead will cause the reception to come and go, as you describe.

Then gently prod the valves and the components one by one. By proceeding slowly and methodically in this way you are fairly sure to come across a valve, or a grid leak, or a lead (for every wire should be gently investigated) that is causing the trouble. And once you know where the trouble lies you can put it right by improving the contact at that point.

Notice, too, whether all the wires which are supposed to be apart are really well apart or nearly touching. Because if something which is supposed to be insulated is sometimes actually touching another piece of metal it may be shorting all your results away. (The aerial lead touching against the gutter-pipe or other earthed conductor was often the cause of this when simple sets were all the go, but nowadays the fault is generally a little more subtle.)

Be specially careful to test the switches as thoroughly as possible; they often develop poor contact after they have been in use, especially if they are not well made and soundly designed. And don't trust loose plugs. Open them out so that they fit firmly into their sockets.

By overhauling everything in this way you are fairly sure to find the fault. But if you do not you will at least have the satisfaction of knowing that it is not the wiring, etc., but one of the components that is letting you down.

DOING WITHOUT DECOUPLING.

D. K. (Tunbridge Wells).—"I am not sure if I am doing right, but after a lot of trouble I have got the set going, and I am perfectly satisfied with it, if you are. But this is what I want to ask about.

"When first connected up to the batteries I got no programme at all, and spent a long time trying to make out what was wrong. Finally, I happened to touch the decoupling resistance and heard music.

"This put me on the track, and in the end I got everything going perfectly—reaction strong, volume control perfect, etc.—but *with no decoupling resistance*, only a piece of wire across the terminals of its holder. Do I need to do anything about it, or shall I carry on like that?"

Your decoupling resistance was a dud, and the correct thing to do is to get another one which is O.K. and use that in the holder.

It is, however, quite possible to carry on as you are, because if there is no instability you do not need the decoupling.

But remember that when the H.T. battery begins to age it may cause instability to develop, and in that case, you will find that decoupling is a very valuable feature, if only because it soon pays for itself in the increased battery life which it enables the set to achieve before distortion shows itself.

CONNECTING THE EARTH MAKES NO DIFFERENCE.

F. T. T. (Acocks Green, Birmingham).—"Perhaps you can tell me the cause of a curious fault which has been puzzling me ever since I found it a fortnight ago.

"There is no difficulty with reception or anything like that, but just a failure of the earth connection to make any difference whatever to the set. It goes at exactly the same strength, whether the earth wiring is attached to the earth terminal or not.

"I have tried it on distant stations, and actually got Riga on it one night last week. Before the programme started to fade I was able to try both with and without the earth lead several times, and it makes absolutely no difference to tuning or to strength.

("I believe Riga is about a thousand miles away, and not a high-power station, so this was a thorough test of the set's pulling powers, with and without earth.)

"As you can guess, I am very pleased with the set, which I consider is a wonder for two valves (detector and pentode). But I am puzzled about this earth business, because of my experience last year, when I wrote to you about the "Apex."

"In your reply at that time you suggested that my trouble was likely to be the poor earth I had then, and on your recommendation I went to a good bit of trouble to remedy that, with the result that I proved you were right, and the set went fine as soon as the earth was O.K.

"That being so, why is it that now I have gone over to an all-mains set, with only two valves, using *same aerial and earth*, I can take the earth right off without making any difference?

("By the way, I know the earth is all right, as I had it up and examined it when digging near last month, and I have tested the lead, and will swear that it is as near perfection as can be.)"

We must admit, F. T. T., that we should have been very puzzled to account for your results if you had not disclosed one very important difference between the set you were using before and the set which is

(Continued on next page.)

"P.W." PANELS, No. 142.—POSTE-PARISIEN.

This is one of the finest stations on the Continent, and is very strongly received in this country.

The distance from London is a few miles over two hundred, the station being erected well outside Paris itself, for the same reason that our own Regional stations are outside London, Manchester, etc.—i.e. better radiation.

Poste-Parisien works on 328·2 metres, with a power of 60 kilowatts. Announces "Poste Parisien."

A feature of this station's programmes is the music of an "electric organ"—one which uses oscillating valves instead of organ pipes.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

now in use—we refer to your statement that you have now "gone over to an all-mains set."

On the face of it that may not appear to have very much to do with the earthing efficiency. But if you think it over, you will see that it is possible for the peculiar symptoms you describe to be due to the fact that the set is now well and truly earthed *through the mains.*

It does not always happen that a mains supply provides efficient earthing. But sometimes it does, and apparently that is what is happening in your case.

Naturally, if you have a good earth through the mains wiring, your outside earth is going to make very little difference to results, whether it is connected or left undone. Whereas, on a battery-driven set, it might be absolutely essential to have a good earth connection in order to get good long-distance results. Incidentally, we should like to congratulate you on getting Riga on two valves. He uses only fifteen kilowatts, and is quite a thousand miles from your aerial, so that was "good going"!

PLUGS AND SOCKETS FOR LOUDSPEAKER EXTENSION WIRING.

We should like to thank F. M. T. (of Radley College), who has written to warn fellow-readers of "P.W." of a little snag which is sometimes met with in connection with the wiring of loudspeaker extension points.

THE "S.T.500."

The tremendous interest created by this set has made it impossible to despatch individual replies to queries with our usual promptness.

We hope, therefore, that readers who raise other than definite technical queries will excuse the unavoidable delay in replying to their letters.

The snag is that if you use the ordinary household type of 5-amp. plugs and sockets for joining up the loudspeaker, and if these sockets happen to be placed near others which are used for lamp or electric-iron connections, some careless or lighthearted soul may all unwittingly push the *loudspeaker* plug into the *mains* socket! And that certainly won't do the loudspeaker any good!

Obviously, in any case where such confusion of sockets might arise, it would be far better to have a different type of plug and socket for the loudspeaker leads, so that the plug which belongs to these cannot possibly be inserted in the mains wiring socket. (Some of the miniature plugs sold specially for loudspeaker wiring are very cheap, inconspicuous and ideal for the job.)

We should like also to say, whilst on the subject of readers' experiences, how greatly we value the friendly spirit of co-operation and helpfulness which is exemplified by F. M. T.'s letter, and which exists amongst "P.W." readers all over the country—in fact, all over the world!

THOSE WEAK SHORT-WAVE CARRIERS.

D. W. T. (Luton).—"Like one of your other readers, I have been trying my hand at short-wave reception for the first time. And I am a bit puzzled about the results obtained.

"I get plenty of chirps and whistles, but they are mostly very *weak*, as compared with tuning-in on the medium or long waveband. (At least, the programme-giving stations are. Some of the Morse is anything but weak!)

"Is this usual?"

Generally speaking, the carrier-wave chirp of a short-wave broadcasting station is not at all promising; but very often what sounds at first like a "weak carrier" will prove to be capable of providing a fine loudspeaker programme, so the short-wave enthusiast never neglects a transmission because at first it sounds weak.

The golden rule, as W. L. S. has pointed out in "Short-Wave Notes," is to investigate everything you tune in.

The set should be gently oscillating when the carrier-wave is tuned in, and in order to "resolve" the programme the reaction must be very gently slackened off, so that the set is nearly, but not quite, oscillating, whilst the tuning is very slightly re-adjusted to "hold the station."

This final tuning is a bit critical, so the dials must be rotated slowly and carefully, but there is really very little more difficulty than in tuning on ordinary waves. Once you realise that when reaction has been slightly altered it may be necessary to compensate by retuning very slightly also, the resolving of weak carrier-waves into strong programmes is quite easy.

HOW TO OBTAIN BACK NUMBERS OF "P.W."

C. W. (Leiston).—"I want the number of 'P.W.' in which the 'Class B Mains Unit' was described. Please say if this is still obtainable, and how much."

The "Class B Mains Unit" was described in "P.W." No. 590, dated September 23rd, 1933. This, and any other numbers of "P.W." which are still in print can be obtained through a newsagent's order, or direct from the Amalgamated Press Ltd., Back Number Dept., Bear Alley, Farringdon St., E.C.4. Price 4d. per copy.

THE ANSWERS

TO THE QUESTIONS GIVEN ON PAGE 430 ARE GIVEN BELOW.

(1) Daventry 5 X X. A modernised long-wave station is now being erected near Droitwich.

(2) The Blattnerphone is constantly used to improve the standard of talks, etc. It enables broadcasters to hear their own voices at rehearsals, and many faults of speech, etc., are thus corrected before the broadcast takes place.

* * *

(3) On January 15th the Lucerne Wave-length Plan is due to come into force, and many stations will then alter their wave-lengths.

DID YOU KNOW THEM ALL?

THE MIRROR OF THE B.B.C.

(Continued from page 400.)

A Symphony Concert.

The Merseyside Symphony Orchestra conducted by Louis Cohen, the well-known violinist, who founded it about a year ago, will be heard by North Regional listeners during the evening programme on Sunday, November 5th. The soloist will be Douglas Miller, who, with the orchestra, will play the Concerto in C Sharp Minor, Rimsky-Korsakov's only work for piano and orchestra.

The short history of the Merseyside Symphony Orchestra has proved that Liverpool has a great appreciation of its concerts which are given on Sunday evenings at the St. George's Hall. Among the guest conductors who will direct it during the coming season are Sir Hamilton Harty, Dr. Adrian Boult and Dr. J. E. Wallace.

From the Midland Regional.

Midland Regional's series of County Week programmes have almost run their course. Only one or two still remain to be given, among them being a week devoted to Shropshire, which is to begin on Monday, November 6th, with an introductory talk by the Chairman of the County Council, Mr. T. Ward Green.

Martyn Webster, the young producer whose early service with the B.B.C. was performed in Scotland before he was transferred to Broadcasting House, from where he was recently moved to take the place of Charles Brewer at the Birmingham station, is to produce the Shropshire Pageant, which follows Mr. T. Ward Green's introductory talk.

The Pageant has been written by Mr. A. D. C. Anderson, one of the masters at Shropshire School, a fantasy upon which is included in the last of its eight scenes.

Noises of the Hunting Field.

Industry has not spoiled Shropshire, and has left unscathed its beautiful hills—the Clees, the Long Mynd, the Quorndons, Breidden, the Wrekin and the Long Mountain—which, in their variety, are the most distinctive features of the county.

Shropshire has its sheep and its hunting, and a talk on the latter will be given on Wednesday, November 8th, by Major A. C. Bovill, master of the North Shropshire Hounds. Typical noises of the hunting field will be introduced from the kennels at Lee Bridge, near Wem.

Appropriate Musical Items.

On the musical side of the programmes, what could be more appropriate than that composers of such national fame and Shropshire birth as Sir Walford Davies and Sir Edward German should be represented in two of the midland composers' series of concerts that week?

Sir Walford Davies, who was born at Oswestry, will be represented on Thursday, November 9th, by eight of his part-songs, including three from his cantata "England's Pleasant Land," which are to be sung by the Midland Studio Chorus.

Sir Edward German is a Whitchurch man, and the concert of his music will be heard on Friday, November 10th. It will be given by the Studio Orchestra, directed by Frank Cantell.

THE LISTENER'S NOTEBOOK

(*Continued from page 400.*)

so brimful of sunshine, jollity and interest as this Florida talk was.

* * *

It is such talks as these that lessen our tendency to take everything, including broadcasting, for granted. By which I mean that, to my mind, there was something of the wonderful in this broadcast, although the transmission fell far short of perfection. Well, that was how it struck me.

* * *

I don't think the six telephone conversations that introduced the principals of "Pursuit" should be regarded as the solution to the identification problem in radio plays. But they went a long way towards achieving that end. The fact is, radio drama will always have this problem, and the real solution rests with listeners themselves and the skill they display in spotting.

* * *

At the worst, all that's necessary, I suppose, is a little patience on our part. All the same, it is up to authors and producers to simplify things as much as possible. I can recall plays when no sort of attempt was made by them to avoid initial complications. Such a play should never pass the plays' director, whatever the merits of the play.

* * *

I liked "Pursuit" because it was full of incident, and the dialogue was lively. Again, the cast was excellent. We've come to expect this always now, but the two players who took my fancy most were Miss Gwendoline Evans as the abducted girl and Mr. Phillip Wade as a taxi-driver.

* * *

Emerich Kalman's was a real Continental programme of music, though with the B.B.C.'s distinctive touch. I can't remember a programme of this type that I enjoyed better. It would be futile to try to distinguish between numbers that were all so uniformly excellent, but the two songs from "Countess Maritza" pleased me immensely.

Thea Phillips and John Hendrik were at their best, though it is true that Kalman had provided them with some jolly songs to sing. A very enjoyable hour, because one felt one was listening to gay and sentimental music that was pleasing and by no means lowbrow.

* * *

Professor Watson's second talk on "Rural England" confirms the opinion I formed of him after his first talk that he is something of a find as a broadcaster. He enters straightway into the ranks of radio's big guns.

* * *

Charlie Buchan, on international matches, stated his case very clearly, I thought, and conversation among "Soccer" fans could not have been wanting for the rest of that Saturday evening. If not altogether controversial, the issue at stake might be described as debatable. Good fare for a Saturday night for thousands—that's more than I can say for the Welsh interlude that followed Buchan's talk.

THE LINK BETWEEN

(*Continued from page 420.*)

will "Mr. X" please communicate his name and address to me immediately.

By the way, will everyone who applies for literature please note that any slight delay which may occur is due to the tremendous number of applications we have to deal with and not to the fact that they have been forgotten!

Cabinets for Constructors.

The high standard of cabinet craftsmanship displayed in the majority of modern commercial receivers was perhaps the most outstanding "first impression" of the recent radio exhibitions.

But this welcome tendency is by no means restricted to sets of the commercially built type. Several of the cabinet manufacturers are now producing for home-constructed sets models which are both elegant and distinctive. In this connection I want particularly to call attention to the range of cabinets that is now being produced by Peto-Scott. For considerations of space I am afraid I cannot describe each and every one, but take my advice and obtain a copy of their catalogue. It is available under "P.W.'s" postcard literature scheme. **(No. 61)**

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way—just quote the number or numbers.

Making Bad Mains!

I wonder how many readers are aware of the meticulous care that is taken by commercial set manufacturers these days to ensure that not a single instrument leaves the works until it is in perfect order, irrespective almost of the conditions under which it may ultimately be used.

A typical instance has just come to hand from Marconiphone, and because I regard it as a matter of more than usual interest I think it is well worth passing on.

For obvious reasons, the power-supply mains in the testing laboratories of the Marconiphone factory at Hayes are steady and accurate and free from interference.

But, unfortunately, that is more than can be said of all the various sources of mains supplies in the country. In some districts the supply mains are notoriously "dirty," and consequently a set which may be quite up to standard on the "clean mains" of the Marconiphone Factory may not always be completely immune from interference when used elsewhere.

To obviate this difficulty, and to ensure that sets leaving the Hayes factory are suitable for all types of mains, the Marconiphone engineers have now isolated a section of the mains circuit, and have purposely made them "dirty" by feeding in from an oscillator interference of a particularly obnoxious kind with a heavy second harmonic.

If a set will work perfectly under these exacting conditions, it's a safe conjecture that it will work anywhere. Good scheme, Marconiphone!

H.T. ECONOMY

How to make a unit employing the latest H.T. reduction circuit.

ONE of the most ingenious adjuncts to the modern battery receiver is undoubtedly the H.T. economiser: that small group of resistances and condensers, plus a dry rectifier, that enables its user to save something like 40 or 50 per cent in H.T. consumption in the operation of his set.

How it works and what it is, have been described often enough in these columns, but owing to its popularity the question sometimes arises as to how and where to *get* it.

Our latest use of the economiser circuit was in the modernisation of the famous "Comet" (POPULAR WIRELESS, October 7th), when a commercial economising unit was employed. Since then some difficulty has been experienced in certain quarters in obtaining specimens, and we have been asked whether the unit described in POPULAR WIRELESS (September 16th) could be employed instead.

A Single G.B. Battery.

The unit in question incorporated a simple economising circuit which is very successful, but although it could be used in the "Comet" provided separate bias batteries were employed for the two L.F. valves in the set, a later development of the circuit obviates this disadvantage, and enables a single bias battery to be employed.

That circuit we reproduce on the next page, and for clarity we have marked the connections so that they agree with those on the "Comet" diagram.

The circuit can obviously be made up in compact unit form, or it can be built up on the baseboard of the set as desired.

Those who refer back to the unit we published in September will notice where the circuits differ, and how, in the present one, we have obtained the undeniable advantage of the retention of a common bias battery for the set, though in other

(*Continued on next page.*)

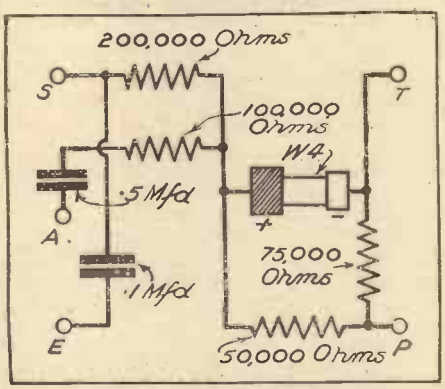
H.T. ECONOMISERS

(Continued from previous page.)

respects the operations of the two economiser circuits are identical.

Naturally, if desired, the two resistances across the Westinghouse rectifier can be substituted by a single resistance, the value being chosen to suit the output valve with which the economiser is to be employed. For a large pentode the value need be some 50,000 ohms only, but for a

SAVES HIGH TENSION



The connections and suggested arrangement of a simple home-made economiser unit.

triode the value is preferably between twice and three times that figure—say 125,000 ohms.

In the "Comet" modernisation we catered for the use of a triode output valve, and so terminal "T" was used on the economiser unit. This, as shown in our diagram, meant that a resistance of the order of 125,000 ohms was being used across the rectifier. With T and P joined together, the value of the resistance is reduced to 50,000, and the unit is suitable for a large pentode valve.

ROUND THE RECORDS

A review of some of the more outstanding of the recently released records, of special interest to all users of radiograms or pick-ups.

ONE of the finest set of recordings ever published is the H.M.V. album of Beethoven's Concerto in C Minor, No. 3, for pianoforte and orchestra. The pianist is Artur Schnabel, and he is finely supported by the London Philharmonic Orchestra under the baton of Dr. Malcolm Sargent.

There are five twelve-inch discs, the Beethoven Concerto taking up nine sides and the remaining side being filled with the same composer's Rondo in C Major, Op. 51, No. 1. The discs number from DB1940 to DB1944 inclusive, and can be obtained either for "straight" playing or for automatic record changers.

A single disc that deserves high praise for both its recording and its conception is the Columbia "The Floral Dance," a descriptive ballad of the famous Helston Furry, with the immortal song theme running through it. The soloist is Raymond

(Continued on next page.)

ROUND THE RECORDS

(Continued from previous page.)

Newell, while others taking part include Charles Wreford, Franklyn Bellamy and Mrs. Charles Wreford (DX520).

The new Concise Grand Operas, also by Columbia, should meet with a ready sale, for they provide the best out of two of the most tuneful and popular operas, though widely contrasted in style. The operas chosen are "Madam Butterfly" and "Aida," and run on records Nos. DX500-505 for the former and DX506-511 for the latter.

Terence O'Brien, the famous Irish tenor, records for the first time on Regal-Zonophone MR1018. He has chosen two of the most tuneful Irish ballads, "Mother Machree" and "A Little Bit of Heaven," which he sings with great effect.

Dance and Comedy Numbers.

Jack Jackson and his Orchestra are to be welcomed on H.M.V., one of their best recordings being B6392, "I'm Gettin' Sentimental Over You," while "hot" fans will be pleased to have another Louis Armstrong disc, B6387, where the famous trumpet player lets himself go in "Mississippi Basin" and "Dusky Stevedore."

A comedy number worth hearing, though somewhat over-exaggerated in theme, is "Taking Possession," by Those Four Chaps (Claude Hulbert, Bobbie Comber, Paul England and Max Kester). It is recorded on H.M.V. B8003, and portrays the troubles of Claude on his purchase of a new house.

"The Invalid" is a comedy sketch that is well done and quite unusual in type. I shall not give any idea here of its theme, for that would spoil the surprise, but I advise you all to hear it. Columbia DB1179.

The Radiolympia record of Henry Hall (Columbia CB660) is novel, but as entertainment to others than were present during one of his shows there it must fall a little short in entertainment value. It shows, however, that advances have been made in recording, for the plaudits of the audience are excellently portrayed.

"C. B. Cochran Presents."

Another fine Columbia release is the topical "C. B. Cochran Presents," which was brought out coincident with the famous producer's sixtieth birthday and the special broadcast programme arranged to celebrate the event.

It is a twelve-inch disc, and contains a number of the big hits of Cochran shows over the last ten or twelve years. The orchestral parts are provided by Henry Hall and the B.B.C. Dance Orchestra, while artistes "appearing" in their original numbers include Delysia, Peggy Wood, Noel Coward and Mary Ellis. The whole is compered by the inimitable Christopher Stone.

The record is the excellent result of a fine idea, and should prove extremely popular not only with those to whom the Cochran shows are familiar, but to the whole radio and gramophone public. It is good entertainment.

Fans of Val Rosing, one-time Henry Hall's vocalist, will like to follow his recording career on Rex records. I have had several of these, and they form some of the best shillingsworth I have ever had. The latest is "Let's Call it a Day" and "Don't Blame Me" (8023). And, talking

(Continued on next page.)

ROUND THE RECORDS

(Continued from previous page.)

about Rex records, let me put right a slight slip made in the last "Round the Records" when I was discussing the products of the Crystalate Record Mfg. Co. It was stated that they were the manufacturers of the "Four-in-One" records. This should have been "Four-Tune," of course.

Another old favourite has been resurrected, a number that is said by "those who should know" to be the best dance number ever composed—"Avalon." It is re-recorded by Billy Cotton, and is coupled with his rendering of Duke Ellington's "Sophisticated Lady" (MR1035).

And here's the story of another Billy Cotton release, the tale of a song which its composers wanted to sell for £5, but which actually, through the astuteness of its "discoverer," will net probably thousands of pounds,

The manager of the Regal-Zonophone Company was asked over the telephone recently if he would consider a new song that had just been written. The reply was a polite refusal. The composer then happened to mention that what had been written was a "rhymes" song, and although discouraged, the young man persisted, and was invited to bring his effort along.

The sequel came when the members of a vaudeville act—The Three Blue Boys—rpesented themselves and handed over the MS. of a song entitled, "Sunday School Stories." The Regal-Zonophone official, struck by its originality and humour, arranged with two representatives of the publishers to advance a far better remuneration, with the result that we now have an excellent recording.

K.D.R.

FOR CLASS B SPEAKER USERS

Below we give the alterations to the S.T.500 Rapid Construction Guide which are necessary in the case of those constructors who have loudspeakers already provided with a Class B transformer.

(20) Not now in the set. Tighten the H.T.+3 terminal on strip.

(21) Driver-transformer terminal G1 to 7-pin valve holder V4 grid terminal (tighten) G1.

(22) Driver-transformer terminal G2 to 7-pin valve holder V4 grid terminal (tighten) G2.

(23) Driver-transformer terminal G.B. via 12-in. length of flex to G.B. — 2 plug (tighten).

(24) Driver-transformer G.B. via 10,000-ohm resistor to driver-transformer terminal (tighten) G1.

(25) Driver-transformer terminal (tighten) G.B. via 10,000-ohm resistor to driver-transformer terminal (tighten) G2.

(26) L.S. — terminal (tighten) on strip to 7-pin valve holder V4 anode terminal A1.

(27) L.S.+ terminal (tighten) on strip to 7-pin valve holder V4 anode terminal A2.

(28) Not now in the set.

(29) Not now in the set.

(30) Not now in the set.

PASTE ABOVE over third column of page 289 of "Popular Wireless," dated October 21st, 1933. The numbers before (20) and after (30) remain the same, and the Rapid Guide remains identical except for the above.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

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

Radio Relays.

THE radio relay movement seems to be catching on, and I have met quite a number of people who are enthusiastic about it. I must say that when it was first talked about, I suppose some two or three years ago now, I personally did not think much of the idea, and I never thought it would become popular. You know what it is—a "central" receiving set which receives a choice of just a few programmes and redistributes these to loudspeakers in the houses of the subscribers to the "system."

In principle it is not unlike a local telephone exchange, where incoming calls are distributed to subscribers who have telephone instruments. With such a variety of regular receiving sets at popular prices I should have thought that everyone would have been fully catered for by a set of his own; but the extraordinary thing is that, so I am told, practically all the subscribers to the "local-relay" system have their own radio sets as well!

Some Output.

There are, of course, variations in the actual arrangement, but, briefly, the distributing station is fitted with one or more receivers of a specially powerful type which can be tuned to receive a few special programmes—generally not more than four or six. A set of powerful amplifiers, usually on the push-pull system, are employed, the number and power of the amplifiers depending on the total number of subscribers to be served, and you can guess that a pretty heavy output is delivered. In some cases the actual output may be between 100 and 200 watts, whilst the high-tension current may reach as much as one ampere at its maximum value.

Dual Speakers.

Some little time ago one of the well-known loudspeaker manufacturers sent me one of their dual instruments for test. I had not had an opportunity of trying this out until a day or two ago, when I made a series of pretty exhaustive trials.

This idea of balancing the tone by means of two or more instruments is not new—it has been tried out at various times during the past few years. Hitherto, or until recently, it never seemed to me to meet with a very great deal of success, possibly because the different component parts did not really bring out their assigned portions of the audio range.

You Should Try This.

However, I must say that the tests I have made with this instrument have convinced me that there is a great deal to be said for using two speakers together in this way. One of the units is specially designed for favouring the higher register, whilst the other one brings out the bass, and in that way you get a result which it would be

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

much more difficult to obtain from a single instrument. Naturally, it costs more to produce what is, in effect, a *pair* of loudspeakers, than a single one, but on the other hand each of the two separate units is simpler, since there is no need to make it cover more than one particular range.

Then Stop and Buy One.

If you have not tried this scheme it is worth looking into, and you can make your first tests, without actually buying a new instrument, by means of a couple of loudspeakers which you may have on hand or which you can borrow, one with a high-pitched note and the other a low pitch.

Having satisfied yourself that there is really something in this scheme, you can then consider going in for one of the excellent dual-compensated speakers which are now on the market.

Condenser Values.

With the very large number of different types of condensers which are now available the ordinary man gets rather confused on the question of capacity values, and unless you are continually handling condensers for different purposes you are liable to go wrong on a decimal point, which means multiplying or dividing by 10, and makes a lot of difference!

I have often been asked questions on this matter, and it might perhaps be useful to some of you if I just mention the purpose for which different capacities of condensers are generally used. For instance, the very small capacities, say 0·00005 up to about 0·0005, are generally used for aerial tuning, the smallest values being for aerial selectivity adjustments. Values ranging from ·0003 to ·0005, are also used for tuned anode, and for high-frequency transformer tuning, whilst fixed condensers having values of about 0·0001 to 0·0003, are often used for high-frequency coupling, detector anode bypass and power-grid detectors.

For Resistance Capacity.

Coming to higher values, resistance-capacity coupling takes 0·001 up to many times this value, even as high as 0·1, whilst this latter value is also useful for high-frequency bypassing. With parallel-feed transformers you can use from 0·05-microfarad right up to 1 microfarad or even up to 2 microfarads. For low-frequency decoupling, condensers of 1 or 2 microfarads may be used, whilst for smoothing circuits, as in a mains-supply unit, you can use 2 or 4 microfarads and, in fact, go to electrolytic condensers with very much higher capacities.

Decoupling.

Talking about decoupling, by the way, reminds me that many of my readers seem to be a bit hazy about what decoupling

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

means; it is continually mentioned in technical articles and is one of the most important of the many dodges used in a radio receiving circuit. Decoupling, as its name implies, is the separation of two circuits, or rather of two *parts* of the circuit, in such a way that unwanted interaction between them is got rid of.

Motor-boating.

If you have an ordinary receiving circuit without special decoupling devices you will often get interaction between different parts of the circuit which will cause instability, howling and motor-boating. There are certain interaction effects between different stages which are definitely required for the proper operation of the circuit as a whole, but these unwanted or, as we may perhaps call them, parasitic effects only cause trouble, and therefore we have to keep them out.

It would take too long to give you all the various causes of unwanted coupling and the different places in the circuit in which decoupling should be used, but I can illustrate the general principle by referring to the commonest of all causes of unwanted coupling, and that is the high-resistance H.T. battery.

I dare say you know that if an H.T. dry battery is getting a bit ancient and dried up its internal resistance increases very much, and then it will cause howling and motor-boating and all sorts of troubles, quite apart from the fact that its voltage is running down. Well, this is due to the resistance of the battery causing a coupling between one valve stage and the next.

High-Frequency Stopper.

If the battery has a *low* resistance the high-frequency currents will get through and go straight to earth; but if the resistance of the battery is unduly *high*, the high-frequency currents, not finding an easy path to earth through the battery, will go off to the anode of the succeeding valve and cause oscillation trouble. If, however, a suitable resistance is introduced into the anode lead of the first valve, this will act as a stopper to the high-frequency currents, so that they will not be able to pass into the H.T. battery.

Alternative Path.

If, in addition to this, the anode of the valve in question is connected to earth *via* a fixed condenser of suitable value, not only will the H.F. currents find themselves stopped from going on to the H.T. battery, owing to the resistance referred to above, but they will find an easy alternative path offered them to earth. They will thus be faced with an opposition on the one hand, whilst on the other they will have a strong inducement to go in another direction. This resistance is known as a decoupling resistance and will render the circuit stable.

This is a very good example of what is meant by decoupling, and, as I say, decoupling has to be done in different parts of the circuit. The principle, however, is the same as that described above.

Non-Inductive Components.

You are continually reading that this or that component to be used in a circuit should be "non-inductive," and inasmuch as some of the components, such as transformers, chokes and so on, have a definite and necessary inductance, readers sometimes wonder why it should be so important whilst specifying inductance in one place to prohibit it in another.

As you no doubt know, inductance and capacity together comprise the makings of a tuned or resonant circuit, and whilst you want such resonant circuits in some parts of the set you don't want any tuning effect at other parts, or else you will get things all mixed up. For instance, in a band-pass circuit you use a bypass resistance and a coupling condenser, but these must be non-inductive, otherwise you would get what are known as "resonance peaks."

In the Grid Lead.

In the grid lead of a low-frequency valve you sometimes introduce a stopping resistance so that high-frequency currents will not get into the low-frequency amplifier—as I have mentioned earlier in these Notes—and this resistance must be of the "non-inductive" type, so that it will not discriminate between one frequency and another; if it were an *inductive* resistance it would single out certain frequencies and treat them differently from others, and you would get distortion troubles. Another case is where a bypass condenser is placed between the screening grid of a screen-grid valve and the earth: this condenser must be as far as possible non-inductive.

Never Actually Zero.

Of course, in practice the most we can do is to make the component of as low an inductance as possible, but we can never reduce its inductance to zero. Even a piece of straight wire carrying current has a certain inductance. When current flows it creates a magnetic field, and there you have the elements of inductance; but if the current is caused to flow in certain special ways (for example, in a coil of wire) the inductance is greatly increased.

NEXT WEEK

Another Long Article by

JOHN SCOTT-TAGGART

entitled

The S.T.500 in Action

also

HOW TO MAKE A UNIVERSAL AMPLIFIER

A SPLENDID BOOK

Chums Annual is one of the most up-to-date and thrilling books on the bookstalls. It is full of school and adventure stories and mystery, footer and cricket stories, too! There are also many interesting and instructive articles on hobbies, pastimes and new inventions. It costs 12s. 6d., but it is worth a good deal more.

RI DRIVERMU

THE REAL 'CLASS B' TRANSFORMERS

SPECIFIED FOR **S.T.500**

DY 39 FOR **S.T.500**

GREATEST POWER *for* LEAST INPUT

The highest ratio of output power to input power essential for 'Class B' amplification is only obtained when driver transformers having high power efficiency are used. It is futile to use a cheap so-called 'Class B' transformer which is incapable of giving the necessary output power. Such transformers are 'Class B' in name only.

R.I. Drivermu Transformer DY39 has been specially designed for use with the Driver and 'Class B' valves specified for the S.T.500. It has an inductance of 26 henries with 2 milliamps, thereby ensuring adequate power at all frequencies and at all power outputs.

The DY 39 gives you bass and treble without distortion, exactly as transmitted.

DRIVERMU TRANSFORMERS ARE THE MOST EFFICIENT AND RELIABLE FOR ALL 'CLASS B' CIRCUITS

R.I. "DRIVERMU" TRANSFORMERS

List No.	RATIOS Total	RATIOS Per Secondary	PRICE Royalty 1/6 extra
DY37	1 : 1 and 1·5 : 1	2 : 1 and 3 : 1	15/-
DY38	2 : 1 and 2·5 : 1	4 : 1 and 5 : 1	15/-
DY39	1 : 1	2 : 1	11/-
DY41	2 : 1	4 : 1	11/-
DY42	1·5 : 1	3 : 1	11/-
DY43	2 : 1 and 1·6 : 1	4 : 1 and 3·2 : 1	15/-
DY47	1·75 : 1	3·5 : 1	11/-
DY48	1·25 : 1	2·5 : 1	11/-
DY49	1 : 1 and 1·25 : 1	2 : 1 and 2·5 : 1	15/-

R.I. 'CLASS B' CHOKE No. DY40 Ratios 1:1, 1·2 : 1, 1·5 : 1, and 1·8 : 1. *Over 90% efficiency* **12/6**

POST COUPON *for* R.I. 'CLASS B' BOOK

LEARN HOW TO CONVERT YOUR EXISTING SET TO 'CLASS B'

This brochure tells you all about 'Class B' in the simplest possible language, and enables even the most inexperienced constructor to understand exactly what he is doing with 'Class B.' It shows you at a glance what combinations of valves, transformers and chokes are needed for every desired output. The diagrams are easily understood and apply to the conversion of old and the construction of new sets.

To Radio Instruments Ltd.,
Croydon, Surrey.

Please send me free and post free a copy of your 'Class B' Brochure.

Name .....

Address .....

..... P.W.4.

(Enclose coupon in ½d. stamped and unsealed envelope).

The Advt. of Radio Instruments Ltd., Croydon, Surrey (Phone: Thornton Heath 3211).

Presentation Book Token 3

Printed and published every Wednesday by the Proprietors, THE AMALGAMATED PRESS, LTD., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices: Messrs. John H. Lile, Ltd., Ludgate Circus, London, E.C.4 (Telephone: Central 5352). Registered for transmission by Canadian Magazine Post. Subscription Rates: Inland and Canada, 17/4 per annum. Abroad (except Canada), 19/6 per annum. Sole Agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd.; and for South Africa: Central News Agency, Ltd. Saturday, November, 4th, 1933. S.S.

POPULAR WIRELESS, November 11th, 1933. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

CAR RADIO FOR 1934 (SEE PAGE 451)

TELEVISION PROGRESS

Popular Wireless

HOW TO BUILD A UNIVERSAL AMPLIFIER

No. 597. Vol. XXIV. November 11th, 1933.

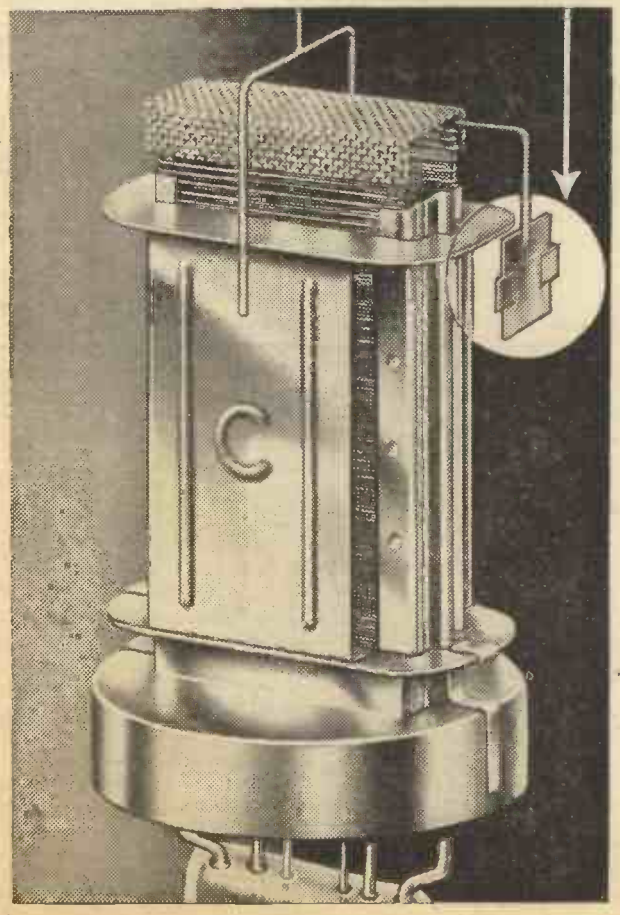
EVERY WEDNESDAY PRICE 3D

The S.T.500 SWEEPS THE COUNTRY!

The Flag that signals

"All Clear"

for BETTER *Radio Reception*



A flag in a Cossor Valve? Nonsense! But it's true. It plays a big part in maintaining Cossor consistency and reliability.

In making Radio valves, the highest degree of vacuum is essential. The very last traces of air must be pumped out of the bulb. But even this is not enough. Within, there may still be gaseous matter which would be liberated when the valve is in use.

And so, Cossor uses a flag carrying a special alloy. During the process of pumping, the anode is raised to a high temperature. This causes gaseous matter to be liberated. Finally, the flag is made incandescent by the application of high frequency eddy current. This causes the alloy to volatilize and absorb the last traces of any residual gas. Thus all impurities are removed—and an exceptionally high vacuum created. Here is another process—another safeguard—used by Cossor to ensure Better Radio Reception.

COSSOR VALVES

To A. C. COSSOR LTD., Melody Dept., Highbury Grove, London, N.5

Please send me free of charge, a copy of the Cossor 72-page Wireless Book B.V.33.

Name .....

Address .....

P.W. 11/11/33.

♡ 3894

POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
Technical Editor: C. V. DOWDING, Associate I.E.E.
Assistant Editor: P. ROBERT BIRD.

Managing Editor: N. F. EDWARDS.

Chief Radio Consultant: P. P. ECKERSLEY.
Assistant Editor: A. JOHNSON-RANDALL.
Chief of Research Dept.: K. D. ROGERS.

THE BLESSINGS OF RAIN
RADIO AIDS TO MARINERS
MARCONI IN CHICAGO
A TECHNICAL TIP

RADIO NOTES & NEWS

POPULATING THE EMPIRE
"ARIEL" ON AERIALS
ORIGINALITY IN CEYLON
TRANSPARENT CABINETS

Small Mercies.

LAST Sunday a friend was driving me from his house to mine when a dull, dank morning turned into a pouring wet afternoon. Presently he burst into a series of joyful bellows. Said I: "Great Scott! It is a noxious day; we are late for lunch, and I have a cold in the head. Why these transports of delight?" Said he, with another bellow: "Good! This'll save me watering my 'earth tube.'"

Which reminded me that I have never watered an "earth" and have long since forgotten whether mine is still the plate which was buried in the garden or whether it is now something to do with the casing of our electric light wiring. Happy go lucky *me-e-e!*

Ex-Telegraphist Scores Again.

FROM time to time I have drawn your attention to instances of ex-telegraphists, wireless or land line, who have attained high positions.

My latest find is Mr. E. St. P. Iddon, who has been appointed buyer of the radio, gramophone and record department of Selfridge's, in addition to his job in the radio department of Whiteley's.

Mr. Iddon joined the Marconi Company in 1917, and eventually served as a sea-going wireless operator until 1922. By the way, I see from the recently published biography of Andrew Carnegie that he, too, served as a telegraphist at one early stage of his career.

They Say—What They Say.

ALDERMAN YOUNG, of Nottingham, at a luncheon club, said that whilst they did not always see eye to eye with Sir John Reith regarding B.B.C. policy, he thought Sir John had achieved a very high standard of broadcasting in this country. Just the sort of stuff I used to draft for my chief when he wanted to make a fighting speech about the Post Office!

Mr. Dinwiddie (how *did* Dickens miss that name?), Scottish Regional Director, at the opening of the Scottish Radio Exhibition (no mention of luncheon!), stressed the necessity for having good receiving sets to receive good programmes. Very profound thought. Ten thousand Scots at once rushed home to readjust their catswhiskers!

A Basement Bulletin.

THE truth about radio seems to permeate very slowly. Some people evidently think that the programme depends upon the listener. It is credibly reported to me that "Gasper" Gert, our domestic helper, so called because she smokes cigarettes all day, said that she did not like the "Radio Times" and wished that "Mister" (i.e. me) would "take in" a different paper full of Jack Payne and Henry Hall. That's what I get for providing an L.S. extension to the maids' quarters!

PROGRESS!

¶ **CRYSTAL SETS** used to be all the rage—and then the best designs for home construction were found in "Popular Wireless."

¶ **The Latest Receiver** to achieve phenomenal popularity is the S.T.500—it was described in "Popular Wireless" three weeks ago.

¶ **TELEVISION** is the next great development to watch—there is a fine article about it on page 449.

"P.W." Always Leads!

British Beacons Best.

BRITISH radio "beacons," one of Marconi's little contributions to the safety of life and property at sea, are finding their way all over the world. The most recent countries to adopt them are Uruguay, Rumania and China.

These automatic radio beacons transmit omni-directional signals at the orders of a master-clock, which enable ships fitted with direction-finders to take bearings as and when required.

The signals consist of a characteristic group of dots and dashes incorporating the call-sign allotted to the beacon. Provision is made for continuous calls to be made during periods of bad visibility.

Snippets of News.

THE appeal entered by the Marconi Company against Justice Maughan's decision in favour of Philips has been withdrawn.

The Performing Right Society has over two million copyright works to protect, and the B.B.C. programmes contain more than 80 per cent of those works.

Sales of components for the "S.T.500" will probably make the British Empire run short of wire.

America Welcomes Marconi.

FROM details of Marconi's visit to Chicago which are now available, I observe that the American flair for lionising has lost none of its vigour. The Secretary of the Navy sent an extremely kind and cordial message to the illustrious inventor, and Chicago's "Marconi Day" was marked by a "stunt" which was no less than the lighting up of the Exhibition by Italian moonlight.

A luminous impulse from the moon was picked up at the observatory of Arcetri, Galileo's last residence, converted by a photo-electric cell into an electrical impulse, relayed from Italy to Chicago, and there used to operate an apparatus which lit the electric lamps of the Exhibition. Great as he was, Galileo would probably have said "Liar!" to that!

"Ariel's" Accumulator Tip.

S. K. (Ely), in a postscript to a letter about next door's broadcasting dog, asks me whether there is any hope for a sulphated accumulator. There's no harm in hoping, but the realisation of the hope depends upon the size and age of the dreaded deposit.

If the trouble is of long standing all you can do is to give the cells a long, long charge; but if you are dealing with new sulphate you can sometimes save the battery by emptying it, filling it with distilled water and swashing the liquid about so as to loosen or detach the stuff.

Then empty, put the *old acid* back and give a good, long charge. If, then, the S.G. is low add a little acid and charge again. Probably all wrong by the books, but worth trying.

(*Continued on page* 474.)

THE S.T.500 IN

Four valves have never been used to better advantage than in the balanced-phase double-reaction system which the S.T.500 employs. No compromise has been made in the number of controls on the panel, and, by correct manipulation of them, results are obtainable which no other circuit can equal. Your guide to the ether via the S.T.500 controls is given below.

By JOHN SCOTT-TAGGART, A.M.I.E.E., F.Inst.P.

YOU have built the "S.T.500." Or so I am presuming, because I am now going to tell you how to work it.

The operating of the set will take perhaps an hour's practice to get the last ounce out of a variety of widely differing kinds of stations.

But once you know what each control does you will have months of enjoyment before you. The dull, uninspiring operation of a single control gives none of the thrill which comes of having absolute and complete control of your receiver.

Nevertheless, the "S.T.500" *can* be operated in a dull, unexciting manner, and I advise novices to start using it that way.

A Preliminary Precaution.

There is only one single thing that worries me. And that is that your differential condensers may be wrong way round. Mind you, that will not affect the working of the set, but it will make all my instructions read wrong. The anode coupler and the anode reaction should therefore be made right first, and tests were given on page 339 of POPULAR WIRELESS (dated October 28th).

Briefly, the signals should be weaker if the anode-coupler knob is turned anti-clockwise (even after slight retuning of the right-hand dial). The reaction on the anode circuit should increase when you turn the anode-reaction knob to the right.

Good; I shall now assume your two differentials are O.K. I am very keen on your having these right, because I once received a letter from a Dutchman who was unable to obtain the types of differentials I used. He said: "I turn your aerial and anode couplers to the left for selectivity and to the right for signal strength, but it makes little difference."

He had the anode-coupler differential wrong way round, and for four months he had failed to get good results because any good effect on one coupler was defeated by the other.

The Function of the Couplers.

I advise you to do all your first tests with aerial and anode reaction at zero (full left). Get the hang of the two couplers first.

Their operation is extremely simple, and each does the same thing, but for a different circuit.

Remember that the "S.T.500" has two compartments, so to speak, and these are operated in exactly the same way. There are two tuned circuits: (a) the aerial circuit and (b) the anode circuit.

The tuning of the aerial circuit is accomplished by the left-hand dial. The current to the circuit is fed through the aerial coupler. This aerial coupler governs the signal strength in that circuit and also governs the general selectivity. The aerial-reaction knob, if used, boosts up the signals and also improves the selectivity.

The anode circuit has exactly similar gadgets. The main tuning is by means of the right-hand dial. The current to the anode circuit is fed through the anode coupler.

This governs the signal strength in that circuit and also its general selectivity. The anode-reaction knob, if used, boosts up the signals in the anode circuit and also improves the selectivity of that circuit.

Dividing the Controls.

In addition, each circuit has its own wavechange switch, and both of these must be either "in" (for long waves) or "out" (for medium waves).

You can imagine a vertical line drawn down the panel just to the left of the anode coupler. This will divide the controls into two similar sections. To the left we have the aerial circuit complete with tuning dial, aerial coupler (top left) and aerial reaction (bottom left).

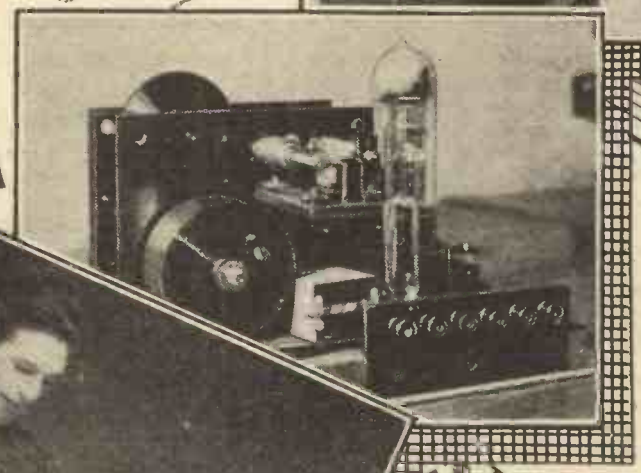
The right-hand half panel contains the anode circuit controls, which are the tuning dial, the anode coupler and anode reaction.

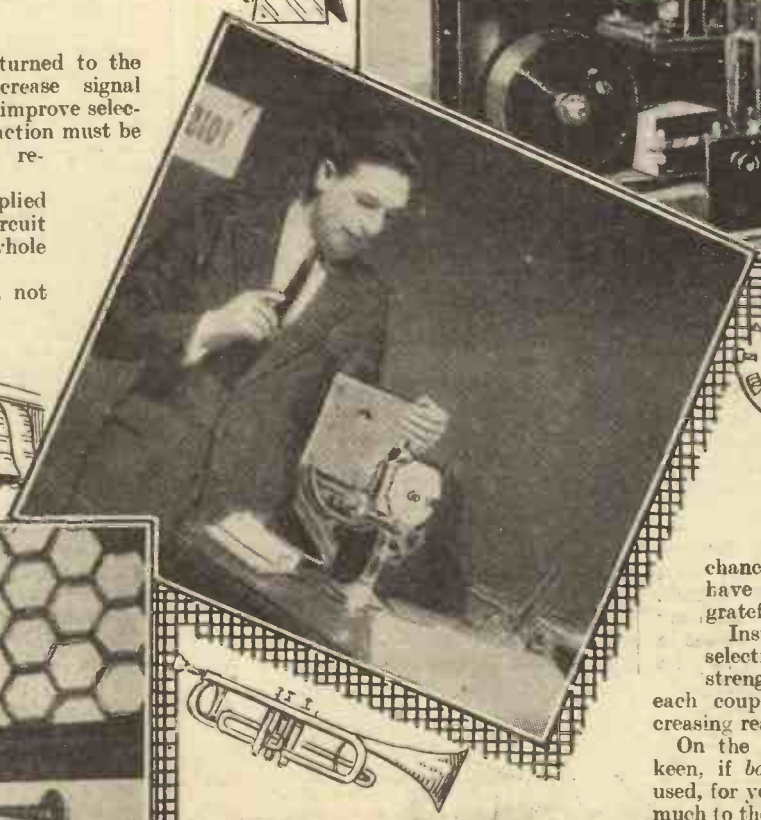
Now these are the effects of the controls on the circuit they govern, whether aerial or anode circuit:

1. The coupler controls the amount of radio current fed to the tuned circuit.

ACTION!

ALL EUROPE AT YOUR COMMAND





Our top picture shows the device which reproduces the same tune as the Potsdam chimes for the Deutschland-sender interval signal. Below it is the Budapest "musical box." Cracow's trumpet call is depicted in the bottom picture, below Turin's "nightingale" apparatus.

Turn the coupler to the left (anti-clockwise) and you will decrease signal strength. Turn it to the right and you will increase signal strength.

2. The coupler will also control the selectivity, since it varies the "load" on the tuned circuit. Turn the coupler towards the left if you want increased selectivity.

3. The tuning dial tunes its respective circuit. It has the last word on tuning and should be the last thing you touch. Any alteration of the coupler should be followed by a slight retuning of the tuning dial associated with it. Any alteration of the reaction should be followed by a slight "touching-up" of the tuning dial. This is customary on all sets.

Two Simple Circuits.

4. The reaction knob, if turned to the right (clockwise), will increase signal strength and simultaneously improve selectivity. Any alteration of reaction must be followed by a very slight retuning on the tuning dial.

In those four rules, as applied to the aerial or the anode circuit of the set, you have the whole operation of the "S.T. 500."

Think always of the set, not as a conglomeration of knobs, all of which do something, but as two simple circuits, the sensitivity and selectivity of each being governed by a coupler and a reaction knob.

The best combination of adjustments is a matter for trial. You can, for example, use a flatly tuned (i.e. unselective) aerial circuit and a highly selective anode circuit. Or you can make the aerial circuit very selective and the anode circuit "flat."

Usually you will operate both circuits so that each has medium selectivity. With that as a starting point, you can improve the selectivity of each by reducing the value of its coupler and, if necessary, by applying reaction.

But it is highly likely that sometimes you do not need the full selectivity of the set. For example, suppose you are listening to a British station during the daytime and you live, say, 70 miles away. Here is an excellent chance to let the set "rip." If you have a poor aerial you will be doubly grateful for my controls.

Instead of aiming at maximum selectivity you can increase signal strength. You can do this by turning each coupler more to the right and increasing reaction.

On the whole, however, I am not too keen, if *both* reaction controls are to be used, for you to turn the anode coupler too much to the right. There are two technical reasons why you gain nothing in most cases. With the anode coupler full right the inherent reaction existing in every set is at a maximum.

The Better Method.

The real controllable reaction can then only be applied in small doses and is not very smooth. Feeding less H.F. current to the circuit and increasing it with reaction is, in practice, better than feeding more and using less reaction.

The second reason is rather similar, but applies to the aerial circuit. To obtain the best aerial reaction the source of reacting current should be the choke rather than the tuned-anode circuit.

Knife-edge Selectivity with full-bodied Volume

If the anode coupler is between full left and about vertical the aerial reaction is as near perfect as is possible. Beyond the half-way mark the reaction tends to lose some of its smoothness.

An interesting point for connoisseurs is that as you tune to longer wavelengths (on either waveband) you can use more anode coupler while retaining smoothness of reaction.

Rules for Tuning.

As a matter of fact, the reserves of sensitivity of the set are such that I, personally, never use the anode coupler more than about quarter-way round.

The rules for selectivity and sensitivity are these, and apply to either aerial or anode circuit :

1. *To increase selectivity :* (a) Turn coupler more towards the left, keeping reaction zero, and retuning on the dial. (b) Turn reaction knob clockwise, a little at a time, retuning slightly on the dial.

2. *To increase signal strength :* (a) Turn coupler more to the right, keeping reaction zero. (b) Turn reaction knob clockwise a little at a time, retuning slightly on the dial.

The above rules apply to each circuit, and you will use the couplers first and the reaction if necessary. The slight retuning is no trouble. Since you will probably only alter one circuit at a time, the other will be in tune, and it is very simple to pick up the station you were receiving.

Suppose, for example, you are listening to Poste Parisien, and you can hear a slight background of Breslau. You would reduce reaction and then reduce the anode coupling probably.

This would alter the tuning, but you would, by a slight movement of the right-hand dial, pick up Poste Parisien, and, on applying reaction again, find the station clear of Breslau's interference.

Avoid Overloading.

Why did I reduce the reaction ? Because I always do so instinctively on any set I handle—and you probably do so yourself. It is probably because I demonstrate my sets so often that I am rather cautious in avoiding oscillation. I shall never forget a little sniggering girl who gleefully cried to her father : "Ooh, Daddy, he's made it squeal ! "

After this had happened once or twice, and I had glanced speculatively at a conveniently near and extremely tempting poker, I gave in. I received the remaining sixty or seventy stations without the whisper of a squeal. That dear, sweet child taught me more in ten minutes about operating a wireless set than I had learnt in twenty years.

A sound rule in operating a receiver, therefore, is to make no alterations without first reducing the reaction ; then bring the reaction up again. This only applies if you are using reaction near the critical point.

There is one general note to be added to the four main rules. Never feed the set with more signal current than is necessary to give full loudspeaker results. The odd thing is that, although you are reading these words, half of you will completely ignore them.

You will use too much aerial coupler and too much anode coupler. You will then try to improve selectivity with either or both reactions, and then complain of a wide spread of your locals.

The reason for the effect is simple. You are overloading your set. Overloading means that "quality" will be impaired and selectivity ruined. And it doesn't do a scrap of good ; you get no louder results.

The best test for overloading is to reduce slightly *any* one of the couplers or reaction controls. If you hear no weakening of signals the chances are ten to one that you are overloading the set.

Reaction works best if it has weak signals to handle. Suppose you tune in a loud station without any reaction. Now you reduce one or other of the couplers until you know for certain that the loudspeaker is not giving maximum volume.

Let Reaction Give You Volume.

The spread of the station may be considerable. You therefore apply anode reaction—or perhaps aerial reaction as well.

The spread remains. What are you to do ? Write to me ? No, please don't. Thousands will, but only because they are skipping this.

The trouble is simply this : that you didn't reduce signals enough. Long before the great selectivity benefits of reaction were reaped the set was overloaded.

You will be on much safer ground if you go to the other extreme if you want selectivity. Weaken the desired station until you can only just hear it ; you can do this on the aerial coupler or on both couplers, retuning, of course, on the main dials.

Then, and only then, start applying reaction to both circuits. With critical reaction signals will be enormously louder, but should be a little weaker than you know would be possible if more coupling were employed.

You can increase volume cautiously by increasing the aerial coupling and keeping the aerial reaction well up. But the moment you get signals too strong, "spread" will increase.

I am all for full-bodied volume, and the perfected Class B of the "S.T.500" will give it to you. But if you are out for knife-edge selectivity, get that volume by low values of coupling and more reaction. Unnecessarily large couplings mean more letters for me !

A Final Note.

Please read my articles not just before building the "S.T.500," but also again when you are working the set. You will find the very point I should mention to you if I were at your side.

You need not worry about reaction affecting the quality of reproduction. I have taken care of all that and there is a tone control at the rear of the set which enables you to have your music sparkling or mellow.

No two people ever like exactly the same tonal reproduction. Some prefer a preponderance of the lower notes. Others prefer something less mellow. But many like a different quality on different kinds of music.

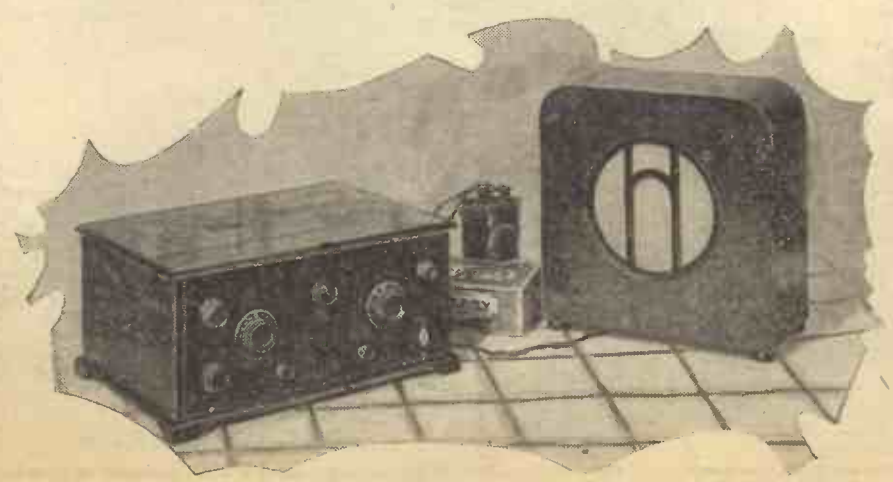
Where there is a risk of heterodyne interference, the whistle may be cut out by the tone control. This is the commercial method ; but in the "S.T.500" the tone quality can be varied over a wide range in a perfectly smooth manner.

J. S.-T.

Eleven *Exclusive* Features of the S.T.500

none of which is found in any other designer's sets.

- ★ DOUBLE REACTION
- ★ FULL-RANGE SELECTIVITY ON BOTH CIRCUITS
- ★ BALANCED-PHASE AERIAL REACTION
- ★ LOW-CAPACITY GRID CONDENSER
- ★ EXCLUSIVE COIL DESIGN
- ★ SPECIAL TONE CONTROLS
- ★ PERFECTED CLASS B
- ★ SELECTIVITY RANGE ADJUSTER
- ★ PROGRESSIVELY ADJUSTABLE SELECTIVITY
- ★ DIFFERENTIAL ANODE COUPLING
- ★ LARGE-CAPACITY AERIAL COUPLER



HERE IT IS ! The first photograph to reach this office of an S.T.500 built by a reader. The satisfied constructor in this case is Mr. Geoffrey Charles, of 10, Rectory Gardens, Beckenham, Kent, and he has built his set into a Peto-Scott cabinet, using a W.B. loudspeaker.

TELEVISION PROGRESS

It has been announced that the B.B.C. is changing the system of Television used in its transmissions and the benefits which the change will confer on "lookers-in" are discussed below

By A. E. SEMPER.

HOT on the heels of Vladimir Zworykin's announcement of his remarkable new cathode-ray system comes the news that the B.B.C. are building two 120-line television transmitters for use on ultra-short waves. Experiments have been taking place since last spring on 7·75 metres, and it is reported that very good results have been achieved.

The international race to achieve commercial television has thus been tremendously intensified during the past few months. In Germany television appears to be making good progress; it is reported that ultra-short-wave transmitters are to be installed in twenty large towns.

A Comparison of Systems.

At the Berlin Radio Exhibition, which was held in August, several firms were showing television apparatus. In France television is not so advanced, but in both countries considerable attention is being paid to cathode-ray systems.

Let us for a moment compare the proposed 120-line transmissions on ultra-short waves with the existing transmissions on the medium waveband. You will doubtless remember that the existing transmissions are 30 line, twelve and a half pictures per second; that is to say, the picture is divided into thirty vertical strips, each of which is scanned by a photo-electric cell, the whole picture being transmitted twelve and a half times a second.

Assuming that the 120-line transmissions will be at the same rate, it will be seen that the pictures must, of necessity, possess considerably more detail, as each picture will be divided into 120 strips. With the present 30-line transmissions what is known as "aperture distortion" is a disturbing factor, its effect being to blur the picture by softening edges which should be sharply defined.

How Lines Become Blurred.

Exactly how this happens can be seen by referring to Fig. 1, which represents a part of an image as seen momentarily by the photo-electric cell. As the front edge of the scanning hole approaches the dark part of this picture point the photo-electric current, instead of changing immediately from maximum to zero, changes only gradually, since the cell is looking partially at a bright part.

The cell responds to the *total* amount of light which falls on it, so that the actual result in a receiver is a blurring of the line of demarcation.

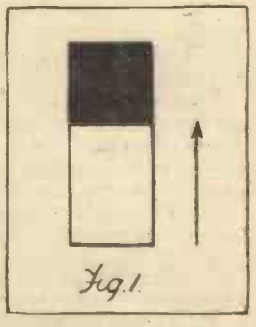
Medium-Wave Drawbacks.

Some of you who have not yet taken up television will doubtless ask why 120-line transmission has not been tried on the medium waveband as at present used. There are two main reasons. Firstly, by international agreement the carrier frequencies of radio stations in Europe are separated by only 9 kcs., so that if a transmitter is modulated with a frequency higher than 4,500 cycles its sidebands will interfere with the sidebands of adjacent stations.

In practice some interference does occur, as the transmission of music may include frequencies of any value between 30 and 10,000 cycles per second. Strictly speaking, the television transmitter must be modulated by a frequency not exceeding 4,500 per second to avoid interference. The problem is, therefore, how best to get the clearest pictures with this available frequency.

A DIFFICULT SUBJECT

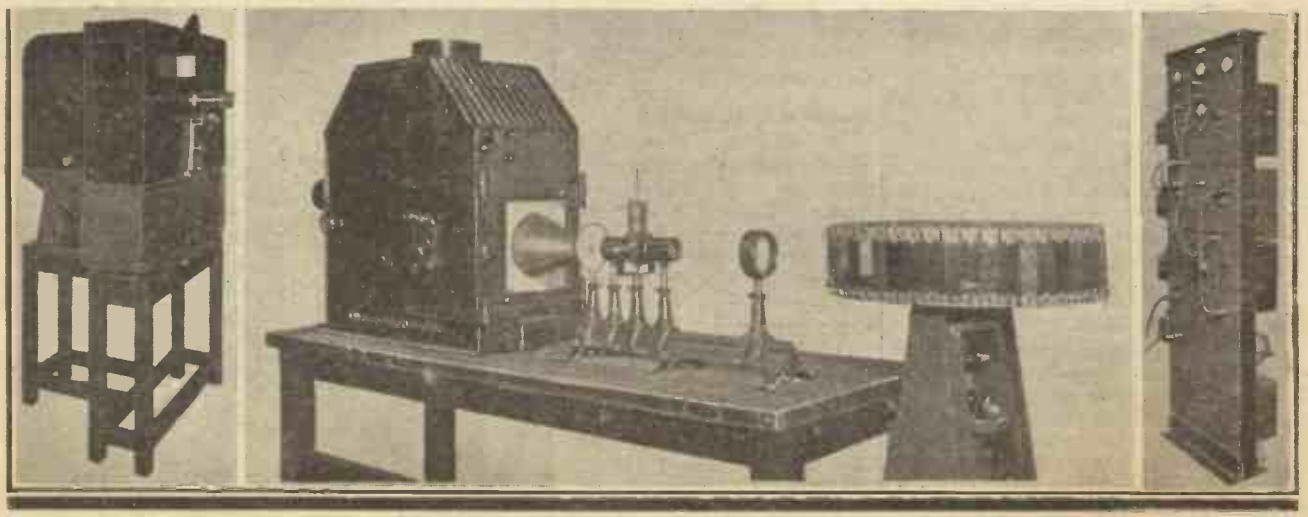
A televised image of such a subject as this would be indistinct because the light-cell responds to the total amount of light it receives.



The minimum number of pictures per second is fixed by the effect known as "persistence of vision"—with less than twelve and a half pictures per second the image appears to flicker too much to be comfortable. The number of changes which occur during the scanning of one

(*Continued on next page.*)

SOME NEW DEVELOPMENTS IN TRANSMISSION AND RECEPTION APPARATUS



One of the latest contributions to television development is the Marconi System. The receiver, consisting of light-chamber, Kerr cell, condenser lens and mirror wheel is shown in the centre picture. A transmitter scanner is at the left with its bank of amplifiers on the right.

MAINTAINING BATTERY EFFICIENCY

If you want to keep running costs down to the minimum it is important to "keep an eye" on your batteries.

IN wireless apparatus, as in a good many other things, appearances are deceptive. Sometimes the most robust-looking components or accessories are really the most vulnerable. Batteries are a case in point, for, although accumulators and H.T.B.'s are so weighty and substantial in construction, they may be more easily damaged by accident, neglect or carelessness than almost any other part of your receiving outfit.

Instruments That Help.

If, therefore, you want to keep running costs down to the minimum—and who does not?—it is important to "keep an eye" on your batteries and take steps to protect them from damage or premature deterioration.

Certain instruments are almost essential to the proper care of your batteries, for you cannot keep an eye on them if you are blindfolded, so to speak, by lack of the necessary meters that are used for measuring high- and low-tension voltages, anode current and the specific gravity of accumulator acid.

A suitable multi-range meter may be more convenient and less expensive than a separate voltmeter and milliammeter of equally reliable make. It certainly does not pay to "economise" by purchasing a cheap and nasty meter, as reasonable accuracy is essential if the readings are to be any real guide to the condition of the batteries and to the current consumed by the set. So buy the best instrument you can afford.

For measuring the specific gravity of the accumulator acid, you need, of course, an accurate hydrometer with a clearly graduated float. It is advisable to make a point of checking up the voltage and S.G. of the accumulator at regular and fairly frequent intervals, to see that the cells are never discharged beyond a safe point (1·8 volts per cell).

The voltage should, of course, be read when the accumulator is on load, i.e. with the set actually taking current from the cells. Generally speaking, the voltmeter and hydrometer readings should be considered in conjunction with one another, as either reading alone may not indicate the true state of affairs.

Keep The Accumulator Clean.

When testing the voltage, etc., of your accumulator, you will naturally take the opportunity of topping up with distilled water if the surface of the electrolyte has dropped below the correct acid level marked on the case, cleaning any traces of corrosion off the terminals, giving them a smear of "Vaseline," if necessary, and wiping any sprayed or spilt electrolyte off the top of the cells, so as to keep them clean and dry between the terminals.

It is a rather good plan to use a rag wrung out of soda or ammonia solution with which to wipe the accumulator, as the strong alkali serves to neutralise any traces of acid on the outside which tend to corrode the terminals, eat away the covering of the leads, etc.

The high-tension voltage should be read from time to time and the anode-current consumption of the valves checked up periodically. Anything untoward will not escape notice for long if you make a point of this regular and systematic testing.

The grid bias should, of course, be adjusted when necessary to keep the anode current down to its correct value. Always remember to switch the set right off before removing a G.B. wander-plug, otherwise the sudden rise of anode current may do damage.

Test Batteries While In Use.

Provided that the voltmeter has a reasonably high resistance, the voltage of the high-tension battery should always be read when the battery is on load. Readings taken when the battery is off load are apt to be deceptive, as the voltage of a partly discharged battery tends to be recuperated to some extent when the cells are "resting."

The battery circuits should be well protected by proper fuses, rated to "blow" at an appropriate current. You should bear in mind that a single fuse in the negative lead is not necessarily a complete protection of the H.T. battery against damage by accidental "shorting." If there is more than one positive lead the single fuse is no protection at all against a portion of the battery being shorted through accidental contact between two of the H.T. positive leads going to different tappings.

TELEVISION PROGRESS

(Continued from previous page.)

strip cannot reasonably average less than 25—that is, a frequency of 12½. By simple arithmetic we get $4,500 \div (12\frac{1}{2} \times 12\frac{1}{2}) = 30$ approx., which gives us the permissible numbers of strips or "lines" per second.

Another important point is that it is impossible to modulate a medium wavelength transmitter with a frequency higher than 7 to 10,000 without causing distortion of the transmitted signals and consequently a poor image.

It may be argued that short waves of 20 to 50 metres would solve the problem of a picture with finer detail, but this is not so in practice owing to skip distance, fading and echo effects. Echo effects are due to the fact that under certain circumstances the signals travel right round the earth's surface twice or more, the second and succeeding trains of waves striking the aerial at intervals of one-seventh of a second.

Use of Ultra-Short Waves.

The ultimate solution appears, then, to be with ultra-short waves which have remarkable characteristics of their own. We have still a lot to learn about these waves, but it appears that the sky wave is absent; and, although this factor limits the range, it will be of considerable advantage from a television point of view and will eliminate some of the difficulties referred to above—namely, echoes and fading.

But these waves bring problems of their own which require solution. It is found that motor-car ignition systems cause troublesome interference, and obstacles such as hills and buildings cast "shadows" which are far more pronounced than with the longer wavelengths. This will lead to very definite blind spots; for example, if you placed your aerial along one side of the house you might receive next to nothing, whereas at some other point, say in the garden, you might get good reception.

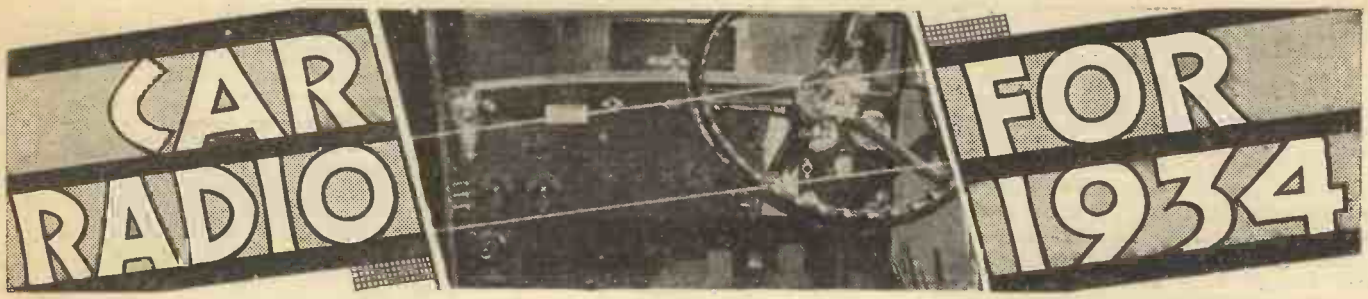
Fundamentally Suitable.

Nevertheless, these ultra-short waves are fundamentally suitable for television because of their extremely high frequencies; and the higher the carrier frequency the higher the modulation frequency which can be successfully impressed upon it.

Without being unduly optimistic one can venture the opinion that television is now "coming down to brass tacks"; so if you are thinking of building a short-wave receiver this winter why not make sure that it tunes down to 5 metres. Then, if you think of going in for television later on you will need only the optical part for a complete television receiver.

COMMERCIAL TELEVISION IN PRACTICE

The complete assembly of the Marconi Television Transmitter



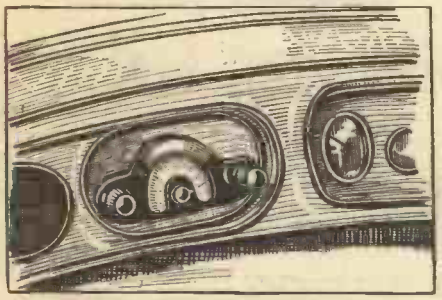
The application of radio to the modern motor-car has demanded the exercise of considerable ingenuity on the part of set designers and manufacturers. Some of the more outstanding examples of car sets, and details of their specially interesting features, are described in this review

By K. D. ROGERS.

I HAVE been having an energetic time lately in a branch of radio reception that is only just coming to the fore in this country. I refer to the car-radio receiver, and my activities have been concerned with testing and investigating many of the various types of commercial sets that are available for the car, boat or caravan owner.

I started at the recent Motor Show at Olympia, that wonderful building which is the home of the Radio Exhibition, and which changes its appearance scores of times during the year.

A FINE INSTRUMENT



The Ekco four-valve superhet A.V.C. receiver is panel operated and fits, complete with speaker, into one of the "cubby holes" in the facia board of the Austin "Westminster" Sixteen.

For the first time radio has invaded the Motor Show, and it has done it in no uncertain manner. This was soon borne on one as the steady examination of stands proceeded, in spite of the very bashful attitude of the motor salesmen to the new "accessory."

Salesmen's Reticence.

They are very naturally timid concerning radio, for they are motor people, not radio engineers, and so the new addition to the cars is largely an enigma to them. This will pass, and next year, instead of somewhat apologetic reference to car radio, I shall expect to find the new feature eagerly pushed forward as a first-class selling point.

For the present, however, the visitor to the Show had to dig and delve to unearth any of the outstanding points of the various car-radio fitments. The prices were rapidly forthcoming, but there the matter ended unless vigorous probing took place as to the make, nature and method of installation of the set in question. Of the *performance* nothing could be gleaned.

A great deal of the trouble was undoubtedly due to the fact that at the time of the Show the motor manufacturers who had decided to fit radio as an added accessory (in every case of a car I believe the radio is an added luxury) had done so more or less at the last minute, and numbers of car models showing fitted radio were very few.

Many cars included aerials in their roofs as standard, but few were really ready to explain to the public what they could do about fitting radio to the car, other than to divulge the price and the fact that it was "quite simple." Literature on the subject—this was completely non-existent, except for very bare leaflets.

However, this state of affairs will be righted in time, and before long we ought to see numbers of radio-equipped cars on the road and to hear them in various parking and picnic places. We are not likely often to hear them going along, for the radio is remarkably quiet outside the vehicle, though it is amply loud enough inside.

Adjusted from Steering Column.

Among the cars at Olympia which were shown completely fitted with radio were certain models of Chrysler, Packard, Dodge, M.G., Renault, Rolls (on which Philco sets were exhibited) Dodge (again) with a Lissen set, Essex with the Majestic six-valve superhet and the Austin 16 "Westminster" saloon with the Ekco four-valve superhet.

In the caravan section of the Show I saw two models with radio equipment—the Essex with a three-valve set, called the Castaphone Essex, and the Cheltenham Caravan Co.'s larger model in which was the Telsen Class B Four.

There is sharp division between the various sets as to the method of arranging the controls. Some, like the Lissen and the Philco, have steering-column control of wavelength and volume, with on-off switch, of course, while the Ekco set fits snugly into the facia board of the car and has the controls on the panel, like any ordinary set.

Is It Dangerous?

There will be adherents to both types of control, for many will argue that the steering-column method is easier for the driver to operate, while others will say that they see no hardship in the Ekco method, and here the front passenger can be very useful in carrying out tuning while the car is in motion, besides amusing himself if the driver has no objection.

Here, again, there will at first be a great deal of divided opinion, for many now hold that radio in action is disturbing to the driver of a moving car, and that it is likely to be dangerous. It might be if allowed to continue too loudly and if the driver were inexperienced and lacking in concentration, but not if the volume control is properly employed.

To test this point and the efficiency of good car radio as at present evolved, I went for a run in an Austin fitted with the Ekco four-valve superhet. This contains a pentode mixing valve, one stage of automatic-volume-controlled intermediate pentode H.F., a detector (double-diode triode) and pentode output. So out of the four valves a very great deal of useful work is obtained.

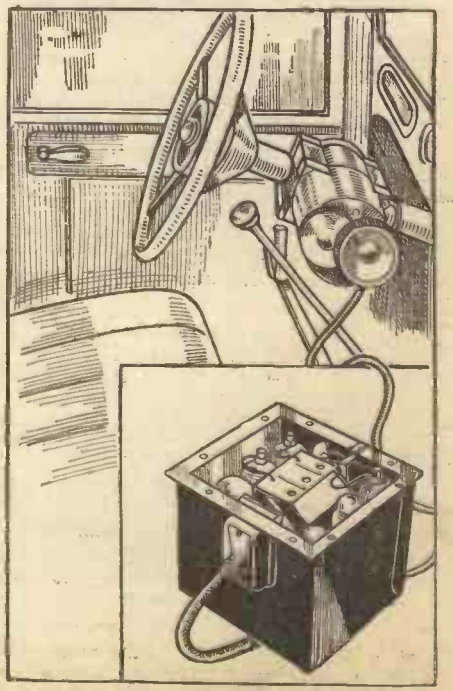
Free from Interference.

A.C. valves are used, together with a low-tension field-energised moving-coil speaker and a high-tension generator, the whole being operated off the car battery. Suppressors were fitted on the car plugs, dynamo, coil, starter, windscreen wiper and even the stop light at the rear, so that the operation of the set is completely interference-free as far as the car is concerned, no matter what is happening.

On a tour round London and the outskirts

(*Continued on next page.*)

WITH REMOTE CONTROL



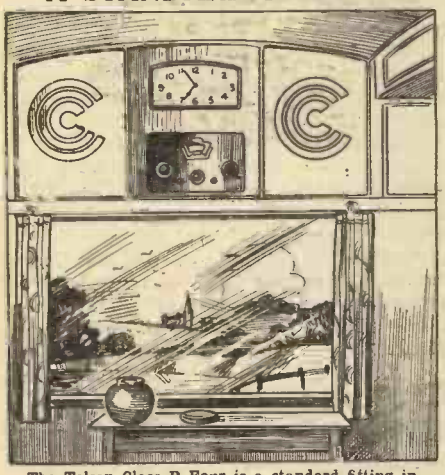
This Lissen battery set is secured under the floorboards of the car, control being obtained by means of a Bowden cable from a special attachment on the steering column.

CAR RADIO FOR 1934

(Continued from previous page.)

in bright sunshine the set behaved perfectly, only giving any sign of a fade on the local and Daventry stations when we passed under railway bridges. At other times the A.V.C. kept the volume at a surprisingly level strength, while the sensitivity of the set was such that stations like the Northern Regional, West Regional, Midland

A STANDARD FITTING



The Telsen Class B Four is a standard fitting in the larger model of the Cheltenham caravan. The loudspeaker is housed in one of the cupboards at the sides, while the batteries are stored under one of the seats.

Regional, Poste-Parisien and Brussels were heard at good strength, the Midland Regional, of course, being very much stronger than the others.

On the long waves three or four stations were available as programme providers besides Daventry, thus testifying to the powers of the set on that wave range. The cost of the outfit, including fitting to the Austin, is £25.

I am convinced that once one has got used to car radio the fact that it is on while the car is in motion will not upset the driver one whit—but it will take a little time to get used to, of course.

Car radio is a thing in which many cannot see any value. All I can say to them is that they should hear it demonstrated before they criticise; one cannot conceive its effect without hearing it, and hearing is to applaud.

Popularity of Distant Control.

But I must get on with the description of the other types of car radio that are now available for the motoring public.

The Philco set is also a superhet, and is energised from an H.T. point of view by a generator driven from the car battery. Unlike the Ekco, the receiver is fitted in a box below the facia board of the car, with the speaker separate (the Ekco speaker is incorporated in the set). Thus this can be fitted anywhere convenient in the car. The control of the set is carried out by means of a fitting on the steering-column of the car. The whole outfit costs £33.

On the Essex cars the Majestic super is available at a cost of 22 guineas. This, too, has distant control, the control being fitted to the facia board of the car. All Essex saloon cars, by the way, have aerials fitted as standard.

The Lissen car set is another distant-control type, but it is designed for use from batteries and not from a converter. With the Ekco set it is the only *car* set that covers the long as well as medium wavebands.

A Six-unit Receiver.

The Lissen installation consists of six parts. There is the set itself, a six-valver incorporating A.V.C.; then there is the control unit which fits on the steering-column of the car; the loudspeaker; a separate H.T. battery container; Bowden wire equipment for linking up the control unit to the set; and special suppressor resistances and condensers for the car ignition.

The set is contained in a weatherproof box, and is meant to be mounted under the floorboards, while the speaker is designed to go under the facia board of the car. The H.T. required is only 120 volts of power type of battery, so that the demands of the set are not great in the way of space.

A caravan is an ideal place to have radio fitted, for the space is ample and the aerial can be more efficient than in the case of the car, where in most cases a wire-mesh aerial in the rear portion of the roof (behind the sliding section) is all that can be conveniently arranged.

Sets for Caravans.

The Cheltenham Caravan Co. have chosen a simple but very effective receiver to include in the front portion of their caravan—in the "dining-room," so to speak. It is the Telsen Class B four-valver that was described in the last "Radiomag," and it fits conveniently into the bulkhead of the front of the caravan, as shown in our sketch. A

BRIGHTER CAMPING!

Two campers listening to a Castophone three-valver fitted in an Essex trailer caravan.

clock is provided above it, and the loudspeaker can be housed in one or other of the flanking cupboards, which have grilles cut in them for the purpose. The batteries

TUNE WHILE YOU DRIVE

Philco favour steering-column control for their superhet car radio receiver which is designed to be installed under the dashboard.

are housed underneath one of the seats of the caravan.

This radio set is fitted as standard, and is, with the set on the Essex caravan, the only car radio that is not regarded as an extra. The aerial is run along the roof of the caravan, and an earth is made to the chassis.

One of the most surprising homes for radio that I found at the Motor Show (which also included boats) was the Chris Craft Runabout, a speed boat that is capable of something like 35 miles per hour. Where the radio was to be fitted I could not ascertain, nor what the exact nature of the aerial would be, but it struck me that a speed boat was hardly the place for radio listening. Anyhow, if it is required it can be fitted for a matter of £20.

Public Interest.

There is no doubt that car radio has come to stay; and though the apathy shown towards it by the motor salesmen at Olympia this year was marked, the interest in it shown by the public was even more noticeable—and that is saying something. Doubts are sure to arise at such an innovation in this country, but after a season or two of car radio I think it will have obtained sure hold on the imagination of the motoring public.

One thing I would like to assure myself of is that I have made it quite clear to readers that there need be no danger whatever in having the radio set "on" when the car is in motion. In some cases it is possible to have the set going so loudly that the driver is unable to hear the horn of another vehicle, but the judicious use of the volume control enables comfortable listening to be obtained without in any way detracting from the concentration of the man at the wheel on the main job on hand—driving the car.

ECKERSLEY EXPLAINS

What is your idea of a perfect receiver? Our Radio Consultant-in-Chief gives his specification for such a set, and then goes on to deal in detail with the points he raises, showing how some of them require the introduction of new technique before they are capable of consummation.

IT may seem irrelevant to mention the Motor Show when writing about wireless, but I have always maintained that the developments of the motor-car and the wireless set have followed very similar lines.

In the beginning motoring was all gadgets, and so was wireless. The early motor-car was a carriage with no horses; the broadcast receiver was a commercial receiver adapted for new wavelengths.

To drive a motor-car one had to be a mechanic and an enthusiast. To work the early wireless set one had to be an empiricist and a contortionist.

Now the motor-car is an automobile. The wireless set is an automatic player of music, a talker—anyway, it's not a wireless set only.

This year's Motor Show revealed tremendous engineering developments. One might have thought that by this time the motor-car was fairly well standardised; not a bit of it: the gear box is revolutionised, for example. Good-bye to the grease gun and hail independent wheel springing and smoother power units! The engine is, in one car, behind, where it ought to be.

So the wireless set cannot be, and is not, yet standardised. Far from it.

If you had to make a specification for a perfect receiver, what would you write down? I'll tell you what I would write down.

Armchair Control.

A knob or a switch would be to my hand handy. Turning it would give me a choice of all the world's programmes and would indicate to me at once the source of the programme. The noises coming from the speaker would be indistinguishable from the original. The set would be very small.

It would plug in to any electric plug (we shall never defy the "conservation-of-energy" principle), but it will consume next to no current—why should I pay for watts when my sound delivered is measured in microwatts? The shape and colour of the set will not offend me nor quarrel seriously with any decoration. The cost will be such that I can perfectly well afford to have one or two sets, so that if I want to listen to this and other people in my house want to listen to that, there is no reason why this should not be.

I want to be able to control the volume coming from the set from my chair, and I want to be able to switch on or off when I am sitting down, and I want to change programmes when I am sitting down far away. In fact, I want remote control, because nothing annoys me more than jumping up and down changing programmes—or, usually, switching them off.

It's a grand specification. Let's see what we want in the way of components to make it realisable.

Accurate Calibration.

Tuning, apparently, has to be done on the basis of a strictly accurate calibration. Well, that's done moderately well to-day. But the world's programmes? How am I, with a noisy lift and a steel-frame building, going to get the world's programmes? WANTED—new physics. Perhaps ultra-short waves.

We could postulate the B.B.C. picking up for us all the best foreign programmes and relaying them via ultra-short waves. We *could* postulate the idea technically, I mean. But . . . Good quality? Well, we've got everything except the loudspeaker, and there are (dual) loudspeakers in America which do a great deal of justice to a true input.

And with this ultra-short-wave technique we could get quite good quality—I think—perhaps. But—then, again, here's a snag: how can I, in a steel-frame building (and we're all going to live in steel frame buildings one day), get a little baby aerial to work so that my set can be taken anywhere in the house or flat? No! That's a nasty one. I cannot see how we get over that.

A Chance for Inventors.

Then we want another loudspeaker improvement. We want to make it, say, 100 per cent efficient (not more) so that we don't pay for unnecessary watts. The valves will have infinite input impedance and "cold" emitter filaments. They would have a magnification of several hundreds of d.bs., being free from Miller effect and perfectly screened. One valve could do everything, probably—or possibly.

But . . . as to the shape and colour of the set, I suppose art in industry will have its little way; but so far as I can see it won't be the way I want it to be for some time yet. But the consummation of the ideal is not impossible.

Cost—I will resist the subject, only saying that we have seen remarkable changes, and that value for money is given in greater measure to-day than yesterday. Remote control? . . . Pure ingenuity, and engineers are, if nothing else, ingenious.

We seem to be up against just one thing, and that is the physics of wireless. Will ultra-short waves give a reliable indoor aerial magneto interference free constant one-valve set service to all? It is doubtful. It is also doubtful if the national authorities want to give people a wide choice of programmes.

(*Continued on page* 483.)

FOR THE NEW LONG-WAVER

"The B.B.C. are doing away with the possibility of giving more alternatives than two," says Eckersley. But they are making sure that they will be real alternatives, as witness the new long-wave station now being built near Droitwich, one of the masts of which is seen in this reproduction.

THE MIRROR OF THE B.B.C. By O. H. M.

THE P.M.G. and THE B.B.C.

Broadcasting at Christmas—Supervision of Studio Arrangements—A Burlesque Broadcast—Important Midland Item.

THE recent visit of Sir Kingsley Wood and Sir Stephen Tallent to Broadcasting House signifies fresh Post Office interest in the B.B.C. I hear that Sir Kingsley is busy preparing to defend the B.B.C. against the threatened attacks in the House of Commons.

Mr. Churchill can be counted upon to rally the forces that are hostile to Broadcasting House. The Labour Opposition is restless because of the feeling of insufficient microphone time compared with the Government. The younger Conservatives, too, have their grievances.

Regional Development.

One good result is already in evidence in connection with the new organisation of the B.B.C. Regional staffs which have been strengthened by the addition of London officials who have now taken up their posts. Apart from the obvious value of this method of exchange in acquainting staff with the problems of the work in different parts of the country, there is no doubt that the programmes generally will improve.

The Christmas Day Broadcast.

What with the King and the bells of Bethlehem straight from the Holy Land, the Christmas Day broadcast promises to be another exceptional transmission. Instead of the "Round the Empire" touch of last year, the scheme this year is for a homeland Christmas party, built round the King's Message and the Bethlehem bells.

A B.B.C. Staff Council.

The idea of a staff council, to protect the interests of the individual and particularly the junior individual broadcaster, which owed its origin to Lady Snowden when she was a Governor of the B.B.C., is being revived. The readjustments involved by the new division of function between creative and administrative have caused hardship in certain cases, and there is a growing feeling that only a staff council machine can protect the interests of the individual.

A New Scheme.

I hear that a new scheme is being introduced in connection with the general supervision of studio arrangements at Broadcasting House. This work has hitherto been part of the duties of Mr. H. L. Chilman, the House Superintendent, who was also responsible for the studio arrangements in the B.B.C.'s Savoy Hill days.

It will in future be carried out by Mr. D. H. Munro, an energetic young Scot, who, before he came to the Head Office Productions Department a few years ago, was assistant to Mr. Neil Maclean, then the station director at Aberdeen.

Supervising the Studios.

Mr. Munro will have two or three young women assistants who will have to ensure that all studios are ready for use in good time before they are required for broadcasts, as well as for rehearsal and audition purposes.

They will see that artistes and speakers are well settled in their places, waiting for the red light to flick, denoting that they are "on the air," and it will be a further part of their duties to keep the balance-and-control staff up to scratch.

From what I hear, the new scheme will entail a new rota of duties extending throughout the whole of the hours of broadcasting.

The routine work of allocating studios to the various sections of the Programme Department—music, vaudeville productions, talks, etc.—will also be carried out by Mr. Munro and his staff.

THE G.P.O. RESEARCH LABORATORY

A view of the magnificent new G.P.O. Research Laboratory at Dollis Hill, which was recently officially opened.

"America Calling Again."

Some of the details of "America Calling Again," the second burlesque of the type of broadcast programme to which our U.S. cousins are accustomed, have already been published in our columns.

In addition to Evê Becke, Al Bowlly, Marie Dayne, Dave Burns, The Moderniques, Burns and Allen, Jack Hylton and his Band will also take part.

Mr. Hylton has been allocated an exacting task, because while the other artistes will only each impersonate single American radio stars, Jack and his Boys will imagine they are Paul Whiteman and *his* Orchestra, Vincent Lopez and *his* Orchestra, Duke Ellington and *his* Band, and finally Guy Lombardo and his Royal Canadians.

A Big Job.

As all these famous combinations have their own distinctive features, Mr. Hylton has a big job on hand. So, too, has Eddie Pola, who will impersonate the

(*Continued on page* 480.)

Weekly jottings of interest to buyers.

IF proof were needed that "Class B has come to stay," it would be amply provided by the number of manufacturers who are now turning out special units for this form of amplification, either with or without incorporated loudspeakers. I have already mentioned several of these, and recently have had an opportunity of seeing two others, the Blue Spot Class B Output Stage and the Wearite Class B Unit.

The Blue Spot unit is a complete output stage comprising Class B components, a 45P.M. loudspeaker and an Osram B.21 valve, and sells for the remarkably low price of 43s. 6d. inclusive. I can recommend this unit with confidence.

The Wearite unit does not include a loudspeaker, and is in the form of a constructor's kit, using, of course, Wright and Weaire's own Class B components. A special folder with constructional charts may be obtained through the "P.W." postcard scheme. **(No. 62)**

A New Battery Factory.

I have often mentioned the fact that there are still many thousands of listeners who use battery receivers. It now appears, in support of my contention, that the demand for high-tension batteries is increasing rather than growing smaller, for the Ever Ready Company have found their present factories, extensive as they are, insufficient to cope with the orders. Recently a new factory has been opened at Walthamstow, with a floor space of something like 175,000 square feet, which will deal with every stage of dry-battery manufacture. It is the only factory in England, incidentally, in which production is carried out from the raw material to the finished battery, and it is the eighth which Ever Ready have built in London.

Static Suppression Topics.

The Kolster-Brandes "Rejectostat" system needs no introduction at this stage, but

(*Continued on page* 482.)

Give Generously for Your Poppy.

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way—just quote the number or numbers.

BIG PAY for Trained Radio Men

"Practical Wireless" writes:—
"*There is no doubt that the Courses have been prepared in a most masterly fashion by men who know what they are writing about. The Principals of the College are in constant touch with leaders in the radio industry and can, therefore, effect introductions which can be of the greatest assistance to students. A recommendation from the College direct to an employer is not only a guarantee of the student's training but also confirms his determination to qualify for a good position. The student is assured that the College will use its influence to the utmost to help him to succeed.*"
"*Amateur Wireless*," "*Popular Wireless*," "*Wireless World*," and other publications also testify to the excellence of T.C.R.C. training.

Fathers! Prepare your Sons for well-paid jobs!

Fathers who are faced with the problem of finding employment for their sons should send for our Prospectus. Radio and its allied industries offer unlimited opportunities for boys and young men who are ambitious. Our training will equip them for well-paid and progressive positions and will provide them with an intense interest to occupy their spare time.

Individual training by experts

Our Chief Technical Contributor, Mr. G. P. Kendall, B.Sc., needs no introduction. He is an authority on technical and commercial radio. Both he and our Director of Studies have proved, by their own achievements, that radio offers wonderful opportunities to trained men. Each student is treated as an individual and the number accepted is limited in order that each student may be given personal attention. All communications are sent in plain envelopes and students study in the privacy of their homes. Age and circumstances are no obstacle—we have students of all ages and in all walks of life. Our fees are extremely reasonable and can, if desired, be paid by instalments. One fee covers the complete training; there are no additional expenses except postage.

Radio offers rich rewards to the trained man. It is a field of tremendous and unlimited opportunities. Broadcasting, television, talkies, cathode ray, air traffic and the whole of the electrical industry, quite apart from the actual radio industry, are becoming vitally linked up with radio science. In less than ten years over 150,000 jobs have been created. Already there are over a thousand men earning more than £2,000 a year and over 25,000 earning more than £500 a year and these men are doing interesting work that you would call a hobby.

YOU CAN QUALIFY FOR HIGHLY-PAID WORK.

Trained men are urgently wanted and we can give you the sort of training that employers demand. The T.C.R.C. Radio Correspondence Courses are prepared and conducted by men who have themselves made good in the Radio Industry and earned four-figured salaries.

FULL-TIME EMPLOYMENT FOR TRAINED MEN.

Our Director of Studies and his colleagues are in close touch with leading radio employers. Every student obtaining over a 70% pass on completion of his studies is guaranteed introductions to suitable employers and is given valuable help in obtaining the sort of work he wants.

TURN YOUR SPARE TIME INTO MONEY.

If you do not require full-time employment, we can train you to earn money in your spare-time. Set Designing, Inventing, Demonstrating, Installation and Maintenance, Servicing, Set Building, Writing for the Press, Mail Order, Accumulator Charging, and many other interesting occupations which will not interfere with your ordinary occupation can bring you in additional money. You can make your hobby pay and derive much greater enjoyment from it. We will teach you how.

ACT NOW! Success awaits you.

We train students of all ages. We can train *you*. Our Prospectus contains full details of the opportunities that radio offers and explains how we can train you quickly to become a radio expert capable of demanding big money. T.C.R.C. Training is intensely interesting—no foreign text-books, no obsolete theory or dull drudgery, no additional expenses. You will enjoy studying.

Our Courses cover the whole theory of radio and include practical instruction. They are always up-to-date and contain instruction on all the latest developments of radio. Every student is treated as an individual, and additional instruction and advice is given him to suit his particular needs.

Send for our Prospectus now. It is free for your asking. It will place you under no obligation. You will not be pestered to enrol. ***FILL IN AND POST COUPON NOW.***

TECHNICAL & COMMERCIAL RADIO COLLEGE, LLOYDS PLACE, BLACKHEATH, S.E.3

Mr. R. H. Bradley, Director of Studies.

Mr. W. S. VERRELLS, Managing Director of E. K. COLE, LTD., Manufacturers of EKCO RADIO, writes:—

"There can be no doubt as to the urgent necessity for such a College, and I heartily commend your enterprise in spreading wireless wisdom in this manner. There is a great future in radio and the men who take the trouble to study and specialise will find their progress assured. I know that those who complete the thorough course will be well equipped with the valuable knowledge so essential to the modern radio craftsman."

ANOTHER LEADING RADIO MANUFACTURER says:—

"I have always experienced the greatest difficulty in finding men with a sound technical and commercial knowledge. Your Courses fill an essential need in the radio field."

SERVICE MANAGER, writes:

"Technical training on the part of the radio dealer or his assistant has been an advantage in the past. It is now becoming a necessity."

POST COUPON NOW AND TAKE THE FIRST STEP TO SUCCESS AND PROSPERITY

To: TECHNICAL & COMMERCIAL RADIO COLLEGE, Lloyds Place, Blackheath, S.E.3.

Please send me, free, full details of the T.C.R.C. Radio Correspondence Courses and tell me how I can qualify for highly-paid employment, as well as making money in my spare time.

Name .....

Address .....

Occupation ..... Age .....

Pop. W. 2. (½d. stamp if posted in unsealed envelope.)

RADIO STEP-BY-STEP

OUR SPECIAL SUPPLEMENT for BEGINNERS

ELECTRICAL UNITS

A simple explanation of Pressure, Current and Resistance.

JUST as we measure water in pints, quarts or gallons, sugar in pounds, coal in tons, and ribbon in yards, so we measure electricity in definite units. The electrician speaks glibly of pressure, current and resistance. He refers to a battery of so many volts and to a current of so many amperes. What does he mean? He uses these words in exactly the same way as you yourself would speak of a pint or a foot.

When electricity flows along a wire, as it does, for example, from a power station to your house, from a motor-car battery to the headlamps or from one telephone to another, it requires a driving force. It will not flow unless there is something, as it were, to push it along.

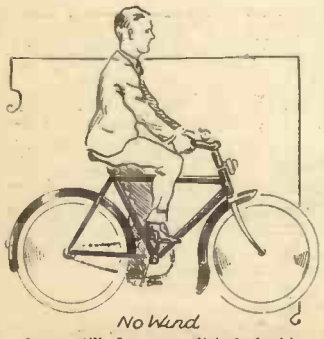
Therefore we sometimes speak of *electromotive force* as that property which produces a flow of electricity. The unit of electromotive force (abbreviated to e.m.f.) is called the *Volt*; hence we hear of a battery having an e.m.f. of so many volts.

The Driving Force.

This is simply another way of saying that so many units of pressure are available for driving a quantity of electricity along a wire or round a circuit.

Everybody is familiar with the ordinary garden hose. In order to obtain a powerful stream of water from the nozzle it is necessary to have plenty of pressure. Given sufficient pressure or force, the nozzle will pass a large quantity of water in a comparatively short time.

But if, on the other hand, the force behind the water is small the result will be little more than a trickle from the nozzle.



No Wind

On a still day a cyclist finds his work easy, because the resistance he meets with is comparatively small.

The pressure behind the water can be obtained in several ways, the most obvious being a pump. A powerful pump would force more water past the nozzle in a given time than a less powerful one.

If the length of the hose is considerably increased the power of the pump will have to be increased also, in order to maintain the same flow of water past the nozzle.

Here we have a good analogy for electrical pressure. The pump supplies the pressure which forces the water through the hose.

Similarly it is the pressure or electromotive force which drives the electricity along a wire. And it is the volts that supply the pressure.

Now, the hose analogy is a very useful one. We know that for a given size of hose we shall get more water in a certain time if we increase the pressure. Suppose, for instance, we wanted to fill a tank. We could do this in two ways. One method would be to use just sufficient pressure or force to ensure a small flow from the nozzle and take perhaps half an hour to fill the tank.

The alternative would be to use plenty of force behind the water so as to maintain a powerful stream past the nozzle, thus filling the tank in a third or a quarter of the time.

Obviously, the amount of water per second passing through the hose will be much greater in the second case. The term gallons alone has little meaning because it does not take time into consideration.

So long as some water is flowing past the nozzle of the hose we can obtain as many gallons as we like, if we are prepared to wait.

But if we are told that with a given pressure we can get a gallon a second (or a fraction of a gallon per second) we know where we are.

We can now revert once more to our electrical units. The flow of electricity along a wire is analogous to the flow of water along a pipe or hose, and this electrical flow is known as a *current*. The electrical unit of quantity or amount of electricity is the *coulomb*. This is analogous to the gallon.

In order to obtain a powerful jet from a hose nozzle it is necessary for the pressure of water to be high. If the pressure of water is low only a trickle will flow from the nozzle of the hose.

But electricians never speak of coulombs. They are concerned with the rate of flow, or, in other words, how many coulombs flow past a given point in a second (this is analogous to gallons per second past the hose nozzle).

Now, the word *ampere* is used to express a flow of one coulomb per second. If we increase the electrical pressure or voltage we shall force more electricity past a given point per second, i.e. the number of amperes flowing along the wire will be increased.

But however great the pressure of electricity (voltage) the flow of current (amperes) along a wire is not unrestricted.

When water flows along a pipe it meets with a definite resistance which depends upon several factors. For example, whether the walls of the pipe are smooth or rough, and also upon the length of the pipe.

In electricity every length of wire has a definite resistance to current flow. This resistance depends upon the length of the wire, the material of which it is made, its cross-sectional area and to some extent its temperature.

The amount of electricity passing a given point along the wire in one second (amperes) will be less if the resistance is made greater, assuming the pressure or driving force (volts) to be the same.

An Analogy.

A cyclist pedalling along the road on a still day finds his work comparatively easy, because he meets with little resistance (there is always some resistance to his progress—otherwise he would not have to apply pressure to the pedals).

But if he has to pedal against the wind he finds his work much harder. If he continues to apply the same pressure to the pedals as before the effect of the wind resistance is to decrease his speed. Alternatively, he can maintain his previous speed by pressing harder upon the pedals, and so overcome the extra resistance due to the wind.

This is the effect of electrical resistance on the pressure and current (volts and amperes). Quite simple, isn't it?

Against the Wind

A cyclist finds his work more difficult against the wind. He meets with resistance, and this slows him down unless he presses harder on the pedals in order to maintain the same speed.

Special Beginner's Supplement—Page 2.

RADIO TERMS
A PRACTICAL REVIEW
BY G.V. DOWDING, ASSOCIATE I.E.E.

This section is much more than a mere list of definitions. It is a complete survey of radio presented in a compact form, giving succinct theoretical explanations and packed with useful practical facts. It constitutes a perfect accompaniment to the other articles in the supplement both by providing summaries of the subjects covered and by building a fascinating bridge between theory and practice.

Aerial.

THIS is the arrangement used to collect the radio energy from space. It can take any one of many different forms, but the most efficient for normal broadcast reception is a single wire suspended in the open.

Height is of greater importance than length, generally speaking, and, in practice, that is really the only vital point to remember.

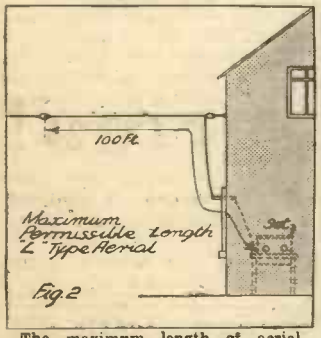
The actual wire itself should be chosen first for its strength and weather-resisting qualities. Seven-strand phosphor-bronze is excellent material for the purpose. Insulating covering is not necessary, nor does it interfere with reception, but if it provides a good protection against the weather it can certainly be useful if only for that reason.

Aerial wires should be kept as far away from walls and trees as possible.

A convenient length is 75 feet, including the lead-in portion which connects to the set. There is usually no great advantage to be gained by employing the full 100 feet allowed by the P.M.G.

An inverted "L" type, as shown in Fig. 1 and Fig. 2, is slightly directional. That is to say, it will receive best from the one direction, and that is from the direction to which the set end is pointing.

P.M.G. SIZE



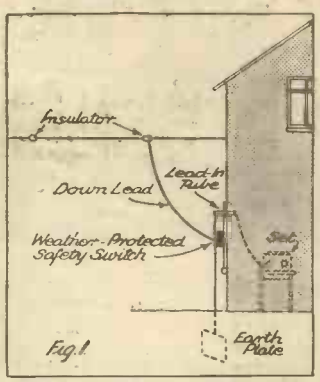
The maximum length of aerial permitted by the Postmaster-General is 100 ft. This includes both the horizontal portion and the leading-in wire.

The "T" type (Fig. 3) is, obviously, less directional, but the difference is not one that is likely to affect the average listener to any great extent.

Probably the best type of indoor aerial is a pair of parallel wires suspended in a loft or other roof space (Fig. 4), though good results can be obtained from a wire run around the picture-railing of a room. Special wire for the purpose is freely obtainable. A superior effect is achieved if the aerial is in an upper room of the house. It should not run round all four walls, but only three, as shown in Fig. 5.

The aerial terminates at the aerial terminal of the set, and that part of it referred to as the lead-in should be kept as short, free of bends, and as far from walls as possible.

INVERTED "L"



With the inverted "L" type of aerial the lead-in wire is taken from one end, normally the house end.

Where severe interference is experienced the expedient of shortening the length of the aerial, perhaps drastically, is often worth trying.

Frame Aerial.

The great advantages of the frame aerial are its compactness, strongly directional properties, and freedom from depreciation as compared with the ordinary outdoor system But it is not as sensitive.

The directional effect is extremely useful. The frameaerial is, in fact, the basis of practically all direction-finding schemes. It receives best from the two opposite directions in line with it, and minimum reception results from the two directions at right angles to it.

By employing this property discriminately the selectivity of the set with which it is used can be emphasised, and it is often possible to reduce atmospheric disturbances to a lower level than with an ordinary type of aerial.

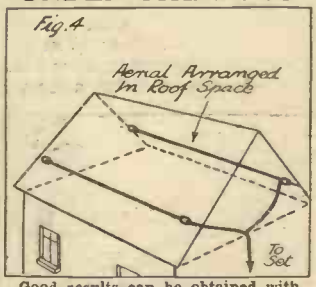
Fig. 7 gives practicaldetails of a satisfactory frame for broadcast reception of dimensions suitable for an "all-in" type of set. Double silk-covered wire is advised, the gauges being indicated in the drawing.

The two windings are in the same direction. Wave-changing is accomplished by means of a simple on-off switch, which either leaves the medium-wave winding disconnected for long-wave reception or connects it in parallel with the long-wave winding for medium-wave reception.

Within limits the larger the frame the greater its efficiency (fewer turns of wire are needed for given wavebands as with increases in size).

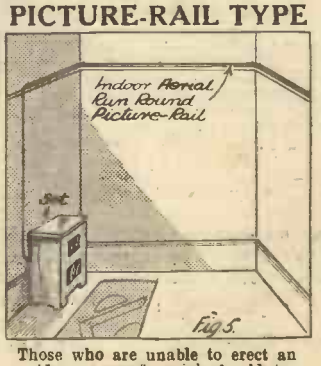
The directional effects of a frame are reduced and its sensitivity increased somewhat if an ordinary earth connection is used with it.

UNDER THE ROOF



Good results can be obtained with an aerial arranged under the roof. This is probably the best type of indoor aerial.

PICTURE-RAIL TYPE



Those who are unable to erect an outdoor or roof aerial should try the arrangement shown above. The aerial wire runs round the picture railing on three sides of the room.

Aerial Insulation.

The wireless waves generate feeble currents of electricity in the aerial system. These must not be allowed to leak away, so where it is necessary to secure the aerial at its ends or pass it through a window frame or wall, good electrical insulation is needed.

Aerial Insulators.

The popular and inexpensive "egg" type insulators made of glazed porcelain are perfectly satisfactory. There is no need to cut the aerial wire at the end of its horizontal run. It can be looped through the insulator, carefully tied so that the strain is taken up, not by a knot but by the smooth surface of the insulator, and continued unbroken for the downlead.

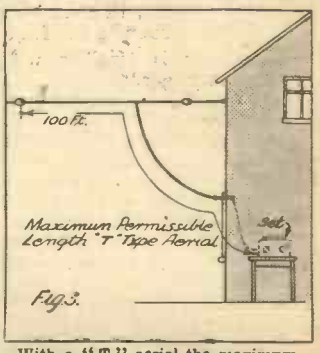
Aerial Lightning Switches.

The chances of lightning striking any one particular aerial are a million or more to one. Nevertheless, the careful listener will want to guard against even those long odds.

Complete protection against lightning is afforded by a safety switch which can be operated so as to disconnect the aerial from the lead-in and join it to a wire which runs direct to earth (Fig. 1 and Fig. 6).

But such a switch must be outside the house and wired to allow the most direct run from the aerial to a good buried earth.

A "T" ARRANGEMENT



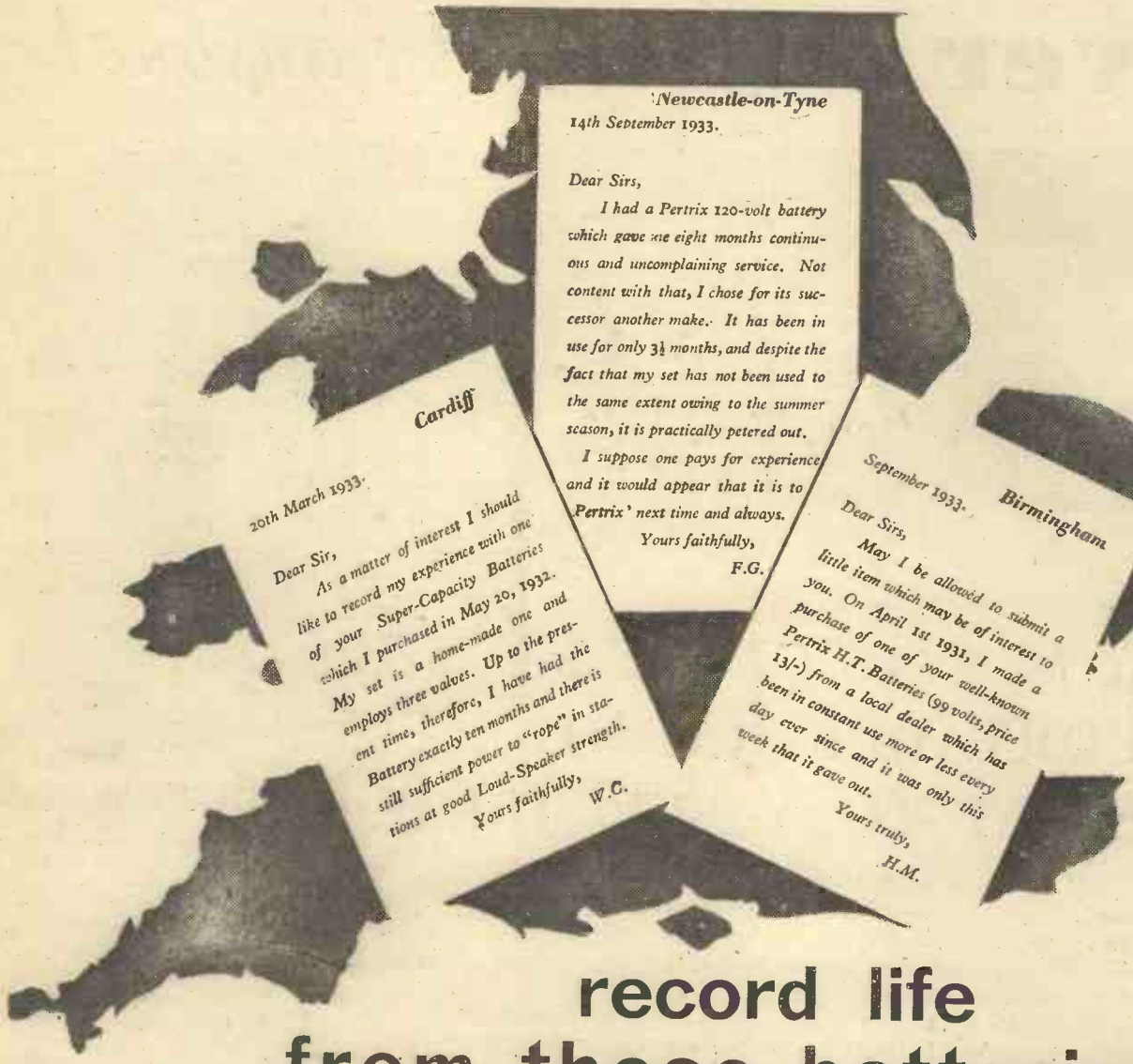
With a "T" aerial the maximum permissible length is that of the longer arm plus the leading-in wire.

A substantial, covered switch is needed—one that has been specially designed for out-of-doors use.

Alternatively, there are devices which are automatic in nature and embody "safety gaps." (A very small gap between two pieces of metal, one of which is joined to the aerial and the other to earth. The electrical charge induced in the aerial prefers to jump across this

(Continued on page 461.)

All over the country . . .



record life from these batteries!

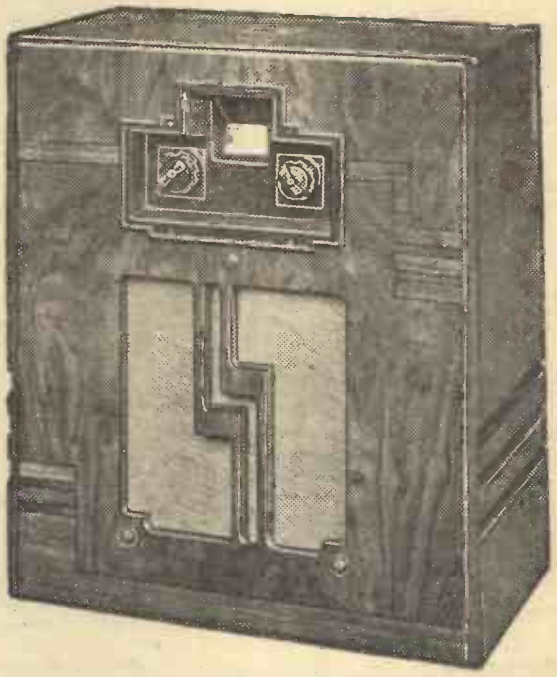
Letters beyond number, from all parts of the country, tell how Pertrix Batteries have lasted until they became sources of wonder. If you could read all these letters, you would be convinced that Pertrix Batteries really have put up records for long life. Yet you still wouldn't be any wiser as to *why*. The reason is that Pertrix Batteries are non-sal-ammoniac.

They are the only batteries using a patent ***neutral*** electrolyte which cannot rot the zinc cells. There is no 'shorting' between the cells—and no resistance crystals to clog the current. Instead of wasting away when the set is idle, a Pertrix actually recovers power. ***Now you know how and why, make your next battery a Pertrix!***

FIT **PERTRIX** TRADE MARK *FOR GOOD*

BRITISH MADE BY BRITANNIA BATTERIES LTD., 233 SHAFTESBURY AVENUE, LONDON, W.C.2

The Finest Portable ever built — *by anyone!*



A NEW 15 GUINEA PORTABLE RADIO BUILT TO A £100 IDEAL!

The ultimate in Portable Radio is here—the latest "His Master's Voice" Superhet A.V.C. Portable Grand, Model 462. Into this set has been built all the advancements hitherto obtainable only in all-main instruments of the very largest size and price. Not only is Model 462 a six-valve Superhet Portable with permanent magnet moving coil speaker, giving beautifully balanced reproduction, but it is equipped with :—

(a) Automatic Volume Control. This means that you can now receive your programme from a portable at constant strength — distant stations coming in delightfully clear with absence of fading.

(b) The simplest of controls. Illuminated scale showing station names.

(c) Provision for the operation of an additional low resistance loudspeaker, and for the attachment of a gramophone pick-up so that your records can be played with the highest quality of reproduction.

OUTSTANDING FEATURES

- Mains performance from a battery portable.
- No earth ; no aerial.
- Delayed Automatic Volume Control which combats fading.
- Perfect grading of volume even on powerful local stations.
- Simplicity of control.
- Station names on illuminated scale.
- Super sensitivity and selectivity.
- Correctly balanced reproduction from moving coil loudspeaker.
- Ample power for additional loudspeaker.
- Sockets for gramophone pick-up.
- Handsome walnut cabinet, designed acoustically.

Ask your "His Master's Voice" dealer for a demonstration.

"HIS MASTER'S VOICE"

"TRUE-TO-LIFE"

RADIO

The Gramophone Co., Ltd., 98-108 Clerkenwell Road, London, E.C.1

(Price does not apply in I.F.S.)

Special Beginners' Supplement—Page 8.

WHAT IS A.C.?

The answer to this question is given in a way which everyone will find easy to follow.

A CLEAR understanding of what constitutes alternating current is of vital importance to the radio enthusiast. And the best method of gaining this undestanding is to start at the beginning and consider the simple generator of electricity.

VARYING VOLTAGE

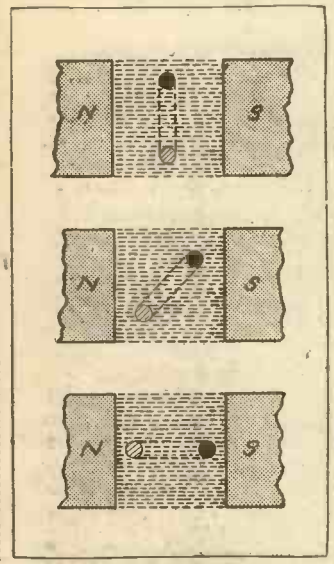


Fig. 1. How a loop of wire revolving in a magnetic field cuts the lines of force. In the top diagram the voltage is zero, and in the bottom diagram it has reached its maximum.

Last week, in the article on "Mysteries of Magnetism," we showed how a length or loop of wire moving across a magnetic field causes a flow of electricity along the wire. This flow of electricity is the result of cutting the lines of force at an angle. This, it was pointed out, is the principle upon which the dynamo works.

Now let us assume that we have a rectangular loop of wire capable of revolving in the magnetic field produced between two magnet poles (Fig. 2).

In Various Positions.

In Fig. 1 this loop of wire is shown in section in three of the positions which it will take up during a revolution. In the top diagram the loop is vertical, in the second it is at an angle midway between the vertical and horizontal, and in the bottom diagram it is horizontal.

Suppose we commence our revolution from the vertical position (top diagram).

When the loop moves out of the vertical position it will start to cut the lines of force, and immediately it does this a current will flow along the wire and generate a definite voltage between the two ends.

Cutting the Lines.

Now this voltage, which varies with the current flow (see the article on Electrical Units), increases as the number of lines cut by the loop becomes greater. For a given movement of the loop this must depend upon the angle between the magnetic lines and the loop.

Thus in the intermediate position (middle diagram of Fig. 1) the voltage generated is steadily increasing until it finally reaches its maximum, when the loop is moving perpendicular to the lines (bottom diagram Fig. 1).

We can now approach the subject in greater detail. Fig. 1 shows five positions of the loop during one revolution. Directly above these five small diagrams is a simple graph showing how the voltage generated rises and falls, and how it reverses its direction.

The angle through which the loop has passed is indicated in degrees along the horizontal line. To start with, the loop is vertical and the voltage is zero. For the sake of clarity we are only considering the top portion

A REVOLVING LOOP

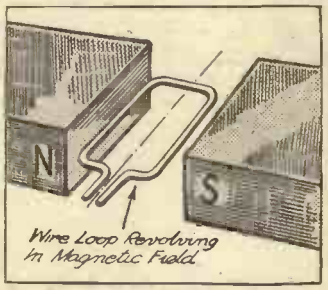


Fig. 2. The voltage rises to a maximum and falls to zero in one direction, after which it carries out the same procedure in the opposite direction.

of the loop, which is shown as a small black circle.

Increase and Decrease.

As the loop moves through the first 90 degrees of its revolution (a quarter of a turn) the voltage gradually rises to a maximum. This is reached when the loop is horizontal. After this, from 90 to 180 degrees, the voltage gradually falls, until at 180 degrees, when the loop has turned for half a revolution, the voltage is zero.

Then the voltage starts to rise again during the next quarter of a turn, but this time in the opposite direction, reaching its maximum at 270 degrees, or three-quarters of a revolution.

COMPLETE CYCLE

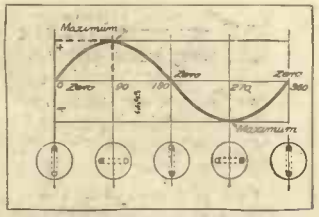


Fig. 3. When a loop of wire revolves in a magnetic field alternating current is generated in the wire.

After this the voltage falls once more, until at 360 degrees, or one complete revolution of the loop, it is zero. This increase from zero to maximum and then back to zero, followed by an increase to maximum and fall to zero in the opposite direction, is called a *cycle*.

There are two *alternations* to one complete cycle, viz., the rise and fall in one direction and the rise and fall in the opposite direction.

The first alternation is between 0 and 180 degrees; the second between 180 and 360 degrees—that is, one alternation for each half-revolution of the loop.

This is why we refer to the flow of electricity generated in this manner as alternating current. The number of cycles in a second is called the *Frequency*. Hence, if there are fifty cycles per second the A.C. supply is said to have a frequency of fifty.

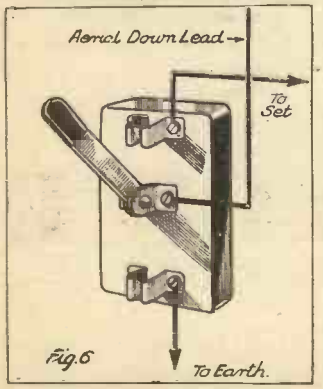
RADIO TERMS

(*Continued from page 458.*)

gap rather than to flash through the devious path offered by the set and so to earth.)

Sometimes such a gap is incorporated in an aerial switch, thus providing a two-fold safeguarding. Also lead-in tubes with safety gaps are to be obtained.

FOR EARTHING



An aerial-earth switch is connected up in this manner. In one position the aerial is joined to the set and in the other position it goes direct to earth.

Aerial Lead-in.

The best way to get the aerial into the house is to use a good lead-in tube. This is merely a double-ended terminal well insulated along its shank. Lead-in tubes of different lengths can be obtained.

It is advisable that its exposed metal portion should be of an anti-corrosive character.

The tube can be fixed through a hole bored in the window-frame.

Aerial Screening.

A great deal of the electrical interference which troubles many listeners frequently reaches the set through the aerial. This can be tested by noting whether or not the interference is eliminated or reduced when the aerial is disconnected from the set.

To prevent much of such interference being picked up by the aerial system, the down-lead of the aerial can be screened by means of special metal screening which is now available.

This sheathing is well insulated from the wire, but has to be connected to earth. Ordinary lead-covered cable would not be suitable; the special material must be used or reception may be ruined by the losses introduced.

The earth lead also can often with advantage be shielded, but only that portion of the aerial known as the downlead should be treated in this manner.

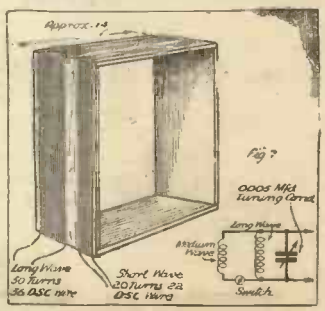
The scheme is not likely to prove beneficial if there are no electric power or lighting mains close at hand, for the simple reason that it is to protect the aerial against interfering radiations from them that the screening is advised.

Mains Aerial.

It is a common practice in mains sets to provide for using the mains themselves as an aerial. This is done merely by connecting the aerial terminal of the set to the mains by means of a small series condenser of the order of .0002 mfd. in capacity.

While this scheme does away with the necessity of more or less unsightly aerial wires, the results are seldom but fractionally as good, and in cases a certain amount of hum will be introduced.

MAKING A FRAME



An effective frame aerial can be made by using the method indicated above.

Short-Wave Notes By W.L.S.

AFTER my several recent comments on the poor show put up by W 8 X K on 19·72 metres, in contrast to his usually excellent strength on 25·27 metres, I was very surprised a night or two ago to find him coming over on 19·72 at such unusual strength that he quite put W 2 X A D in the shade.

For the benefit of any readers who might have chanced to hear the same transmission, one of the items was a somewhat lengthy talk by a lady on the subject of preparing a "Chicken Chop Suey" dinner for a hundred people! Whether "X K" has now got an aerial on that wave that is directional for Europe I have not yet been able to find out; but strength was such that my one-valver, fed into a two-stage radio-gramophone, made him not only audible but intelligible all over the house.

Real news, right up to the minute, and of vital importance to all those interested in short-wave reception, is offered by our popular contributor in these notes. He has some exceedingly interesting reports this week, and also comments on his latest receiver.

Have You Heard Sydney?

D J B, immediately above him, was giving one of the usual interminable talks, but was not nearly as strong as the American.

Sydney, V K 2 M E, is another station that has improved tremendously. I suppose this will be quite exciting news to readers who have yet to bag their first Australian station. Listen for V K 2 M E on 31·28 metres at almost any time between 7 a.m. and 3 p.m. next Sunday, and you *may* be lucky.

"J. B. M.," of Glasgow, reports reception on Sunday, Oct. 22nd, at 7.18 a.m. (R6), 11.50 a.m. (R5) and 2.30 p.m. (R7). He mentions, too, that V K 2 M E announced that he was also transmitting on 7 metres. Here's a *real* chance for someone to do a spot of record-breaking!

"J. B. M.," by the way, describes some of his previous sets as "Sic transit gloria" (Here th' day an' awa' th' morn!). I'm afraid lots of us have had sets like that, J. B. M.

What Station Is It?

I am absolutely at a loss to account for the various reports that I receive about a Spanish-speaking station just above the 19-metre group. Scores of readers have mentioned this, and I have told most of them that I thought it must be X D A (Mexico) on 20·5 metres.

"A. M." (Glasgow) has completely spoilt this little romance by forwarding me a letter from the authorities at X D A to the effect that they have no stations for telephony service on that wavelength, and that station X D A is used exclusively for international telegraphic service.

The only remaining possibility seems to be the famous little station T I-4 N R H, in Heredia, Costa Rica, working on 19·9 metres. As this is quite a "fly-power" station, however, I find it hard to believe that so many different people should have reported it.

If anyone can clear up this small mystery I shall be very much indebted to him.

"G. W. C." (Leicester) reports transmissions on 73·5 metres that apparently emanate from aeroplanes. I didn't realise that the R.A.F. worked on that wave, but it looks very much as if they do, from what "G. W. C." reports. Incidentally, readers picking up this sort of thing should remember the "divulgence" clause in the receiving licence.

REAL PORTABILITY

The little box hanging round the neck of this Austrian policeman is a complete transmitter. The battery is contained in one of his pockets, and he is holding a special Morse key in his right hand.

We can't be stopped from accidentally picking up things that are not meant for our ears, but there is a very rigid rule against passing such information on promiscuously. I have even heard of a case in which a man complained to the G.P.O. about a neighbouring amateur transmitter, quoting some conversations that he had overheard and taken down in shorthand; and the said man was very severely reprimanded for intercepting private experimental messages!

Uses a Pentode Detector.

An amusing letter that I received recently from a foreign amateur contains the beautiful term "bulv" several times repeated. I eventually managed to read it as "valve," but I originally wondered what on earth he wanted a "bulv" for in his set. I think "bulv" is awarded the weekly biscuit.

My most recent receiver, using a pentode detector, is now finished, and will be in the Editor's hands almost immediately. I don't recommend it for reception of amateur C.W., or, in fact, for any headphone work except for weak stations during bad conditions. It does, however, make a very good "quiet" loudspeaker receiver.

The pentode is resistance-coupled to an L.F. stage, which may be another pentode if one is keen on plenty of volume. One of the advantages of pentode detection is that one seems to be able to get the detector into practically any state that one requires by varying the priming-grid voltage. In this particular set I have done this with a potentiometer.

Fine Reaction Control.

This control *can* be used as a kind of fine reaction control; or, when the set is already below the oscillation point, as a volume control. On the other hand, if the detector tends to oscillate fiercely when reaction is controlled by the condenser provided for that purpose, a reduction in priming-grid voltage will put things right.

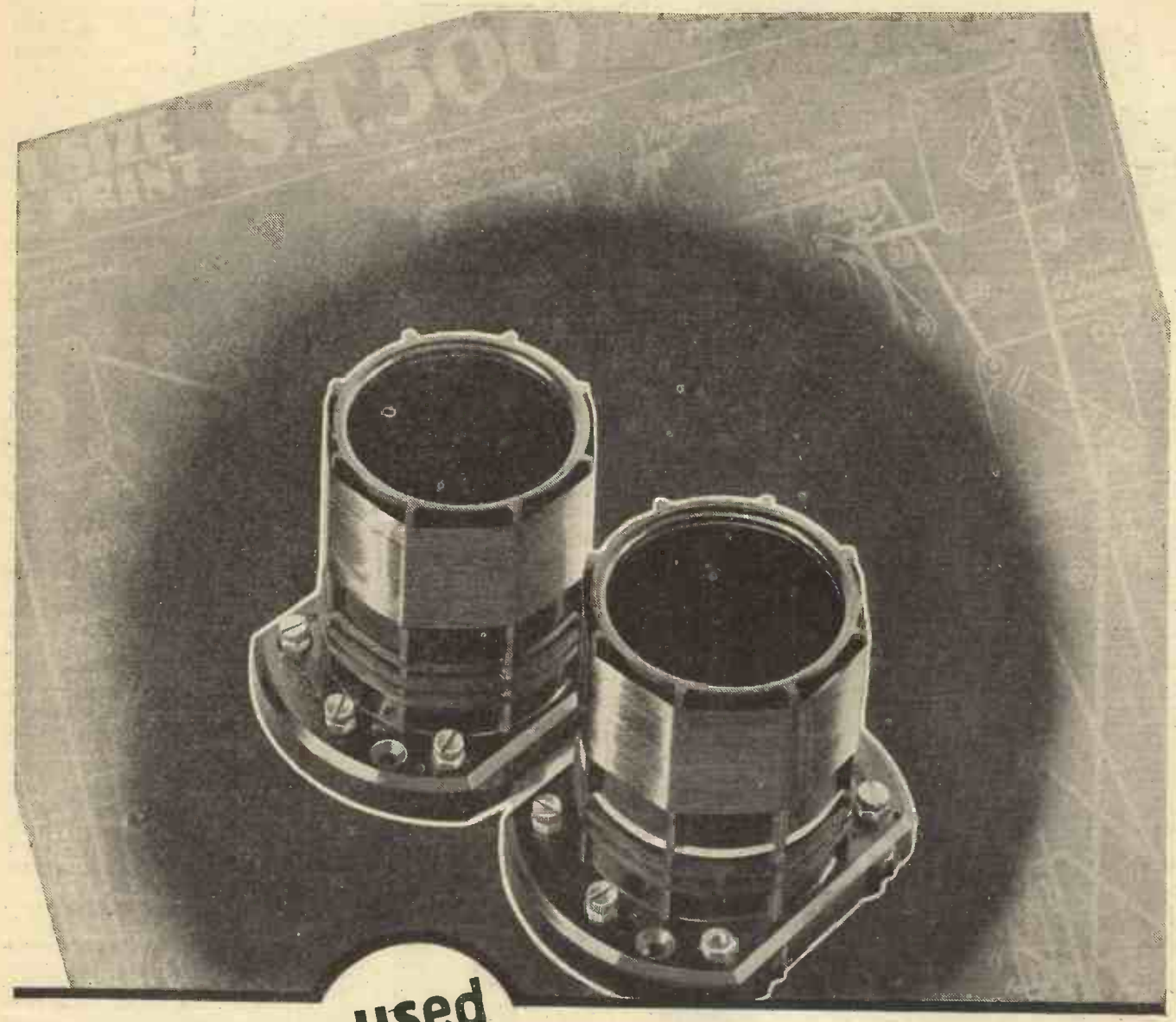
There are a good many single points of view from which pentode detection would not seem worth while; but on the whole I think it *is* an improvement on the triode as most of us use (or misuse) it.

I hear that exciting things are likely to happen on the ultra-short waves in the near future. Among these are television, Regional broadcasts, pictures by radio, and several other attractive features. Taking all this with the proverbial grain of salt, we certainly have to face the fact that all that space between 5 and 10 metres will most *certainly* not still be empty in two or three years' time.

Utilising the Wavebands.

Our treatment of the gamut of wireless waves rather reminds me of the behaviour of a family of seventeen who move into a house with eight rooms. At first they all insist on living in one room; but in the course of years they spread out over three of them.

Even now at least five of the rooms are untenanted except for an occasional noisy rush in and out again by one of the children (as happened at the Crystal Palace on May 21st, 1933!). One of these days that family is going to be twice as big, and it will be essential for the comfort of all that every room should be made full use of.



The coils ~~specified~~ used by Mr. Scott-Taggart

To ensure results identical with the original S.T.500, you must use Colvern Coils. For selectivity, range or performance, Colverns are the most accurate coils ever made—the result of years of experience. Built to the highest standard of engineering precision, every pair of S.T.500 coils is thoroughly tested, and guaranteed to be identical with those employed in the original S.T. Receiver.

COLVERN S.T.500 COILS—8/- per pair

COLVERN

COLVERN LIMITED, Mawney's Road, Romford, Essex. London Wholesale Depot: 150, King's Cross Road., London, W.C.1

The £.S.D. of LOUDSPEAKER RESULTS

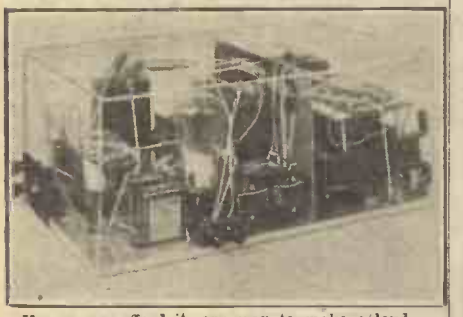
Like most of life's luxuries and necessities, loudspeaker reproduction has to be paid for, and in this entertaining article our talented contributor weighs up all the factors affecting loudspeaker performance and shows how best to get one's money's worth.

By MARCUS G. SCROGGIE, B.Sc., A.M.I.E.E.

LISTENERS and motorists are alike in other respects than having to be licensed. The power question faces both. As a motorist you have to balance up speed, hill-climbing and acceleration against first cost, taxation and petrol consumption. As a listener you have to balance up volume and quality of reproduction against initial and running expenditure.

The amount of power a motorist thinks it worth paying for depends, for one thing, on whether he usually drives in Lincolnshire or Devon. Are there any circumstances that decide how much power is desirable in a

A VOLUME PROVIDER



If you can afford it, one way to make a loudspeaker "deliver the goods" is to feed it from a super-mains-driven amplifier with a large high-voltage triode in the output stage.

receiving set? There are. Lots of them. The list looks rather like the form you have to fill up before travelling abroad (colour of nose, number of wives, object in going, name of mother-in-law, etc., etc.). Here are a few of them:

Size of room.
Size, number and texture of curtains, carpets, etc.
Number and dimensions of people present.
Amount of noise (apart from that due to the loudspeaker).
Efficiency of loudspeaker.
Amount of distortion tolerated by listeners.
Type of programme.
How many milliwatts?

Many Difficulties.

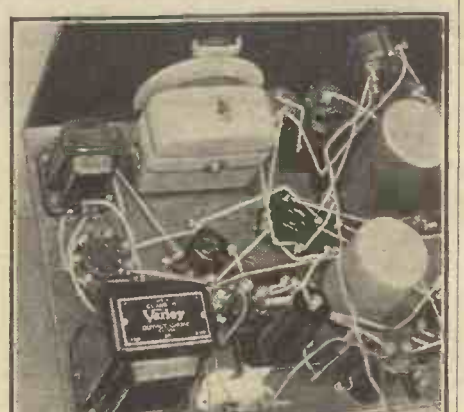
The difference in this list is that all the items are quite important, although they may not all appear so at first sight. It is even more difficult to calculate from these particulars the power output required than it is to calculate the horse-power that a car needs to give a certain standard of performance. But it is quite useful to have some idea of how the apparent loudness of reproduction is affected by the surroundings, so as to avoid disappointment and perplexity when moving from one situation to another.

I used to be in the unfortunate position of having to estimate the capabilities of receivers in a room where there was a continuous rumble of machinery. Being there all day, it was quite difficult to be conscious of this background of noise. But it necessitated just about 10 times the output from a loudspeaker. Traffic noises, a ventilating fan or (too often!) a buzz of conversation, all have an astounding effect on the power needed to maintain a certain level of volume.

Power Comparisons.

The valve's "horse-power" is the milliwatt. The smallest battery-power valves can provide about 150 milliwatts with which to feed the loudspeaker. Larger-power valves give about 300, while 500 or more milliwatts are available from 2-volt

AN ECONOMICAL METHOD



"P.W." always in the van of progress, provided home constructors with the first Class B set, and thus placed economical full volume within the reach of every pocket. Here you see the output end of a "P.W." Class B design.

pentodes and about the same amount from the smallest mains-power valves.

But the most popular mains valve is the pentode, with an output of about 2,000 milliwatts (2 watts). Then there are the luxury valves, capable of 5 or even 10 watts. After that we are definitely in the cinema and open-air sports-meeting class of valves. In contrast to the rather feeble efforts of the battery valves mentioned we have Class B valves, which can deliver anything up to 1,000 or 2,000 milliwatts.

"Miles per Gallon."

Then, of course, one wants to know the "consumption" of these various types. Roughly it may be said that for each milliwatt output an ordinary triode-power valve requires about 5 to be supplied to it from the H.T. battery or mains unit, a pentode about 3 and a Class B valve about 2 *when working "all out."* We shall have something to say about that stipulation later.

The number of milliwatts is, of course, got by multiplying H.T. volts by milliamps. Take the 300-milliwatt power valve, for example; 5 times that is 1,500, so if the maximum H.T. voltage is 150 (which it usually is for that class of valve) the current is 10 milliamps. If you work out the same thing for a 500-milliwatt pentode you will find that the consumption is just the same. So the pentode gives more "miles per gallon."

The Class B System.

People who have explained the inner workings of Class B (and Q.P.P. before it) have pointed out how, in the ordinary method of running valves, the consumption goes on all the time, whether it is being used or not, whereas in a Class B system the consumption is regulated to the work done. In other words, a Class B valve is a piece-worker, whereas the others work by time. And as driving a loudspeaker is a very slack job it is obvious which method is more economical from the employer's point of view (yours!).

(*Continued on page* 482.)

OCCASIONAL POWER

For most of the time an amplifier has an easy job driving its loudspeaker; but when the drums and cymbals are struck there is a sudden enormous power expenditure on the part of the loudspeaker.

THE UNIVERSAL AMPLIFIER

The completion of the grid scheme has by no means solved the problem of the mains set. There are still many districts on D.C., and this state of affairs is likely to exist for some time. Consequently, a great deal of research has been taking place towards the production of universal receivers suitable for operation on either A.C. or D.C. The amplifier described hereunder is an excellent example of developments in this field, and is a product of the "P.W." Research Department.

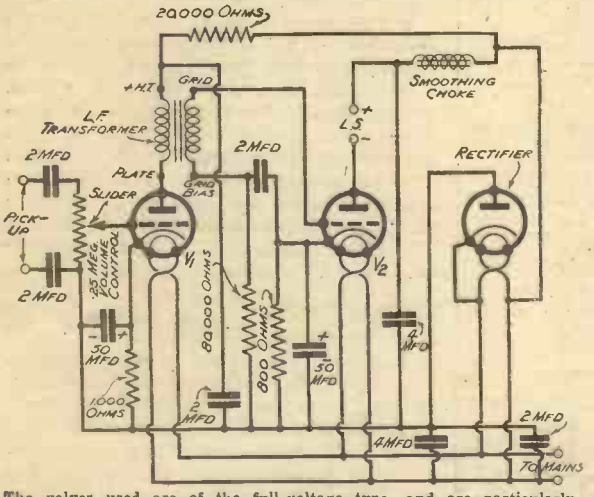
THE grid system of electricity supply is now complete, we are told, but though the whole country is theoretically linked up on synchronised A.C., it will be a long time before the whole of the nation has that type of power available.

Consequently a number of houses that are now on D.C. are in the position that they may go over to A.C. at any time. This naturally causes a great deal of uncertainty among those living in those homes, especially where such things as radio receivers and amplifiers are concerned.

To combat the problem a great deal of experiment has been carried out on what are termed "universal" sets—receivers that are equally suitable whether the power supply is D.C. or A.C., though they derive all their power from the electric light source.

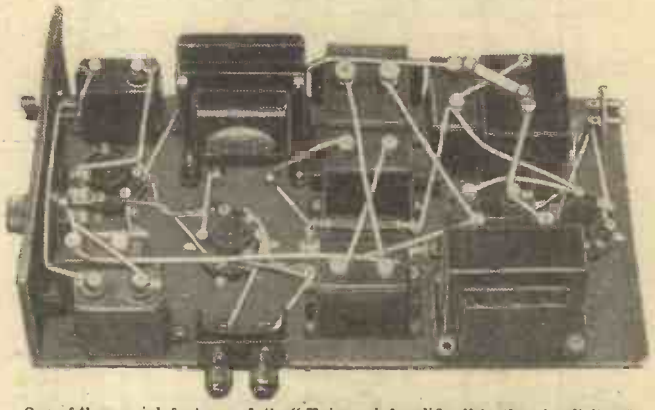
Such sets or amplifiers are ideal for those who may have their type of electricity supply altered at any moment, and who naturally do not want the trouble of altering or rebuilding their sets to match; while, additionally, in the case of a universal gramophone amplifier, the fact that it is universal enables it to be used anywhere where electric mains are available, irrespective of their type.

EMPLOYS FULL-VOLTAGE VALVES



The valves used are of the full-voltage type, and are particularly economical, the heaters taking about 5 watts apiece. It will be noted that no mains transformer is required when the amplifier is employed on A.C., the full voltage of the mains being applied to the heaters of all the valves.

SUITABLE FOR D.C. OR A.C.



One of the special features of the "Universal Amplifier" is the simplicity of the circuit. Only one smoothing choke is employed, while the power output of the rectifier is pre-determined by the capacity of the condenser across it.

Alternative Schemes.

There are two main methods of designing a "universal" set. One is that chosen by us when we made the "Universal Three," published some few weeks ago, and in which ·25-amp. series-connected D.C. valves were

(*Continued on next page.*)

HERE ARE FULL DETAILS OF THE PARTS YOU WILL REQUIRE

Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.
1 Ebonite panel, 7 in. × 4 in.	Peto-Scott	Goltone, Permcol
1 Wooden baseboard, 13½ in. × 7 in.	Peto-Scott	—
2 50-mfd. electrolytic condensers	T.C.C. 521	—
1 4-mfd. fixed condenser	Ferranti type C15	—
1 4-mfd. do. do.	T.C.C., type 61	Igranic, Dubilier
3 2-mfd. do. do.	Dubilier, type BB	Telsen, T.C.C., Igranic
2 2-mfd. do. do.	T.C.C., type 50	Igranic, Telsen, Dubilier
1 ·25-megohm volume control	Igranic, "Megostat"	—
1 80,000-ohm resistance and horizontal holder	Graham Farish "Ohmite," 1½-watt type	Dubilier 1 watt and Dumetohm holder
1 20,000-ohm resistance with wire ends or terminals	Dubilier 1 watt	Graham Farish, Varley "Electronic"
1 1,000-ohm resistance with horizontal holder	Dubilier metallised 1 watt	—
1 800-ohm power resistance and horizontal holder	Graham Farish power "Ohmite," 3-watt type	Dubilier 1 watt and Dumetohm holder
3 5-pin valve holders	Benjamin	W.B.
1 Smoothing choke	Ferranti B.10	—
1 L.F. transformer	Ferranti AF.5	—
1 Twin socket strip and plugs	Belling-Lee 1047 (Pick-up)	—
1 Terminal block	Belling-Lee 1039	—
2 Terminals	Belling-Lee, type B	—
1 Mains plug	Belling-Lee 1042	Goltone, Clix
3 Yards insulated sleeving	Goltone	—
4 Yards 18-gauge tinned copper wire	Goltone	—
Screws, flex, etc.	Peto-Scott	—

VALVES.—Ostar-Ganz A.529, K.3560, E.G.100. (Note.—Specify mains voltage when ordering.)

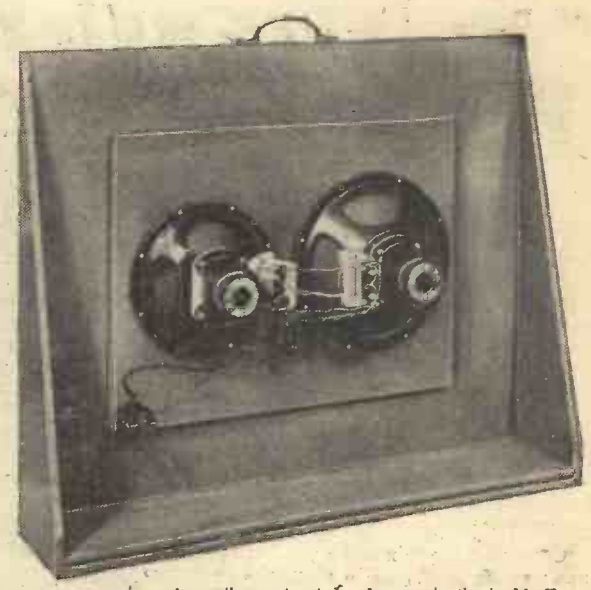
THE UNIVERSAL AMPLIFIER

(Continued from previous page.)

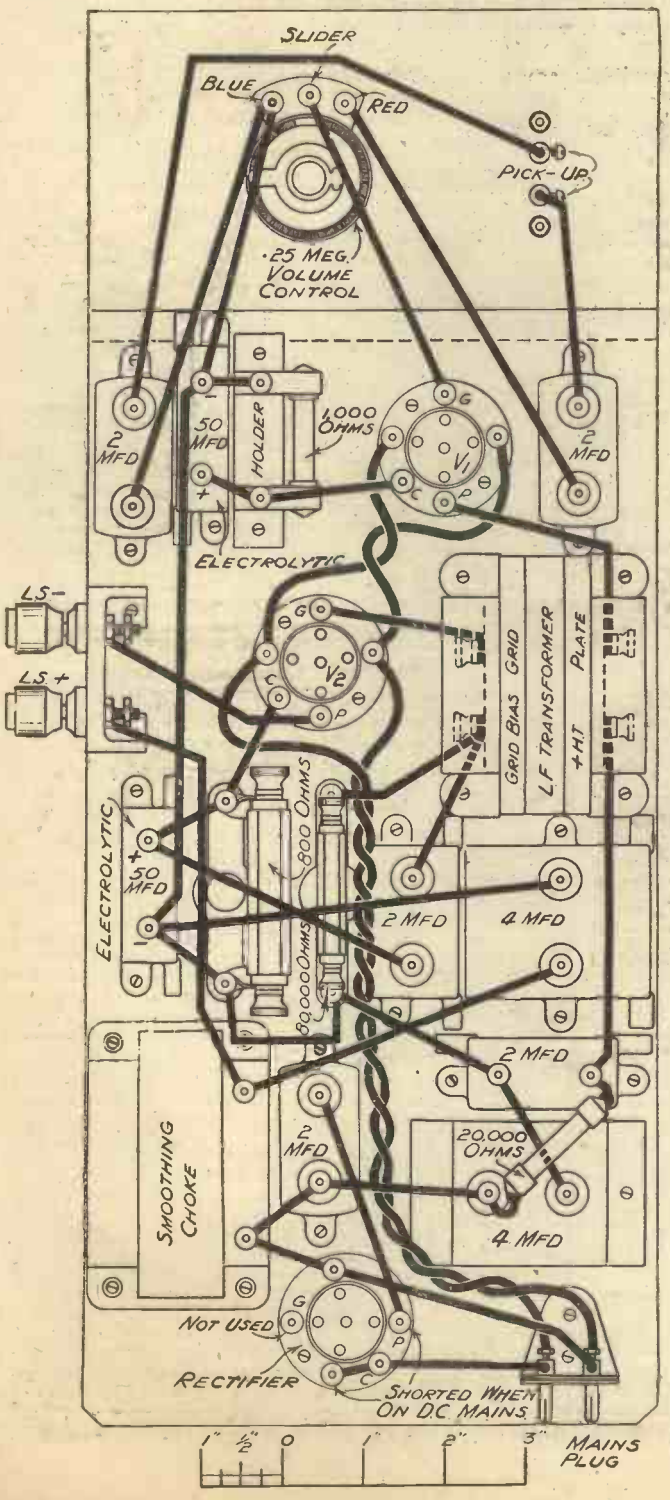
employed. The other is the use of full-voltage valves such as the Ostar-Ganz indirectly-heated types, which are suitable for either a D.C. or A.C. supply.

These valves were discussed in an article that appeared recently, and here we place before readers a small but remarkably powerful "Universal Amplifier" which makes full use of the latest developments in that type of valve.

The "full-voltage" valve is designed to take across its heater the full mains voltage of the supply on which it is to be operated, in the same way as the ordinary electric light bulb is connected across the mains. Thus the valve heaters are rated according to the voltage of the mains, and you order valves for the amplifier in accordance with the mains voltage of the house.



An easily constructed and conveniently sized baffle on which are mounted the dual speakers which were used during the tests of the Universal Amplifier.



In this amplifier, for instance, there are two essential valves—V1 which is an A.520 type and the other, V2, a K.3560. They are so connected that the full mains voltage is applied to the heaters, and so, when ordering, the mains voltage has to be specified. Those photographed are 240–250-volt valves.

Someone will immediately say that there are three valves instead of two in the set. That is correct—if the set is to be used for A.C., but when employed on D.C. there is no need for the third valve, which is a rectifier, though it can be employed if desired, the D.C. being simply passed through it for the anode voltage of the set.

This rectifier (E.G.100), of course, also has to have the correct voltage heater, this voltage corresponding with the voltage of the mains on which the amplifier is to be used.

WHEN USED ON D.C.

When the amplifier is used on D.C. the rectifier valve carries out no useful purpose and can be left in or withdrawn, as desired. In the case of the latter the terminals indicated on the valve holder should be shorted.

The whole design of the "Universal Amplifier" is one that has been chosen for compactness and power. The first valve is a normal steep-slope amplifier with a mutual conductance of 2·5 ma/v., while the second is a new power-output type that has just appeared on the market. It has a very steep slope—the mutual conductance is 6 ma/v.—and it is capable of supplying an undistorted A.C. output of something like 5,000 milliwatts, with a mains-supply of 240 volts.

The Input Circuit.

The input from the pick-up is insulated in a D.C. sense from the amplifier, so that no matter whether the mains have positive or negative pole earthed there is no possibility of the pick-up leads becoming "live." From the two condensers in the input circuit the impulses from the pick-up are applied across a volume-control potentiometer, whose slider is connected to the grid of the first valve.

This valve is connected by a transformer to the output valve, normal decoupling being employed in the H.T. feed to the anode circuit of the valve. The smoothing of the set is particularly simple, consisting of one smoothing choke and a condenser in the H.T. circuit of the output valve. The resistance in the decoupling of the first valve acts as adequate smoothing in that case.

The loudspeaker is inserted directly in series with the anode circuit of the output valve, it being intended that the amplifier be situated near the loudspeaker, or else that the transformer of the speaker be attached close to the set. It is not advisable to run extension leads from the amplifier to the speaker if these are to be any great length.

For D.C. Working.

In the theoretical as in the wiring diagram, the rectifier valve which is required for A.C. working is shown completely connected. In the case of D.C. mains this valve can be omitted and the anode terminal of the valve holder connected to one of the filament terminals. This terminal must be the one that is in circuit with the negative H.T.

(Continued on page 484.)

"No Tears with a PILOT AUTHOR KIT"

S.T.500

PILOT AUTHOR KIT
EXACT TO SPECIFICATION

The Pilot Kit SERVICE was founded in 1919.

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

For detailed list of Parts SEE OUR PREVIOUS S.T.500 ANNOUNCEMENTS Oct. 21st and Oct. 28th issues, or sent upon request by return of post.

CASH — C.O.D.

£5-5-0

OR YOURS FOR 9/6

Balance in 11 monthly payments of 9/6.

KIT "A" Comprising Mr. John Scott-Taggart's Kit of FIRST SPECIFIED Components, including Telsen "Class B" output Choke, Peto-Scott Metaplex Baseboard and Ready-drilled Panel and Terminal Strip. Less Valves and Cabinet. With FULL-SIZE Blue Print and copy "Popular Wireless," Oct. 21st. Cash or C.O.D. Carriage Paid. **£5-5-0**

or 12 monthly payments of 9/6.

KIT "B" As Kit "A" but including 4 Specified Valves. Cash or C.O.D Carriage Paid. **£7-10-3**

or 12 monthly payments of 13/9.

KIT "CT" As Kit "B" but including Peto-Scott Specified Walnut Table Cabinet. Cash or C.O.D. Carriage Paid. **£8-9-9**

or 12 monthly payments of 15/6.

KIT "CC" As Kit "B" including Peto-Scott Specified Walnut Consolette Cabinet. Complete with Baffle Baseboard Assembly, but less Speaker Cash or C.O.D. Carriage Paid. **£8-18-9**

or 12 monthly payments of 16/3.

If Peto-Scott Permanent Magnet Speaker required add 15/- to Cash Price or add 1/3 to each monthly payment.

All Kit and Finished Instrument Prices exclude batteries. Recommended "S.T.500" Battery Equipment: 120-volt Drydex, Orange Triangle, Triple Capacity; 9-volt Drydex G.B. Battery and Peto-Scott 2-volt 45 amp. L.T. Glass-cell Accumulator. Cash or C.O.D. Carriage Paid, £1-11-3; or add 3/- to First and each Monthly Payment.

S.T.500 CONVERSION KITS

CONVERTS YOUR S.T.300 into the new S.T.500

Comprises: 1 Peto-Scott Baseboard; 1 Colvern S.T.500 Aerial Coil; 3 G.F. ·0005 mfd. Condensers; 1 Polar ·0003 mfd. Diff.: Condenser; 1 J.B. ·0001 preset; 1 J.B. ·00005 mfd. preset; 1 Telsen Driver Transformer; 1 Telsen Choke; 1 G. F. 7-pin Valve holder; 2 5,000 ohm 1 watt Resistances; 2 10,000 ohm 1 watt Resistances; 1 G.F. 250 ohm 1 watt Resistance; 1 Igranic 2 mfd. Condenser; 2 T.C.C. Condensers; 1 G. F. ·0005 Condenser; 1 Lissen ·00005 mfd. Condenser; 1 Bulgin S80 switch; 1 B.R.G. bracket—Wire, screws, flex etc., WITH COPY OF "POPULAR WIRELESS"—21/10/33 AND BLUE PRINT.

CASH or C.O.D. Carriage Paid. **51/-**

or 6/- Deposit and 9 monthly payments of 5/6.

H.P. TERMS: Complete Kit with Valve—12 monthly payments of 6/-.

CONVERTS YOUR S.T.400 into the new S.T.500

Comprises: 1 Peto-Scott Baseboard; 3 G. F. ·0005 mfd. Condensers; 1 J. B. ·0001 preset; 1 J. B. ·00005 preset; 1 Telsen Driver Transformer; 1 Telsen Output Choke; 1 G. F. 7-pin valve holder, 2 Dubilier 5,000 ohm 1 watt Resistances; 2 Dubilier 10,000 ohm 1 watt Resistances; 1 G. F. 250 Ohmite Resistance; 2 T.C.C. ·005 mfd. Condenser; 1 G. F. ·0005 mfd. Condenser; 1 Lissen ·00005 mfd. Condenser; 1 T.C.C 1 mfd. Condenser; 1 B.R.G Bracket; Wire, screws, flex, etc., WITH COPY OF "POPULAR WIRELESS," 21/10/33, AND BLUE PRINT or 5/- Deposit and 8 monthly payments of 5/3.

CASH or C.O.D. Carriage Paid **42/-**

H.P. TERMS: Complete Kit with Valve—12 monthly payments of 5/3.

S.T.500 STRUCTAKIT

CASH or C.O.D. Post Free. **7/6**

Comprising Peto-Scott Baseboard with Metablexed Section; Ready Drilled Panel and Terminal Strip; "S.T.500" Screen; B.R.G. Mounting Bracket with Free copy of "Popular Wireless."

IMPORTANT *Parts, Kits, Miscellaneous Components, 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 all Post Charges Paid.*

PETO-SCOTT S.T.500 CABINETS

EXCLUSIVELY SPECIFIED BY MR. JOHN SCOTT-TAGGART

Consolette Model. An outstanding example of cabinet craftsmanship. Hand French polished. Veneered Macassar and Walnut finish by experts.

Cash or C.O.D., 25/-. Carr. & Packing 2/6 extra, or 6/- Deposit and 4 monthly payments of 6/- (including carriage and packing). Baffle-Baseboard Assembly, 3/6 extra.

25/-

Regd. Design No. 787,010

Regd. Design No. 78,011.

19/6

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.)

Send to-day for copy of 1934 Cabinet Catalogue.

FINISHED INSTRUMENTS

"S.T.500," complete in Peto-Scott Walnut Table Cabinet, exact to Mr. John Scott-Taggart's FIRST Specification. Aerial Tested. Complete with Valves. Cash or C.O.D. Carriage Paid. **£10-0-0**

or 12 monthly payments of 18/3.

"S.T.500," complete in Peto-Scott Walnut Consolette Cabinet, exact to specification. With Peto-Scott Moving-Coil Speaker. Complete with Valves. Ready to Play. Aerial Tested. Cash or C.O.D. Carriage Paid. **£11-5-0**

or 12 monthly payments of 21/-.

PETO-SCOTT CO. LTD. 77 CITY ROAD, LONDON, E.C.1. Telephone: Clerkenwell 9406/7.
West End Showrooms: 62 High Holborn W.C.1. Tel: Holborn 3248.

Dear Sirs,—Please send S.T.500 KIT "A" S.T.500 KIT "CT"
me CASH/C.O.D./H.P.: S.T.500 KIT "B" S.T.500 KIT "CC" with/without SPEAKER.

for which I enclose £.....s.....d. CASH/H.P. Deposit.

NAME.....

ADDRESS.....P.W. 11/11/33

ANY ITEM SUPPLIED SEPARATELY—ORDERS OVER 10/- SENT C.O.D. CARRIAGE AND POST CHARGES PAID

A NEW UTILITY DRIVE

IT has occurred to me—I claim no novelty for the thought, though I haven't yet seen it expressed elsewhere in print—that there is this danger in supplying condenser scales marked in wavelengths even as alternatives to degree marking: supposing the wrong condenser and the wrong coil are used?

You know, both have got to be exactly right or the wavelength marking will be erroneous. Of course, literature supplied with the slow-motion drive or condenser might, and generally does, cover the point adequately. But leaflets and "books of words" are apt to go astray or to be overlooked, and there must be many constructors who would not realise the essential fixed-capacity-inductance implication of wavelength scaling.

In view of this, Messrs. Wilkins & Wright deserve very special mention for the step they have taken with their new Utility slow-motion drive. The wavelength scale of the one I have has plainly engraved on it "For ·0005-mfd. 'Utility' Mite Gang Condenser with 157 M.H. and 1900 M.H. Coils."

This inscription is hidden when the component is mounted on a panel, but it must be seen in the first place, and it is definite. No mistakes can occur.

The device has other claims to attention, perhaps even more important. For example, it has a full-vision scale with a pointer which, by an ingenious but simple mechanical movement, keeps vertical as it moves along.

You will note from the photo how the marking is arranged in accordance with this system. Also the light moves along behind the translucent scale with the adjustments.

The gearing is just right, and the action of this Utility slow-motion drive is very sweet, there being nothing the most carping critic could point at.

THE ROBERTS MICROPHONE

When one has experienced the difficulties of interpreting human speech with one's head poked out into a 100-m.p.h gale, and the quality of those speech sounds initially depend upon a microphone, one's criticism of microphones tends to become acute!

Like mine did when, into the bargain, it was my duty to see that those microphones for Air Force work were as good as the state of the art then permitted!

Since then, however, there has been considerable progress. But not quite as much with small and inexpensive microphones for amateur use as might reasonably have been anticipated.

Nevertheless, there is at least one that reaches the standard of the times as typified by the larger (and more costly) varieties. I refer to a new type of microphone made by Captain A. J. Roberts, of 89, Wardour Street, London.

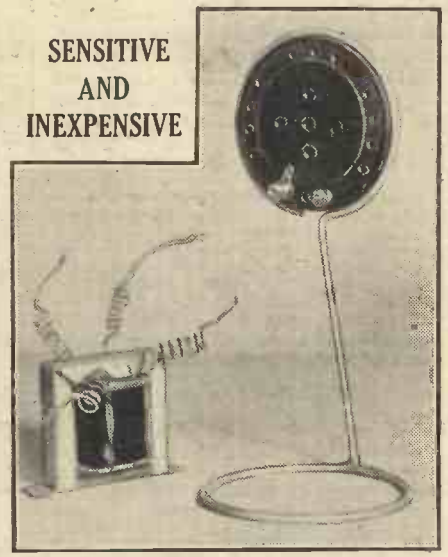
He makes it in three models, and there is one for recording and calibration, as well as the model for amateur work.

A non-directional principle is employed in this new microphone. Instead of the usual solid back, there are two diaphragms, both exposed to sound waves, operating on the carbon granules.

Besides the microphone proving practically non-directional, it is claimed that the response to higher frequencies is increased for the following interesting reason:

"The wavelength of a high-frequency note is only a matter of one or two centimetres. If this note strikes the diaphragm of an ordinary mike at right angles it responds to the varying pressure of the note and is immaterial to the wavelength. If, however, the wave hits the diaphragm from an angle, then clearly we get alternate layers of compression and rarefaction along the surface. With the result that there is a tendency of one wave of compression to be cancelled out by a wave of rarefaction. With the Roberts microphone, however, the note hits two diaphragms, one a definite time after the other. Thus when a wave of compression is reaching one diaphragm the preceding wave of compression is reaching the second diaphragm. This is evident for all directions through which the microphone is tilted"

Well, I have tested the Roberts microphone (amateur model), and I find it very sensitive; its response certainly does justify the claims made for it, especially when its performance is compared with those of similarly compact types.



The Roberts microphone is a particularly compact instrument and is designed to be non-directional.

The new Dubilier non-inductive condensers have a "screw-on" mount, a feature which results in a neat and very secure fixing.

THE LATEST DUBILIER CONDENSERS

Ever been faced by the problem of mounting and connecting one of those tagless, feetless, terminal-less, tubular metal condensers? Such things aren't really intended for home constructors, but for metal chassis commercial sets, though they now and then come the way of the constructor.

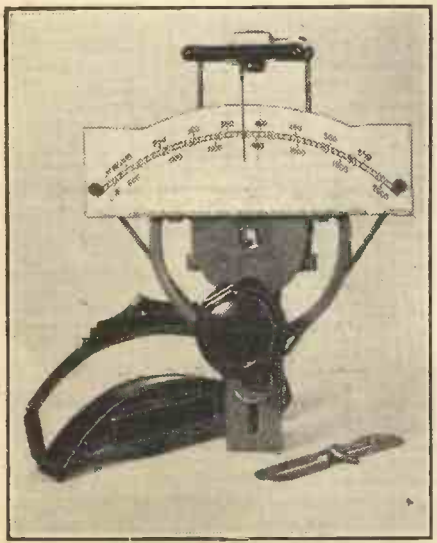
And I can sympathise with his attempts to deal satisfactorily with them!

The new Dubilier non-inductive fixed condensers have a tubular, metal-case construction, but what a different proposition!

To start with, there are stout, easy-to-use terminals inclined outwards slightly at the top. (An excellent idea that.) And then there is a patent screw-bottom fixing scheme.

A false bottom screws off and this has two holes in it for screwing to a baseboard or chassis. The condenser itself merely screws into this holder, and a very secure fixing, with no visible screw-heads, results.

As for the condenser itself . . . . True, I tested a few as a matter of form; but it was hardly necessary, for the name of Dubilier is as synonymous with first-rate condensers as Paris is with good eating.



Several outstanding features of design are incorporated in this Utility drive, which is calibrated in wavelengths.

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes and on microphone personalities of the moment.

Two new variety artistes whom I look forward to hearing again are Gretl Vernon and Donald Peers, alias The Viennese Nightingale and The Laughing Cavalier of Song. I don't question their right to these aliases; they fit them to a T. I like these artistes because they are 100 per cent singers.

* * *

A man who seems to have captured the hearts of the more studious section of the listening public is Herr Max Kroemer. He fairly makes you learn German. And no one will be more pleased with him than Messrs. Sack and Thompson, whose text-book he uses. They must be reaping a rich harvest.

* * *

I hope this enthusiasm for Herr Kroemer won't cause students of the German language to forget Herr Kroemer's predecessor, Otto Siepmann. I think it is true to say that Herr Siepmann is more responsible than any man, alive or dead, for the amount of German spoken or understood by Englishmen to-day.

* * *

Have you noticed the extraordinary appropriateness of some of the evening poetry readings of late? Appropriate in the sense that they have had a theme in common with that of the item that has preceded them. "Tewkesbury Road," by John Masefield, was very apt, following, as it did, Howard Marshall's denunciation of some of our by-pass roads.

* * *

That excellent ventriloquist, Johnson Clark, has not improved his act by introducing a grandfather into it. The addition may give further proof of Johnson Clark's ability but sentimentality of the "Dear Old Dutch" type is a poor substitute for the scintillating repartee of that young and egregious Hodge, who retires—for all too long a period—into the background while "grandpa" recites his woes.

* * *

How very interesting those "What's the News" talks to the schools are! I listened to Joan Woollcombe the other afternoon talking about the "Autumn Herring Harvest," and a very live and colourful talk it was too. If I may say so, I think Miss Woollcombe is wrong to avoid using technical jargon, for, without it, the talk loses a lot of its appeal.

Use all the technical terms, but explain them, is my motto. Children love to ape the expert when they tell their stories, and the story of the Yarmouth fishermen is likely to be retold over and over again this winter.

* * *

An interesting thought struck me the other afternoon as I was listening to Professor Lloyd James trying to get boys and girls up and down the country to say, "He had a black cat in a handbag," as it should be said. And it was this: Here we have a man using the microphone for a comparatively short time each week begging, imploring, almost shaming children into saying "handbag" as he says it.

* * *

Yet through that same microphone, numerous other people shout "handbag" at them in 101 different ways. Professor Lloyd James can never hope to overcome opposition as formidable as this.

(*Continued on page* 480.)

The name Drydex is an assurance of generous power and a long life. It is the battery relied on by Britain's most famous sets.

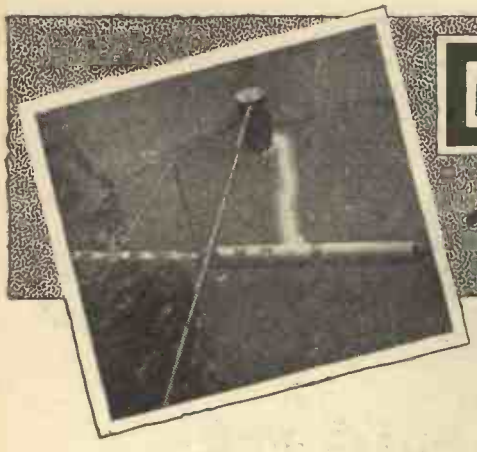
Drydex

by Exide DRY BATTERIES FOR WIRELESS

NOV. 11
REMEMBRANCE DAY
PLEASE GIVE A LITTLE MORE FOR YOUR POPPY

Next time, insist on Drydex. *Obtainable from Exide Service Stations and all reputable dealers in types and sizes for every set.*

EXIDE BATTERIES,
Exide Works, Clifton Junction, near Manchester.



DEATH BLOW to the ATOM

The annual meetings of the British Association, at which leading scientists tell each other and the world about their discoveries, invariably make important references to matters affecting radio progress. This year's Leicester gathering has proved no exception to the rule.

By LESLIE BAILEY

EACH year our most famous scientists meet together and tell each other, and incidentally the world, of their latest discoveries in the realm of science.

Wireless, like all the other famous offsprings of science, was first introduced to the world at such a meeting of the British Association more than three decades ago, and at almost every annual meeting since that time something of interest to wireless engineers has been discussed at the annual conferences.

This Year's Meeting.

A review of the meeting this year at Leicester does not seem to indicate that anything of very great importance has been discovered in the last year, at least in connection with wireless, but then, of course, one never knows. Indeed, brief and more or less incomprehensible statements that Beryllium of a certain mass, when bombarded in a certain way, emits a neutron may lead to some quite new development in the field of practical wireless.

Perhaps one of the most interesting discussions, from our point of view, was delivered by Lord Rutherford on splitting the atom—officially it was known as atomic transmutation in Section A, Mathematics and Physics.

Alas for those of us who hoped for or believed in the vast resources and terrific energy which might some day be obtained from splitting the atom! In his opinion, "such expectations are the merest moonshine."

Must, then, all those hopes of driving Atlantic liners across the Atlantic on the atomic energy in a pinch of salt or in a drop of oil be relegated to the limbo of lost hopes (scientific)? It would seem so, for the atom has been split and we have found no colossal power, nor has the world exploded in a wrack of helium gas, as one famous scientist who was at this meeting forecast twenty years ago.

Atomic Transmutation.

But, if we have found no tremendous source of energy, the results of the atomic transmutation, as it is called, may give the world even more tremendous inventions and discoveries. We are certainly nearer the time when base metals may be transmuted into gold, but when this can be accomplished comparatively easily gold will itself become a base metal—so that's that.

But we can say with comparative safety that this research into the atom will improve our wireless components and all things electrical. It is a queer thing that some rather dry statement, uttered more or less indifferently by one of the learned professors at these meetings, may lead some day to a tremendous business enterprise involving several millions of pounds of money and the welfare of thousands of men and women.

Perhaps the most interesting item in connection with radio was the demonstration of television along a light beam. The ray or the beam of light was used as the link between the television transmitter and receiver, just as wireless waves or a wireless beam is the link between the wireless transmitter and receiver.

Ordinary telegraphy or telephony has, of course, long been possible by means of light rays; but the use of light rays in this direction is naturally limited to a small distance, and light rays, unlike their wireless fellows, cannot penetrate a brick wall or curve round the surface of the earth.

Although one never knows, light-ray television such as this is unlikely to affect wireless television to a very great extent, and probably its development will lie in the field of the kinematograph.

The opening address by Sir Josiah Stamp, although not connected with wireless in a technical sense, yet involved radio as one of the scientific developments of the age which is rapidly altering the face of the present civilisation. He was concerned with the effect of such developments on the human race: was it harmful or otherwise, progressive or retrogressive? He quoted a very apt example in the case of an imagined world where a million people were employed making boots.

Maintaining a Balance.

Should an invention be produced which would enable the same quantity of boots to be made by half the number of people, for instance, then the other half-million people would be thrown out of work. But if new inventions for the pleasure and recreation of mankind were produced, such as gramophones, wireless, the car and aeroplane, or improvements such as that in the case of the push-bike, then those half-million out-of-works would, in the course of time, be employed.

The problem would seem to be to transfer the workers from a dying invention to a newly born product of science.

Here, at any rate, we of the wireless fraternity can claim to have done our share, for the wireless industry, in one form or another, provides bread-and-butter for hundreds of thousands of men and women.

WILL ATOMIC ENERGY EVER REPLACE MARINE ENGINES?

"Must, then, all those hopes of driving Atlantic liners across the Atlantic on the atomic energy in a pinch of salt or in a drop of oil be relegated to the limbo of lost hopes?"

ABOUT THE VALVONIUM

A reader's novel suggestion for increasing its usefulness.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having constructed the "P.W." "Valvonium" in a hook-up form, I thought perhaps other "P.W." readers may be interested to know how it may be used technically as well as for entertainment purposes. If a condenser of a known fixed value is connected in grid circuit where the semi-variable condensers are wired and the tuning note noted, a relative idea may be formed of a condenser whose capacity is not known or as to whether there is any variance of two condensers of supposedly the same capacity. If the musical note heard is of higher key the condenser is less, and if a lower key the capacity is bigger. Also certain resistances may be tested in this manner: that is, larger resistances give lower notes and low resistances higher notes.

Yours faithfully,

H. BRACEGIRDLE.

20, Maple Avenue, Haydock, near St. Helens, Lancs.

TELSEN

'S.T. 500' COILS

for Mr. John Scott-Taggart's

P.W. 'S.T. 500'

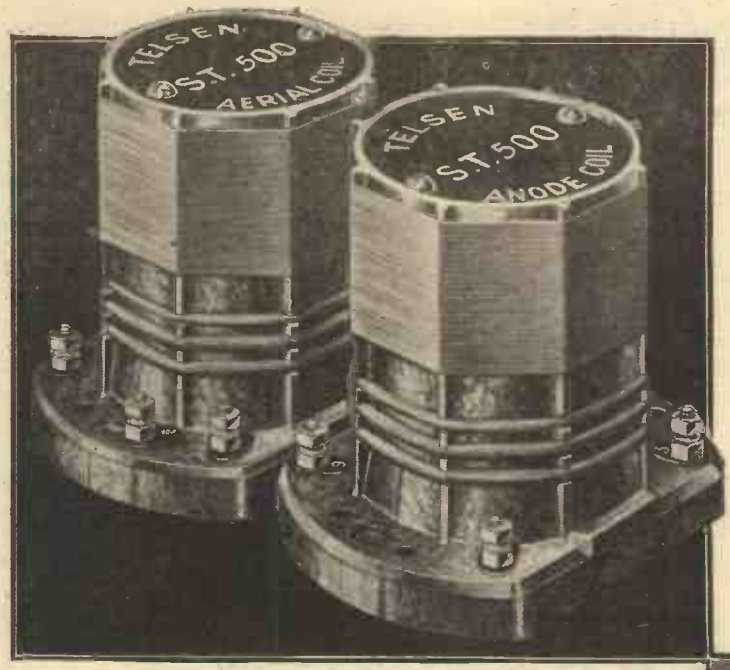


Illustration below shows the position occupied by the Telsen 'S.T. 500' Coils in a built-up 'S.T. 500' Receiver.

RECOMMENDED for use in the S.T. 500 by Mr. John Scott-Taggart, the Telsen S.T. 500 Coils have been specially designed for their purpose, to ensure immaculate performance with enduring efficiency. The Aerial Coil consists of plain long and medium wave windings connected in series, with a separate reaction winding, the Anode Coil having a larger reaction winding connected to the earth end of the main winding. The Anode Coil is supplied complete with two brackets and the necessary screws for mounting.

Price per pair **8/-**

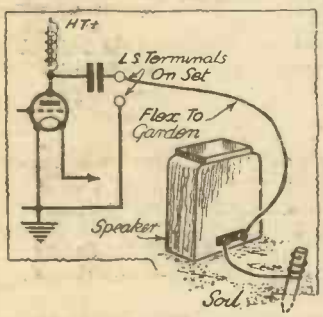
TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

RECOMMENDED WRINKLES

RADIO ON THE LAWN.

WHEN next year's warm weather comes many will wish to take the speaker out of doors while having tea on the lawn, etc. If choke-filter output is used in the set only one connecting wire will be required to the speaker, and a length of single flex will be most suitable. The other



A simple method of using a loud-speaker out of doors.

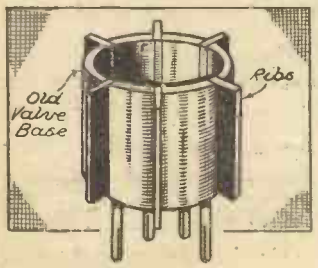
terminal of the speaker should be connected by a short length of flex to an earth spike (any piece of metal rod or tube will do). By pushing the rod farther into the ground or partly withdrawing it, a very useful control of volume may sometimes be obtained.

VALVE-BASE COILS.

VALVE-BASE coils have been used for some considerable time by those interested in short waves, owing to their small field and the fact that they occupy very little space.

With the idea of improving the efficiency of these coils I have fixed ribs to the valve base. This may be done by cutting slots as shown in the sketch, two being cut at a time by running a saw right across.

Thin strips of ebonite or other efficient insulating material are cut for the ribs, inserted in the slots and then glued. The ribs may be fixed to the sides of the base by gluing only, but I have found the slot method to give a more rigid arrangement.



Made from the bases of burnt-out valves.

If the turns of wire are slightly spaced it is advisable to cut small notches in the ribs with a file, to prevent the turns from slipping.

LOOSE CONNECTIONS.

AFTER your set has been in use for some time it may commence to give trouble. It may fade out and then come in again as suddenly as it went out. A continual frying in the loud-speaker may cause you some alarm. The set may stop suddenly and mysteriously.

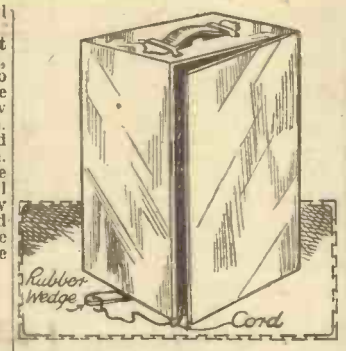
These things may happen to a set in which the connections are soldered, or it may happen to a set which has no soldered parts in it. Sometimes if the set is tapped it will function properly for a time, but later will go silent again.

A connection becoming unsoldered will cause any of the above to happen. A connection which has become loose in the case of the unsoldered set will cause the same results. If every connection is gone over carefully and any loose ones tightened the trouble will stop. So in future watch for the loose connection.

AN IMPROVISED L.S. TRANSFORMER.

IN these days of good, inexpensive moving-coil loudspeakers there are numerous old moving-coil speakers on the market. These can be picked up quite cheaply, often under 10s., but it is generally found that they are minus a transformer.

A very good substitute for an orthodox transformer is an ordinary A.C. bell transformer. On these the secondary is generally centre-tapped, and, consequently, if the primary is



The wedge serves to lock the turn-table in the desired position.

apparent fading or for apparent cutting-in.

It is best, then, to keep a portable receiver quite stable, once tuned, by means of a rubber wedge slipped underneath. The wedge can be tied to a cord and tucked inside the cabinet when not required.

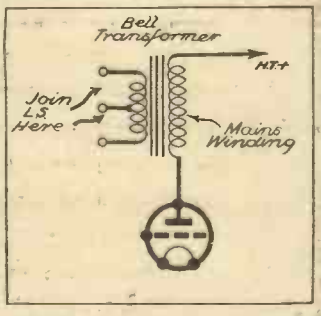
ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear?

The best Wrinkle last week was sent by Mr. W. H. Grayling, 8, Milton Road, Cambridge, to whom a guinea is being awarded.



A bell transformer does the trick.

inserted in the anode output circuit two step-down ratios are obtained, usually about 1 : 15 and 1 : 20.

These ratios are about right for the majority of loudspeakers, and in practice a transformer used in this manner gives very good results.

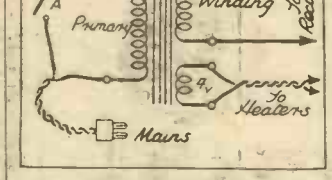
TUNING PORTABLES.

SOME portable receivers swivel on a self-contained turntable, and unless they stand on a level surface they tend to swing out of position after tuning.

This is annoying enough when one is aware of the displacement—for with difficult stations the direction of a frame aerial can be very critical—but it is far worse when the receiver detunes itself, while the listener, all unsuspecting, blames the ether for

SWITCHING A MAINS SET.

IT is well known that a mains unit delivers a very high voltage while the indirectly heated valves are warming up to their task; this is especially so when a metal rectifier is used. It imposes a heavy strain on condensers, valves, etc., and many constructors employ a thermal-delay switch to avoid it.



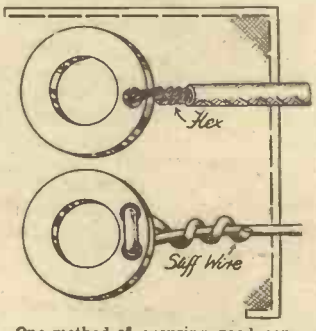
The additional switch allows the H.T. to be applied after the valves have had time to warm up.

Those who cannot afford such a switch, however, can use two ordinary switches, as shown in the diagram, to serve just the same purpose. "A" should be switched on first, followed by "B" when the valves have warmed up; about twenty seconds later, as a rule.

This device is well worth using, as it may save much trouble and expense in the form of broken-down decoupling condensers, blown fuses, etc.

A SUBSTITUTE FOR TAGS.

WHEN the supply of tags runs out an ordinary washer can be soldered on to the end of either stiff or flexible wire in a simple manner. A small hole is drilled in the washer, the



One method of ensuring good connections.

end of the wire is threaded through it and a spot of solder makes it firm enough for the job.

TIN YOUR SCREWS.

YOU can make your set smart by using pure tin to coat all your brass parts. Melt some pure tin in a spoon and drop it into a pail of cold water to granulate it. Put the tin in a coffee-tin with the brass parts, and cover them well with some cream of tartar.

The screws should be burnished or highly polished first. Fill three parts full with water and boil for half an hour. Take the parts out rinse; in cold water. Polish lightly with a soft rag.

This is the closest to a silver deposit that can be obtained, and the parts being well burnished beforehand helps in the process. The parts can be lacquered, but if cleaned well will last for a good time without.

NO-TROUBLE CONNECTIONS.

HERE is a very simple scheme which will prove useful to many constructors. In very many circuits it is found that at least three leads have to be connected to the L.T. on-off switch, and if the connecting wire used is rather thick there is some trouble in connecting them all to the one terminal.

A strap connection saves overloading the terminals.

An easy way of overcoming this is by purchasing a three-point on-off switch (or perhaps the constructor may have one on hand), and by connecting two of the three terminals together by means of a short, thin strip of brass. This is drilled at either end, then it is clamped between the terminals. Now you will find that as many as half a dozen leads can be connected to the switch, as there are two terminals for the one point on the switch.

ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

(*Continued from page* 445.)

The Autumn Crop.

THE end of the tennis and sunbathing season marks the beginning of my autumn crop of letters. Already the pile has engulfed my spare baccy pouch, Old Moore's Almanac and my pet pair of scissors.

Now the crank lifts his pen to bore me with his sad stories, but these are leavened by many a thoughtful and helpful letter from some unknown chum who has been digesting these Notes during the greatest summer of all summers.

Believe me, almost all that a journalist lives for is a "scoop" or a decent letter from someone who has read his "stuff" and liked it well enough to blue one of the P.M.G.'s best three-ha-penny's to say so.

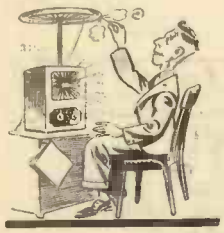
Humble Suggestion.

THIS country has many young men and women who are unemployed. This British Empire has many thousands of square miles yelling for development. Could not the B.B.C. organise a series of talks showing how our young people could develop this Empire?

We have an embarrassing proportion of the earth's surface under our control, and it ought to provide work for more people than are out of work to-day in the United Kingdom. Why should not the Government and the B.B.C. conspire together to attract our men and women into the Empire's great open spaces?

The "Push-Bike" Three.

KNOWING of my interest in the man with the bedstead aerial, A. H. T. (Acton) has told me about his experiment with a bicycle wheel attached to the aerial terminal of his set. The volume was improved and the selectivity "much improved," especially on short waves.



When he deflated the tyre the results with 2XAD were astounding. He wonders whether the deflation allowed "the waves to get to the spokes more freely." Nothing to do with the air in the tyre, of course. Speaking frankly, I cannot explain it; indeed, I can hardly believe it—unless his usual aerial is very inefficient. Any theories?

Is the B.B.C. Subsidised?

E. H. (Whitefield, Lancs.) very mildly queries my accuracy in referring to the B.B.C. as "Government subsidised." Under its Charter the B.B.C. is authorised and empowered "to receive all funds which may be granted annually or otherwise by the Legislature in furtherance of the purposes of this Our Charter."

Actually, the B.B.C. is granted only a certain portion of the fees collected by the Post Office in respect of the P.M.G.'s licences for the establishment and working of wireless stations for reception in this country. These fees are levied by the Post Office, not by the B.B.C., and were so levied before broadcasting was thought of.

The Edinburgh Radio Show.

THE Radio and Music Exhibition held at Edinburgh during October 11th–21st was a marked success. It was the first combined Radio and Music Exhibition ever held, and was patronised by the Scottish Radio Retailers' Association, the Scottish Music Merchants' Association and the W.R.A. of Great Britain and Northern Ireland.

The Lord Provost, Magistrates and Council of Edinburgh gave a civic reception to the exhibitors, and arranged for the floodlighting of the famous old castle. Scots all over the world (or wurruld) will read this with interest and a pang of regret for the awfu' waste of electric light on a castle which doesn't earn its "overheads."

Caught in the Net.

WHILST looking through a host of overseas radio journals I was charmed to see that of seventeen stands at Radiolympia described by the "Bombay Radio News" that of the Amalgamated Press was one, and though we were referred to as "the Press of the Amalgamated magazines" my pleasure and gratitude was no whit diminished.

And in the "Ceylon Radio Times" I discovered two proofs of originality on the part of the broadcasting authority in Ceylon, which happens to be the Post and Telegraph Department. Firstly, a talk by a twelve-year-old native boy; secondly, a talk by the German Consul, entitled "Hitlerism as an Historical Phenomenon."

Broadcasting on Wheels.

IT was only a few days ago, when a copy of "Tune In," a little monthly DX radio magazine issued by the New Zealand DX Radio Association, came into my hands, that I learned that in Australia there is a broadcasting station, 3YB, which moves about on the railway.

Its first tour, unique in the history of radio, was made in October, 1932, the coach used being that which had been built about 30 years before for the King and Queen when as Duke and Duchess of York they visited the country. This station transmits each week-night from 6.30 p.m. to 10.30 p.m. on 1,060 kc., and is a great favourite with bush dwellers and sheep farmers.

SHORT WAVES

One man is said to have written over five hundred letters to the B.B.C. His wireless licence should be endorsed for exceeding the screed limit.—"Humorist."

* * *

"I cannot get a proper earth lead for my crystal set. May I use a jam jar filled with soil near the set?" asks a young Londoner in the "Daily Sketch."

* * *

Why did the valve howl?
Because the electron passed round the plate and found it 2MT.

* * *

Radio-frequency, writes one of our contemporaries, is a term applied to the appalling number of times a broadcasting station can put over a dud number.

* * *

It has been suggested that the well-known B.B.C. conductor who was recently fined for exceeding the speed limit was beating time as usual.

* * *

ROMEO ON THE WIRE.

The tendrils of my soul are twined
With thine, though many a mile apart;
And there in close-coiled circuits wind
Around the magnets of my heart.

O tell me when along the line
From my full heart the message flows,
What currents are indeed in thine?
One click from thee will end my woes.

Sets in Glass Cases.

AFTER much thought I have failed to appreciate what attraction is presumed to reside in a receiver built into a transparent container. I wish that someone would enlighten me. There are no moving parts except rheostats and condenser vanes, and inspection of those terrific engines does not amuse or enlighten.

No one wants a glass-enclosed gramophone or telephone. So why make transparent cases for radio sets? Perhaps there may be some Yoga-like virtue in staring fixedly at a transformer, but even much staring will not reveal its ratio or whether it is burnt out.

Reply to a Postcard.

L. B. (Halifax), in a p.c. in which he addresses me variously as "Areil" and "Dear Earth," appears to be suffering from a sense of wrong because I mentioned the lovely lady who accompanied her portable on a banjo. Now, why should I not—as unofficial observer of radio in all its branches and all its effects upon people?

The anecdote proves that radio can produce a state of detachment in the female of the species which allows the subject to experience pleasure apart from observing the costumes of other lady persons. A striking piece of research, I call it.

My dear L. B., do, please, unbend slightly whilst reading my columns; there are small beer and skittles, as well as profound technicalities, in the world of radio!

ARIEL.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos

Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so

QUESTIONS AND ANSWERS

A "BURN-OUT" WITH THE H.T. DISCONNECTED.

L. J. F. (Newbury, Berks).—"Two beautiful valves gone west! That's my trouble. And the makers say they have lost emission ('burnt out'), although *there was no high tension connected to the set at the time.*

"The set is a plain detector pentode, working fine at the moment, with its two new valves. I had only had the old valves about four months, and I still can't see why they went, although I have found one thing out-of-the-ordinary about the set. That is that the metallised coating of the detector is connected to L.T.+ instead of to L.T.—, which is usual, I understand.

"All I did to the set when the valves were ruined was this: First, to pull out the H.T. negative plug (I am absolutely certain I did this first, as recommended so often by 'P.W.'). Next, to pull out the grid leak from its clip and squeeze this latter up a bit with my fingers, as it did not seem to be gripping very tightly.

"Finally, I took off the lead from G.B.— (18-volt battery) to grid leak and replaced it by a new one. When all was O.K. I switched on L.T., connected up the H.T.—, and found the set as dead as a coffin-nail. How did those valves go when the H.T. was off?"

We are afraid that the answer is "grid-bias battery"—a culprit very easy to overlook!

When you switched off the L.T. and the H.T. you still had G.B.+ connected to L.T. negative filaments, hadn't you? So if through some mischance the G.B.— end of the battery connects up with the positive filament leads you would have the full G.B. voltage across the filaments.

No doubt what happened was that you just touched that negative G.B. connection on the positive filament line somewhere, probably on the detector valve itself. If its metal coating was connected to L.T.+ it gave a direct metallic connection to the positive end of the filaments.

As the G.B. battery already had its opposite end connected to the opposite end of the filaments, the full voltage would be impressed across them.

(Incidentally, it was a pity that L.T. was off, because then the *only* path for a current was through the filaments themselves, whereas had the L.T. been on there would have been a parallel path of low resistance through the L.T. battery itself.)

"This Year's Economy Three."

J. L. R. (Berkhampstead, Herts).—"I want to make up 'This Year's Economy Three' published in 'P.W.' dated June 24th, 1933, but using a Colvern T.D. coil for aerial and a Goltone G.G.R. coil in the anode circuit.

"What are the connections when these coils are used instead of those shown in the diagram?"

(Continued on next page.)

"P.W." PANELS, No. 143.—RADIO PARIS.

Originally known as "Radiola," the Radio Paris station is one of the oldest and best of Europe's long-wavers. It works on a wavelength of 1725 metres.

The original station at Clichy was recently superseded by a 75-kw. transmitter at St. Rémy l'Honoré. Its power can be increased if necessary, and probably will be raised again under the Ferrie Plan. (This is the name given to the French "Regional" Scheme.

The abbreviated call commonly used is "Ici Radio Paris." Closing tune, a few preliminary bars of "La Marseillaise."

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

When the Colvern T.D. coil is used in place of the aerial coil shown, it will be necessary to use a three-point wavechange switch, in place of the two-point switch originally specified.

The three-point switch terminals should be respectively connected to terminals numbered 3, 7, and 8 of the T.D. coil.

The lead shown connected to terminal 4 of the Lissen coil in the original diagram should be connected to either 1, 2, 4 or 5 of the T.D. coil. These four terminals give varying degrees of selectivity and the most suitable for your own requirements should be found by trial.

The leads shown connected to 1 of Lissen coil should be connected to 6 of the T.D. coil. The lead shown connected to 2 of the Lissen coil should be taken instead to 3 of the T.D. coil.

This completes the aerial coil alterations. As regards the G.G.R. (Goltone), which is to be used in the anode circuit, the connections are the same as for the Lissen coil shown in the diagram, except that some of the terminal numbers are different. The numbers correspond as follows:

Diagram (Lissen) terminal	1	is equivalent to	G.G.R.	1
,,	,,	,,	2	,,	,,	2
,,	,,	,,	3	,,	,,	5
,,	,,	,,	4	,,	,,	6
,,	,,	,,	5	,,	,,	4
,,	,,	,,	6	,,	,,	3

MEASURING THE CAPACITY OF AN AERIAL.

"CAPACITY" (Wembley, Middx.).—"Is there any easy way in which the capacity of an aerial can be measured?

"Through the kindness of an acquaintance, I have the opportunity of borrowing an accurate wavemeter, and should like to measure my aerial's capacity with it, but do not know the method. I am told it can be done with the wavemeter in conjunction with ordinary wireless apparatus, and if this is so, I should greatly appreciate details."

Besides the wavemeter you really need a calibrated variable condenser; but if you have a good one of the straight-line-capacity type this will do, because the method depends upon the amount of capacity required to bring a coil into tune, and this amount is very easily calculated from a straight-line-capacity condenser.

The actual experimental work is very easy. All that is needed is the following:

Connect the aerial to one end of an ordinary tuning coil, and its other end to the earth lead. This coil should also be connected across a simple detector valve with a milliammeter in its plate circuit to act as resonance indicator. Now place the wavemeter at a little distance from the aerial coil, and adjust it slowly until the indicating millianmeter kicks violently, indicating that the instrument is now in tune with the aerial-coil-earth circuit.

DO YOU KNOW—

the Answers to the following Questions?

There is no "catch" in them; they are just interesting points that crop up in discussions on radio topics. If you like to try to answer them, you can compare your own solutions with those that appear on a following page of this number of "P.W."

(1). Which long-wave station often announces itself as "Polski Raadjo"?

* * *

(2). If the two halves of a band-pass tuner are coupled by a condenser common to both the circuits, would the coupling be stronger or weaker if the capacity of the condenser were increased?

* * *

(3). How does the American announcer pronounce the letters of the call sign of the Boundbrook Station, W J Z?

Leave the wavemeter at this adjustment, and take the aerial and earth leads off the coil, replacing them by leads from the respective sides of the straight-line-capacity condenser.

Adjust this condenser until the milliammeter again indicates resonance. The capacity of the condenser is then replacing that of the detached aerial-earth, and the value of the added capacity is, therefore, equal to that which it is desired to know.

With a calibrated condenser, the capacity can be read straight off. With a straight-line-capacity condenser it will be approximately equal to the proportion of the total capacity—i.e. if half of the condenser is being used the capacity will be half the total, which in the case of a ·0005-mfd. condenser would be ·00025 mfd.

Similarly, if the dial showed one-fifth of the total the capacity would be one-fifth of ·0005 mfd., viz. ·0001 mfd.

TROUBLE WITH A TRIMMING CONDENSER.

"W.Y." (Harlesden).—"In the hope that I can save some other 'P.W.' readers from tearing out handfuls of hair, I should like to tell you of my spot of bother," says W. Y., of Harlesden, N.W. And the following extract from his letter shows with admirable clearness what a lot of trouble a little thing can cause.

"When the set was first switched on it didn't seem too bad, the London Regional coming through at fairly good volume, with dance music. But when I tried to tune in other stations I began to dance myself, with rage! It was terrible.

"The tuning was as flat as overnight beer, and apart from the London stations nothing seemed to have any power behind it at all.

"The longer I listened the more evident it became that something really serious was wrong, in spite of my care in wiring and checking.

"To cut a long story short, I went over *everything* again. And after a solid hour and a half I had to confess that everything was in order, except the results. And they were putrid.

"What would have happened in the end I don't know, for I was getting desperate. But in lifting the set bad-temperedly by the ganged control I was rewarded by a sudden liveliness, which lasted just long enough to convince me that I was on the track of the fault at last. And *then* I couldn't find it for another half hour.

"Perhaps you can guess what had happened? The insulation between the H.F. trimmer plates wasn't insulating, and the

(Continued on next page.)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

two sides were touching one another. When I opened them out that set opened out like a volcano!

"I suppose the high-frequency stage was not working at all when the trimmer plates were touching, and I wonder now how it gave as much power as it did. Directly I opened up volume was enormous, selectivity perfect, and everything in the garden lovely.

"What made it so hard to find was the fact that I could *see* the mica insulation between the trimmer faces, but, of course, I could not see that it was not completely separating them. So, if any other of your readers get similar disappointment from an S.G. stage of a ganged set, tell them that even if there is mica in the trimmer, it doesn't always mean that the moving plate is separated, as it should be."

IS YOUR SET BEHAVING ITSELF?

Perhaps your switching doesn't work properly? Or some mysterious noise has appeared and is spoiling your radio reception? Or one of the batteries seems to run down much faster than formerly?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers its unrivalled service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an Application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form, you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS, PLEASE NOTE: Inquiries should NOT be made by 'phone or in person at Fleetway House or Tallis House.

A DECOUPLING QUESTION.

J. C. M. (Eastoft).—"Why is it that decoupling works so well, although the original circuit through the battery is only altered by putting a resistance in it?

"I always thought that a condenser offered a fair impedance to *low*-frequency currents, and yet these apparently choose the 2-mfd. condenser route rather than the battery circuit when this latter has 20,000 or 25,000 ohms put in it.

"Surely the condenser's impedance, also, is pretty high at low frequencies? And surely motor-boating is a very low frequency indeed?"

You raise an interesting point here, J. C. M., but you drag a red herring across the trail when you suggest that the decoupling condenser has to deal with motor-boating frequencies.

What the condenser has to do is to "accept" the ordinary low frequencies of speech and music, and so not allow them to flow round via the battery circuit. If it does this the circuits are decoupled, and the very-low-frequency motor-boating will not arise.

A comparison of figures will show that the decoupling condenser offers very much less "resistance" to L.F. than the decoupling-resistance-and-battery route.

The formula: Reactance $= \frac{1}{6{\cdot}28 \times f \times C}$ gives the reactance of a condenser, in ohms, where f = frequency and C = farads. And, if we assume a frequency of as low as fifty, we get, for a 2-mfd. condenser,

$$\text{Reactance (ohms)} = \frac{1}{6{\cdot}28 \times 50 \times {\cdot}000002} = 1{,}600 \text{ ohms (approx.)}.$$

This, you will see, is very, very much less than the impedance offered by the decoupling resistance which, if must be remembered, is in series with other impedances. So, virtually, all the low-frequency current is diverted from the battery.

A SAND-FILLED LOUDSPEAKER.

H. Y. (Botley).—"I am told that in POPULAR WIRELESS you recently described a novel loudspeaker cabinet, the sides of which were hollow and filled with sand, to prevent boom and 'box-resonance.' Just what I want!

"Please say when this was described, and whether *full*, how-to-make details were given. If so, where to write for the back number?"

The Non-Boom Baffle, as it was called, was described in "P.W." dated October 14th, 1933, No. 593. Full constructional details, for two styles, were given, and the devices have the further merit of being easily constructed and quite inexpensive.

If the back number is unobtainable, locally write direct to the Publishers, The Amalgamated Press, Ltd. (Back Number Department), Bear Alley, Farringdon Street, London, E.C.4. The price is 4d. per copy, post free.

THE ANSWERS

TO THE QUESTIONS GIVEN ON PAGE 477 ARE GIVEN BELOW.

(1). Warsaw, on 1411 metres. The word "Polski" means Polish.

* * *

(2). An increase in the capacity of a condenser placed thus results in a decrease of the coupling.

* * *

(3). In America Z is not pronounced "Zed," as in this country. It is called "Zee."

This often confuses British listeners, as W J Z, when pronounced as "W J Zee" sounds more like W J B or W J C to English ears. Remember this when listening for the States.

DID YOU KNOW THEM ALL?

THE MIRROR OF THE B.B.C.

(*Continued from page* 454.)

American announcer, and whose show it really is.

"Midland Composers."

Chris Edmunds, whose music will be played and sung in the eleventh of the series of "Midland Composers' Concerts" on Tuesday, November 14th, was chorus master at the Birmingham station in the early days of the B.B.C.

Before then he had become a member of Sir Granville Bantock's composition circle and professor of the piano and theory at the Midland Institute. He has just completed an octet for strings, and this will be played for the first time on November 14th.

"The Lady of Shalott."

Other items will include the cantata, "The Lady of Shalott" (to Tennyson's words), for women's voices and orchestra, and his Sonata in E minor, in which Constance Bee will be the violinist and Margaret Ablethorpe the pianist.

Frank Cantell will conduct the Studio Orchestra and Edgar Morgan the sopranos and contraltos of the Studio Chorus.

For West Regional Listeners.

To be able to see the funny side of one's own weaknesses is an attribute that goes a long way towards keeping us sane, especially when it is applied to a nation as well as individuals.

Welsh people will be the first to admit that they have—shall we call it a fondness?—for sending deputations to Government departments in London. That such a serious characteristic cannot be without its humorous side will be shown in a programme entitled "Dirprwyaeth Llanarfon." (which being interpreted means Llanarfon's deputation) for West Regional listeners on Friday, November 17th.

Done for Good Fun.

Of course, it will all be done in good fun, and we shall hear how, when the villagers of Llanarfon have become fed-up with sending letters, telegrams and deputations, they decide to "take over" the West Regional station in their determination to get a place on the map. Once in possession of the microphone, there is no better way of achieving their object than to give listeners the type of programme to which they are accustomed in Llanarfon.

NEXT WEEK

MULTIPLE CONTROL—THE REASON FOR THE S.T.500 SUCCESS.

BY

JOHN SCOTT-TAGGART

ALSO

HOW TO BUILD AN ALL-BAND SHORT-WAVE RECEIVER

We need not go into details, apart from mentioning that they are great believers in parodies, whether on Welsh songs or Welsh poetry, and that when they have no harp they are not averse to their singing being accompanied on the mouth organ.

THE LISTENER'S NOTEBOOK

(*Continued from page* 468.)

The B.B.C.'s treatment of "The Blue Boar" was hardly just. By robbing it of its libretto (which I understand is witty) and substituting in its stead a hastily read résumé of the story this light opera became no more than a recital of Roger Quilter music. As such it was still very enjoyable, but it forfeited its claim to be the outstanding broadcast of the week.

* * *

To me it was no more than, say, "Curtain Up" was on the Regional, and certainly merited no more publicity in the official programmes than was given this programme of Theatre music. In fact, I enjoyed it less than I did "Curtain Up," for in the latter case there was a variety of well-selected music.

* * *

No! the finest broadcast of the week was the Black Watch anniversary play. This was extraordinarily well written and produced. There was much Scotch in it, of course, but all was easily followed. Perhaps the little Gaelic wasn't without its difficulties, but this was essential to the character of the play.

* * *

I liked the way the story was unfolded by the two men stranded in the shellhole. The fade-out that preceded and succeeded each episode was most effective. The loss of the Birkenhead was realistically done, and the noises seemed better controlled than usual. An outstanding performance!

In the advertisement of the British Radiogram S.T.500 kit of parts on page 403 of last week's "P.W." the prices of the two conversion kits were inadvertently transposed. The prices, so B.R.G. tell us, should be 45s. for the S.T.300 to S.T.500 and 37s. 6d. for the S.T.400 to S.T.500.

THE £. S. D. OF LOUDSPEAKER RESULTS.

(*Continued from page 464.*)

The slackness of the job is rather an important point to grasp. If you have a powerful car your foot is very seldom right down on the accelerator; most of the time the engine is running at only a fraction of its full power, which is kept in reserve for the few occasions when it is needed.

In just the same way it is necessary to distinguish quite clearly between the average power your output valve is called upon to deliver, and the maximum power, which is what we have been talking about in figures. Consider a piano or a drum—or any instrument that is made to sound by being struck. At the instant of striking the power sent out as sound is enormous; but a fraction of a second later it is quite small, being just a sort of remnant caused by the string or diaphragm continuing to vibrate on its own.

The Need for a Safety Margin.

So while 100 milliwatts may give ample volume on the average sounds broadcast, it is essential that the valve can handle much more than that amount—actually 1,000 milliwatts may be none too much. What happens in the case of a 150-milliwatt valve is that the margin in hand is often not enough and all the "peaks" may be distorted.

Therefore the type of valve to use, even for a definite and moderate volume, depends on how much distortion you are prepared to tolerate. A critical listener likes to have a valve that can give 10 or even 20 times as much power as the average requirements. But there aren't many people who can afford to pay a day's wages for half-an-hour's work, so the Class B valve is the only reasonable solution where battery power is used.

Class B for Mains Sets.

Mains power is so cheap that the ordinary wasteful Class A system is quite satisfactory for most purposes. But you may be interested to know that in America it is considered necessary to provide at least 7,000–10,000 milliwatts in reserve to give a mere 500 average for ordinary domestic use; and as that would put a strain even on the pockets of a "plug-in" listener if the consumption ran on all the time, they have developed their Class B chiefly from the high-power mains point of view.

The important thing to get hold of is that, while the current you have to pay for in Class A working is 3, 4, 5, etc., times the maximum output the valve can give, in Class B working it depends mainly on the *average* output required to provide a comfortable volume in your room. And as we have just seen that for distortionless reproduction the average is only a tiny fraction of the maximum, it is easy to see where Class B scores.

THE LINK BETWEEN

(*Continued from page 454.*)

there are still quite a number of people who don't know how easy it is to adapt to any set. The addition of two small units, one near the horizontal part of the aerial and the other near the set, joined by a metal-sheathed twin cable in the place of a down lead, are all that is necessary. The results really are good, and noises from mains, passing tramcars and so on are eliminated in practice as well as in theory!

Readers who are troubled with man-made interference and are in doubt as to whether the "Rejectostat" system will help them should drop a line to Kolster-Brandes at Cray Works, Sidcup Kent.

Clocks for the Mains.

I have lately had several letters from "P.W." readers asking where electric clocks for use with radio receivers can be obtained. These and other readers who wish to copy in home construction what many of the commercial-set manufacturers are making standard will be interested to learn that negotiations have now been completed whereby the Edison Swan Electric Co., Ltd., will, in future be marketing battery and all-mains Bulle clocks. Stocks of all models will be available at local dealers, and illustrated lists can be obtained from 155, Charing Cross Road.

Similarity of Cabinet Design.

When a manufacturer of a commercial set finds a really distinctive cabinet design he is very tempted to try to standardise it through all his models as a kind of trade mark of his own brand of set. When for example, a table-model design has proved popular there has been an attempt to transfer it to console or radiogram cabinets, usually without any regard to the artistic balance of the original design.

There are some notable exceptions, of course. The Ekco Model 74, which I mentioned recently, has just made its appearance as a console model, and the cabinet is based on the design which made such a sensation at this year's radio exhibitions. There is certainly a sharp contrast between the black bakelite of the consolette and the grained satin walnut of the console; but the "family likeness" has been maintained so faithfully that, even though the layout is totally different, there is no mistaking the Ekco set. In this case the transferring of the design has been a brilliant success.

"S.T.500" COILS.

We have received for test from Messrs. Amplion a set of their new "S.T.500" coils and Class B components. These have been tested in a model of the "S.T. 500" and were found to be perfectly satisfactory in all respects.

WONDERS OF THE PAST

A Great and Stimulating Work on Other People's Triumphs.

THE more we see of the wonders of the Ancient World the more we respect the men who could conceive and produce them. In recent years the uncovering of these treasures of the past has gone on with extraordinary rapidity, and it has hitherto been difficult to obtain any clear and complete record of archæological achievement.

A work has, however, been prepared which gives us all we ought to know on the subject, and gives it in such a way that we are not only staggered but delighted with the magnificence of the feast provided.

Hundreds of Marvels.

In "Wonders of the Past," edited by Sir J. A. Hammerton, we are provided with a full description of hundreds of the marvels that the men of the past created.

"Wonders of the Past" is the kind of work that is usually issued at a prohibitive price, but this is placed within the reach of all, for it is issued in 52 weekly parts at sixpence. There are 2,000 illustrations, and 60 superb colour plates, and the book is one of the most beautiful and exhaustive works of its kind ever issued. Ask your newsagent for a copy of Part 1 of "Wonders of the Past," on sale to-day, and order the remaining parts so that you may receive them as they come out. You will certainly be delighted with this great work.

SELECTIVITY AT WILL

A simple but useful tip.

BY using a length of lighting flex as the connection between the set's aerial terminal and the aerial lead-in tube, it is possible to arrange for the inclusion of a series-aerial condenser at will. This is very useful for cutting down the strength of the "local" while keeping it free from interference from other stations.

One end of one lead of the flex is joined to the lead-in tube terminal. The end of the other lead remote from the tube goes to the set's A terminal. Connection between the aerial and the set is then via the small capacity of the flex.

If the free end near the set is then equipped with a crocodile clip, direct connection of the aerial to the receiver is obtained by merely clipping on to the A terminal.

ECKERSLEY EXPLAINS

(Continued from page 453.)

Hitler doesn't, Mussolini doesn't, and the B.B.C. are doing away with the possibility of giving more alternatives than two. But that's not a technical problem; it's just a problem.

One thing seems certain: that the specification could be fulfilled if you used wires instead of wireless. That's a solved technical problem, but to do it is—well, just a problem.

THE UNIVERSAL AMPLIFIER

(Continued from page 466.)

There is nothing out of the ordinary in the construction of the amplifier. It is built on the usual panel and baseboard principle, and can be completely constructed in a very short time. In use the connections to the pick-up are taken in the usual way, while the loudspeaker is connected as previously described.

For those who are desirous of using a special loudspeaker with the amplifier we have indicated in the illustrations an attractive baffle containing a dual loudspeaker unit with which the original amplifier operated extremely successfully. This unit is the Rola dual type, with mains-energised pots, and is ideal for use where D.C. is to be used as a general rule. In cases where A.C. mains are to be employed it will be necessary to use either P.M. speakers or mains-energised types with the necessary rectifier and smoothing condenser.

Regarding Polarity.

The connection of the amplifier to the mains is carried out in the usual way by means of an adaptor plug in the electric light or power circuit. In the case of D.C. mains it is necessary that the plug be inserted the correct way round as regards mains polarity. This is easily checked by the fact that when in one way no results are obtained, and when the other way is tried the amplifier comes to life. With A.C. no such polarity check has to be made, for the plug can be inserted either way round.

It will be noticed that no on-off switch is incorporated in the amplifier. This is because it is felt that in many cases it will be desired to fit the unit in a gramophone cabinet, when a separate switch controlling the mains input will undoubtedly be fitted in some convenient position. When used external to a cabinet the amplifier can easily be controlled by the mains switch governing the point into which the plug is inserted.

A TIP FOR FIVE METRES

READERS who are interested in the ultra-short waves, particularly the 5-metre band, where at the moment there is great activity, will find the following tip very helpful. It concerns aerial systems.

When receiving on normal wavelengths it is fairly true to say that the larger the aerial the better. But on the ultra-high frequencies the same rule does not apply.

The writer's experience indicates that best results are obtained on a short *vertical* aerial, 15 or 20 feet long. It should be erected as much in the open as possible, and the lead-in should be really short.

So great an improvement is this arrangement over others that it is possible to hear signals at good strength, which, on an ordinary broadcast aerial, are quite inaudible. No earth connection is necessary, and coupling to the grid of the detector is obtained through a small neutralising-type condenser.

F. B.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

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

Multi-Mu Virtues.

SO much has been said about the virtues of the multi-mu valve that many people jump to the conclusion that they have only got to fit a multi-mu valve to their set and they will get a lot more stations and a general increase in the efficiency.

Perhaps this impression is excusable at first, but it is not really true, because the actual amplification given by the multi-mu valve is not greater than that of an ordinary screened-grid valve; in fact, to be precise, it is sometimes rather less. A good deal depends on whether you want to use the highest magnification you can get—with a low grid bias or with no grid bias at all—or whether you want distortionless volume control and to get away from overloading the high-frequency amplifier.

If you want the former you do not really gain any great advantage from the multi-mu valve. If it is the latter that you are after, then by all means go in for the multi-mu. But I want to make it clear that the multi-mu is designed for the special purposes which I have just mentioned above, and is not a sort of "general improver" of the whole set which you just stick on any way. Like a pentode and many other components in the receiving set, it will give you great advantages if you happen to want just what it is intended to cater for, but will be of little or no use to you otherwise.

Calculating Wavelength.

It is often convenient to know the wavelength to which you can tune by means of a coil of a given inductance and a condenser of known capacity. The wavelength of a closed circuit composed of the inductance and capacity is obtained by multiplying the capacity (in microfarads) and the inductance (in micro-henries), then taking the square root of the result and multiplying this by 1,884.

You will easily see from this formula that if the capacity is made very small the wavelength will be made small also, whilst the longest wavelength for the circuit will be given when the capacity has its maximum value—that is, assuming that the value of the inductance is constant.

Grid-Lead Interference.

Pick-up leads are very liable to cause interference, owing to the fact that they receive all kinds of stray electrical effects and, being in the grid circuit, are at the most sensitive spot. The question of shielding the pick-up leads is really rather tricky, because you don't want to do more shielding than you can help, since this may tend to reduce the efficiency. Sometimes you will find that a pick-up will work quite well without the leads shielded, whilst in other cases even the same leads will pick up all sorts of interference and crackling.

(*Continued on next page.*)

TECHNICAL NOTES

(Continued from previous page.)

Armoured Cable.

I have generally found it best to use sheathed wire at the outset, because this really does save you a lot of trouble and uncertainty. You can get ordinary braided wire or you can use wire which is not only metal sheathed but also armoured. Personally, I prefer this latter kind of wire, as it will stand quite a lot of knocking about without damage.

Earthing and Efficiency.

Having used sheathed wire, the question arises whether the outer shield should be connected to earth. This is a point that can only be determined by actual trial. Sometimes you will find that the mere sheathing is in itself sufficient to stop any trouble, whilst sometimes you will find that you cannot get rid of interference until it is connected to earth.

On this point I would say that it is better to try *without* earthing in the first instance, as generally you get greater sensitivity when the sheath is not earthed. You will see this for yourself, because the outer sheath, especially if connected to earth, forms a condenser of quite appreciable capacity with the inside leads.

If the grid and bias leads are covered with an earthed sheath, this may also be connected to any metal shield which is used under the motor-board so that a single earth connection can be used for the two.

Grid Current.

People often assume that the grid in a valve—in an ordinary three-electrode valve, for instance—serves the purpose merely of a "potential control," as it were, and that it does not actually pass any current. As a matter of fact, the grid must always pass current, although in normal circumstances with a three-electrode valve this should be very small.

With the more recent valves, such as the screened-grid variety, the grid may pass quite an appreciable amount of current. In a screened-grid valve the screening grid is at a fairly high positive potential, and so quite a considerable amount of the electron stream must reach it.

Semi-Automatic Control.

This grid current can, however, be turned to useful account. If you put in a high resistance between the screening grid and the H.T. positive you can get a kind of semi-automatic control of signal strength, rather like that which you get by using a multi-mu valve.

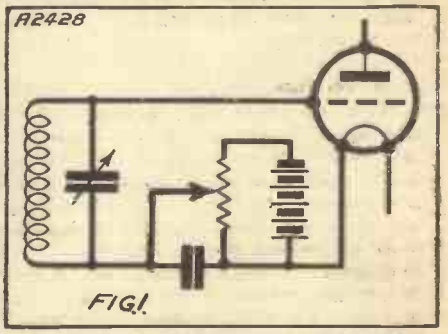
If the signal strength increases, the current passing in the screening grid is increased, and so the potential gradient across the above-mentioned resistance is increased. The result of this is to lower the effective bias on the screening grid, and so the efficiency of the valve is reduced.

Conversely, if the signal strength *falls*, the positive bias on the screening grid is increased, and so the efficiency of the valve is increased. In this way you will see that there is a natural tendency, when this resistance is used, for the output to be "governed" and to keep at a fairly constant level, notwithstanding that there may be appreciable variations in the strength of the incoming signals.

Anode-Bend Detection.

When you are using the anode-bend method of detection it is very important to have the grid bias applied to the detector adjusted to the correct value. In the ordinary way you only get variations in the amount of the grid bias by the 1½-volt steps of the grid-bias battery,

FOR FINE ADJUSTMENTS



A potentiometer enables accurate adjustments of grid bias to be made to the grid of an anode-bend detector.

but this is really not fine enough if you want to get the best results with anode bend and it is advisable to provide for more accurate adjustments if possible.

In the arrangement shown in the figure the grid-bias battery has a high-resistance potentiometer shunted across it, the voltage tapping for the grid being taken from this potentiometer. If a wire-wound potentiometer is used with very fine wire—as it will have to be to get sufficiently high resistance for the purpose—you can get a much finer adjustment than by simply tapping on to the different cells of the grid-bias battery.

I need not say any more on that point as it is fairly obvious, but some people raise

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

the objection to this method that it runs down the grid-bias battery too quickly. If the potentiometer has a total resistance of, say, 100,000 ohms the current through it with a 9-volt grid-bias battery will be less than one-tenth of a milliampere, which represents one milliampere-hour every ten hours or, say, roughly 2 milliampere-hours per day, whether the set is working or not.

It has been argued, on the other hand, that a minute current like this, so far from shortening the life of the battery, actually improves it and that a battery in these conditions will last longer, owing to the reduction of polarisation, than a battery which is standing idle.

Of course, you can, if you wish, easily introduce a switch in series with the potentiometer, so that it is only shunted across the grid-bias battery when actually required.

That Echo Effect.

There seems to be quite a lot of difference of opinion on the question of how much of the "echo effect" should be introduced into broadcast items. We all know the old "padded-cell" effect that was so usual in items broadcast from the studio a few years back, whilst, on the other hand, broadcasts from theatres, halls and so on were apt—and are still sometimes—to be much too "echoey," so much so that it is sometimes difficult to make out the words of the artistes.

A Natural Tone.

With the very great improvements in the equipment of the B.B.C. studios the echo effect can be regulated to a nicety, and I think most people agree now that a slight amount of echo, provided it is not overdone, adds greatly to the naturalness of the programme items. Personally, I hate that dead, "padded" effect, and it must be awfully difficult for the artistes to "put it over" effectively in those conditions.

Adds "Life."

The echo effect adds "life" to the reproduction, and it has been compared to the stereoscopic effect in photographic pictures, where you get a sort of three-dimensional effect instead of simply a dead, flat effect.

After all, this is only to be expected, because, when you hear sounds direct in the ordinary way, you always get, added to the sound, the various echoes from walls and so on, and, if in transmission through a microphone these effects are cut out, the sound is bound to seem dead and unnatural.

L.F. Instability.

I said something a week or two back about decoupling, and several readers have pointed out that low-frequency oscillation, howling, etc., is very liable to crop up when you use an H.T. mains unit unless you take special precautions for decoupling.

This is only to be expected, because you have to remember that the H.T. unit includes resistances which are really large compared to the internal resistance of a good H.T. dry battery or of an H.T. accumulator battery.

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

The moment you have resistance in the H.T. circuit you are looking for trouble with instability due to back coupling, as I have pointed out before. Of course, the trouble may be made much worse by such things as bad placing of the components in the set or by wiring which crosses over and leads to interaction between one part and another.

I am assuming, however, that you have already attended to these latter points, because they will cause trouble anyway, apart from the H.T. unit.

Choke-Filter Output.

If you are bothered with this low-frequency oscillation you might try better matching up of transformers; this often does the trick.

But really the best of all remedies is to use a choke-filter output. This keeps the low-frequency component due to the power stage away from the H.T. unit and will almost certainly give you stability, quite apart from the other well-known advantages of this form of output.

You might also try a condenser across the H.T. mains unit, this condenser being of one or two microfarads or even more, and being connected from the detector positive tapping to the negative terminal of the unit. The condenser will act as a decoupler and should help greatly in reducing instability. But the choke-filter output is the thing, really.

Milliammeter in Anode Circuit.

A milliammeter is a very useful component in the anode circuit generally, and particularly in the detector plate circuit. You can find out by trial what sort of reading is given on the meter when the low-frequency stage and the loudspeaker are receiving what we may call a reasonably full load.

Having once discovered this, you then know that this reading should not be exceeded, no matter what station is being received, and that if, in fact, the reading on the meter *is* exceeded, then you will get distortion.

Anode Bend and Overloading.

To take an example: If you use a leaky-grid detector and, say, a single stage of L.F. or two stages of push-pull, and you get a drop of, say, half a milliampere in the anode current, when properly tuned this should give you plenty of volume for all ordinary purposes, whilst if there are a couple of stages of low-frequency amplification you may, in fact, work with much less coming through the detector. On the question of detector load, by the way, the anode-bend detector will stand a good deal more than the leaky-grid type before showing obvious symptoms of overloading.

Have You Worked This Out?

Has it ever occurred to you to work out what you pay for your high-tension current from an H.T. battery per unit as compared with what you pay when you draw this from the electric light mains? A very simple sum in arithmetic will show you some illuminating results! Let us assume—a fairly optimistic assumption in many cases—that an H.T. battery will last six months when running a set on an average four hours a night, seven nights a week.

Anyway, call this for simplicity 28 hours a week and 25 weeks, which gives a total of 700 hours. Suppose the average current is 5 milliamps, that is 5 multiplied by 700, or 3,500 milliampere hours, in other words 3½ ampere hours. Now 3½ amps. at 100 volts (supposing it is a 100-volt battery) is 350 watts, and 350 watts for one hour is 350 watt hours, which is just about one-third of a unit.

If the battery costs you 10s. this works out at the rate of 30s. per unit. A fair price for electricity on the electric light supply is 5d. per unit, whilst on the power meter 1½d. or 2d. will be plenty. So you see how enormously dearer the current is from the H.T. battery compared with the mains.

The STAR SPEAKER for the STAR SET

Blue Spot
REGISTERED TRADE MARK

S.T. 500

BLUE SPOT AGAIN

SCOTT TAGGART'S *FIRST CHOICE* for S.T. 500

With a wide selection of speakers at his disposal Mr. Scott-Taggart made Blue Spot his first choice for his S.T. 500—by far the most important set of the season.

He further showed his belief in the quality of Blue Spot Speakers by again recommending them for his S.T. SUPER.

Where designers of Scott-Taggart's reputation lead you may safely follow. Any receiver with a Blue Spot Speaker is immeasurably superior. Modern design, high-class construction and the best materials procurable long ago earned for Blue Spot Speakers a reputation for quality and performance that is unassailed and unassailable.

But if even Scott-Taggart's recommendation is not enough for you, put Blue Spot to any test you like. In appearance, construction and performance it will always be an easy first.

MOVING COILS 29P.M., 32/6 45P.M., 45/- 99P.M. as illustrated, 59/6

Also obtainable without transformers.

and in cabinet models of exceptionally fine design, 45/- to 87/6

MOVING IRONS, 12/6, 42/-

ALSO—BLUE SPOT PICK-UP, 35/- MAINS DISTURBANCE ELIMINATOR, 10/6

THE BRITISH BLUE SPOT COMPANY LTD

BLUE SPOT HOUSE · 94/96 ROSOMAN STREET · ROSEBERY AVENUE · LONDON · E.C.1

Telephone: Clerkenwell 3570. *Telegrams: "Bluespot, Isling, London."*
Distributors for Northern England, Scotland and Wales: H. C. RAWSON (Sheffield and London) Ltd., 100 London Road, Sheffield; 22 St. Mary's Parsonage, Manchester; 177 Westgate Road, Newcastle-upon-Tyne; 37, 38, 39 Clyde Place, Glasgow.

SEND THIS COUPON FOR CATALOGUE

Cut this out, write your name and address in the margin and post in open envelope. Full particulars of 99P.M. and other Blue Spot Speakers by return. Catalogue No. P.W. 88.S.

Printed and published every Wednesday by the Proprietors, THE AMALGAMATED PRESS, LTD., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices: Messrs. John H. Lile, Ltd., Ludgate Circus, London, E.C.4 (Telephone: Central 5352). Registered for transmission by Canadian Magazine Post. Subscription Rates: Inland and Canada, 17/4 per annum. Abroad (except Canada), 19/6 per annum. Sole Agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd.; and for South Africa: Central News Agency, Ltd. Saturday, November 11th, 1933. S.S.

Popular Wireless

See on Page 5

THE £ s. d. OF LOUDSPEAKER RESULTS

No. 598. Vol. XXIV. November 18th, 1933.

EVERY WEDNESDAY PRICE 3D

DO YOU KNOW?

The Sherlock Holmes of Radio

THAT you are getting 100% service from your set? Be certain....

THAT the loads on the valves are exactly right? Be certain....

THAT every connection is both mechanically and electrically sound? Be certain....

THAT both H.T. and L.T. batteries are giving full output. Be certain....

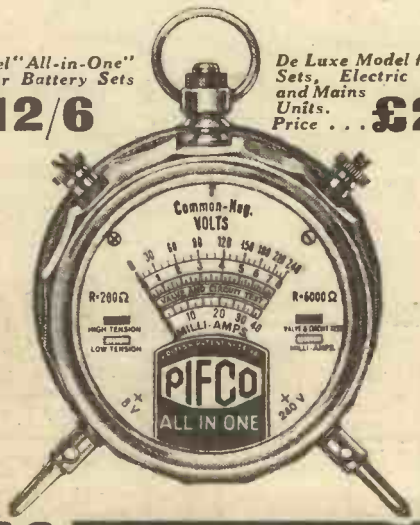
THAT transformer windings, condensers, coils, and other components are O.K.? Be certain....

THAT you can test every single thing and trace any fault? You can—with a PIFCO "All-in-One" Radiometer!

Get one to-day to ensure full enjoyment of your radio. Obtainable through good-class radio shops. Issued by PIFCO LTD., High Street, MANCHESTER, or 150, Charing Cross Road, London, W.C.2.

Standard Model "All-in-One" Radiometer for Battery Sets only, as shown here. Price.... **12/6**

De Luxe Model for Battery Sets, Electric Receivers and Mains Units. Price... **£2.2.**



PIFCO ALL IN ONE RADIOMETER

℗ R4

If You Want a Quality S.T.500

1 Use no Output Choke (You also Save 8/6)

See P.397 Popular Wireless, Nov. 4 1933

2 Use ROLA FR6-PM-23 Class B (As Specified) 39/6

NOTE.

Rola make special type Class B Input Transformers because of the special requirements of Class B as to Super-High Inductance, etc. ***This is why nearly every British manufacturer making Class B receivers uses Rola.***

USED WITH ITS OWN INPUT TRANSFORMER as above, this Speaker will give vastly superior results to any other.

EXTENSION SPEAKERS

Write for list

There is a correct Rola Extension Speaker for practically all British Radio Receivers. Rola speakers are used by nearly all British Radio Manufacturers. As it is highly desirable to have the speech coil impedance of the Extension Speaker similar to that of the speaker in the receiver, the necessity for using Rola Extension Speakers is manifest.

Write for List.

ROLA

the World's Finest Reproducers.

THE BRITISH ROLA CO., LTD.,
Minerva Road, Park Royal, N.W.10.
'Phone: Willesden 4322-3-4-5.

POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
Technical Editor: G. V. DOWDING, Associate I.E.E.
Assistant Editor: P. ROBERT BIRD.

Managing Editor: N. F. EDWARDS.

Chief Radio Consultant: P. P. ECKERSLEY.
Assistant Editor: A. JOHNSON-RANDALL.
Chief of Research Dept.: K. D. ROGERS.

FIFTY YEARS AGO
MARCONI IN AMERICA
A GOOD BOOK
WIRELESS IN INDIA

RADIO NOTES & NEWS

A USEFUL GIFT!
THE PARIS RADIO SHOW
RADIO IN THE HIMALAYAS
A TALL STORY

Looking Ahead.

MARCONI is reported to have said in America that, in his opinion, the "sound" part of the future radio programme will be more important than the "sight" part.

Whilst I do not presume to discuss the point with the great man I really do believe that the two ought rather to be considered as complementary, their combination providing a more complete and satisfying reproduction of the show than "radio sound" alone or "silent movie" alone.

The radio play at present calls for enormous efforts of the imagination.

Early "Broadcasting."

I SEE in the "Electrician" that fifty years ago, in October, 1883, a broadcast took place. During the Leeds Musical Festival ten telephone transmitters were connected to receivers in Bradford, Dewsbury and Huddersfield, where the music was distinctly heard.

Not exactly a Regional scheme, but certainly the ancestor of the radio-relay system now in vogue. I wonder if any "P.W." reader was one of the listeners on that occasion.

Let Smethwick Flourish!

SMETHWICK has a wireless society, and its Hon. Sec. is Mr. E. Fisher, M.A., of 33, Freeth Street, Oldbury, near Birmingham. For the coming winter—if we are to have a winter—this society has arranged an attractive programme, including a special elementary class in wireless theory and practice for new members.

The weekly meetings are held at the New Talbot Inn, High Street, Smethwick, at 8 p.m. on Fridays. So many of these jolly wireless clubs meet at jolly old inns that I think that jolly old G. K. Chesterton ought to be made an Hon. V.-P. of all of 'em.

Marconi "Mixes In."

THE illustrious Marchese Marconi had a great old time during his visit to America. When David Sarnoff, of the Radio Corporation of America, was over here a few months ago he induced the Marchese to go to the U.S.A. and planned a great reception for him, ranging from a dinner in New York during "Radio Progress Week" to a "Marconi Day" at the Chicago World's Fair.

In spite of his fame, Marconi is a man's man and—if I may be permitted to say so—a "regular fellow." He will have given those genial Americans as good a quip as he receives—and a bit over. Not for nothing is he half Irish, half Italian by blood.

THIS WEEK

Link Your Home With FIVE CONTINENTS

by Short-Wave Radio—the most fascinating branch of wireless reception!

¶ **THE ALL-BAND SHORT WAVE RECEIVER** fully described on page 513 covers all the wavelengths between 16 and 200 metres.

¶ **RADIO, STEP BY STEP** appears on page 499, and deals absorbingly with Ohms Law, Radio Terms and Power.

¶ **MULTIPLE CONTROLS—The Reason for ST500 Success,** by John Scott-Taggart, is on page 492.

War on "Interference."

THE committee appointed by the Institution of Electrical Engineers to study electrical interference with broadcasting has accepted the report of its four sub-committees, which report shows that devices for the suppression of interference from many items of electrical plant, especially domestic appliances, could be introduced in future designs at a reasonable cost.

Further investigation on larger items of plant are necessary, and tests are being carried out by the British Electrical and Allied Industries Research Association. More power to their meters!

"Yorkshire Pudding."

I HAVE received from Mr. Leslie W. A. Baily, its compiler, "The Yorkshire Radio Book," which is packed with good stuff as surely as a Yorkshire pudding, and costs sixpence.

Mainly about broadcasting in Yorkshire, this book also contains a number of articles of use and interest to any radio amateur or "listener," and data concerning call signs, time signals, short-wave stations, European stations and the B.B.C.

Mr. Baily is the author of that recent radio play success, "The Fantastic Battle." I wish his little book fantastic sales. It is a rich mine of facts attractively and effectively set out.

Towards the Stratosphere.

BEFORE I leave book reviewing this week I must mention another volume which has given me much pleasure. "Adventure above the Clouds," by F. V. Monk and H. T. Winter, is a graphic account of man's attempts to reach great heights above the earth and study the conditions there.

From the adventures of Charles and Robert in 1783 the book goes on through a series of thrilling tales till it reaches the exploits of Professor Piccard and Flight-Lieut. Cyril F. Unwins (who holds the record for high flying in an aeroplane) and the inter-planetarians with their mighty rockets.

A book to please a boy, a physicist and a radio man, or, for that matter, anyone with imagination. Be thoroughly thrilled for three and sixpence!

India Reforms.

EMPIRE broadcasting may have something to do with the improvement in the radio-licence situation in India! but I like to think that the beneficent influence of radio upon character has also played its part and reduced what Mister Ghandi called "civil disobedience."

Now, in 1932 the number of licensees was 8,557 for the whole of India, but during the first six months of 1933 there were issued 6,276 licences as compared with 4,105 for the corresponding period of last year. That's the stuff! Pay your licence fees and throw away your guns and bombs, and India will be a nation yet.

Radio and Fishing.

AFTER three months of fishing, with an Echometer aboard, the captain of the Violet and Rose wrote a very interesting article in which he recorded

(*Continued on page 522.*)

MULTIPLE CONTROLS

"I consider that the wireless set for the constructor is, first and foremost and every time, a musical instrument and source of real enjoyment and happiness," says John Scott-Taggart.
And in the S.T.500 our distinguished contributor has unquestionably put these words into practice by placing at the disposal of the constructor a non-compromise receiver which for range, selectivity, power and quality stands unequalled by any other combination of four valves.
The efficiency of Scott-Taggart designs is proved by the phenomenal success of the S.T.500 which is being built by thousands of constructors all over the country.—Have you built yours ?

NO inventor worthy of the name is ever satisfied with what he has done; he is always searching for better methods or cheaper methods or easier methods of achieving a given object. If, however, he makes the public discontented he has failed.

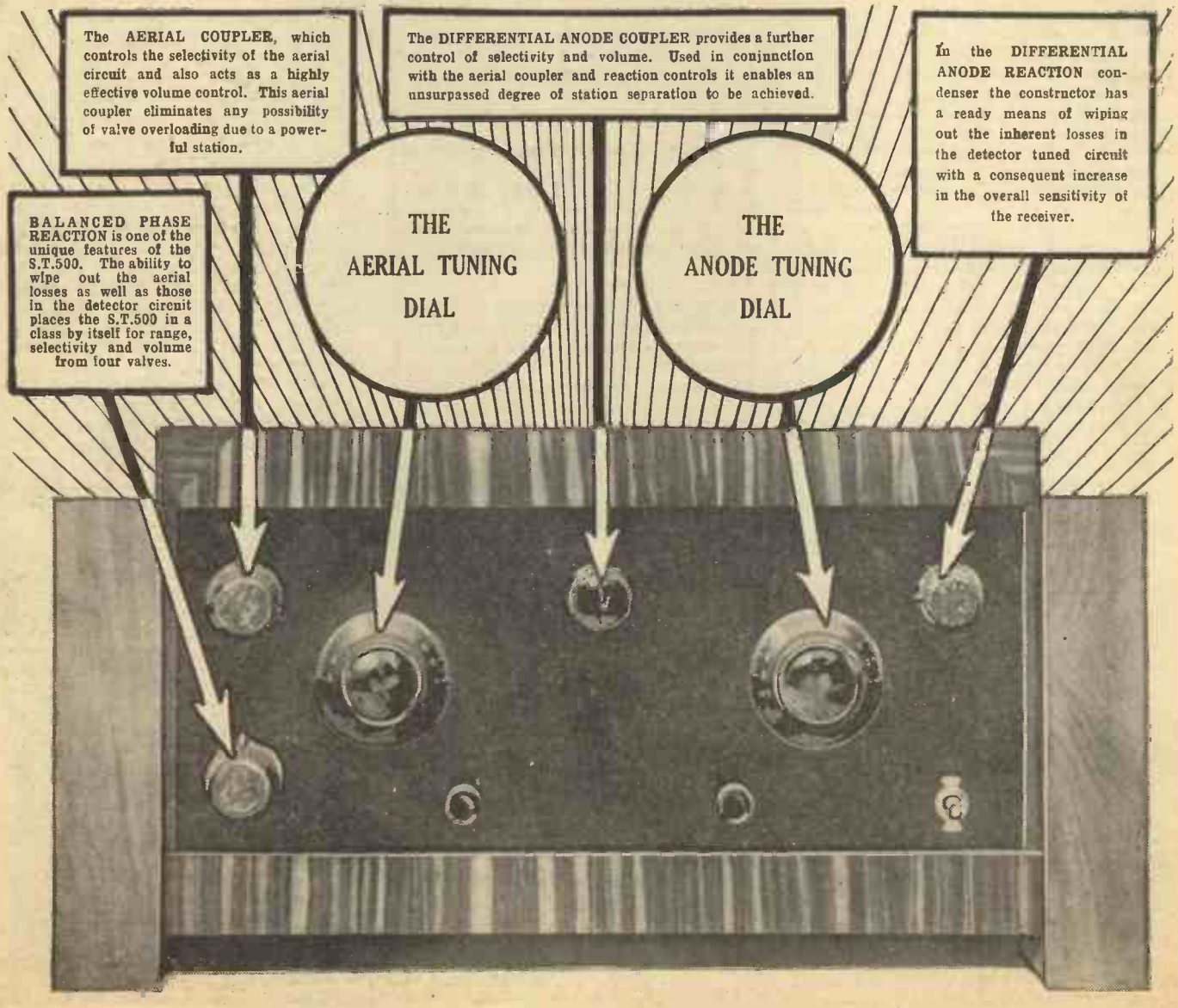
The "S.T.500," as presented in this journal, is a result of my being discontented with the average set design of to-day; it also represents all the improvements in technique which I consider are requisite to a set which is not merely up to date, but which will make the constructor happy in the future.

I have been criticised on the score of designing so few sets that the public is given no choice in the matter; it is said that they have to "take it or leave it." There is some truth in this. No attempt is made by me to cater for their special individual needs.

There are some constructors who will not build anything more than a two-valve set; others who want a ten-valve superheterodyne. There are others who have never been satisfied unless they had a magnificent piece of furniture in their room. Some constructors derive almost their whole joy from fiddling with a very short wave receiver which gives plenty of fun but questionable entertainment.

There is a certain section of the public that calls out for a vague imitation of the manufacturers' type of set. There is a whole heap of people who will sacrifice almost anything for the sake of simplicity of operation.

For none of these do I cater. Nearly all of them are worth catering for, and there are competent designers to do the work. But in a set which is to have a nation-wide appeal the only considerations I am prepared to admit are Performance and Entertainment. By performance I mean



The Reason for S.T.500 Success

that the results must be obtained with maximum efficiency and with a full regard to the future; and as regards entertainment, I consider that the wireless set for the constructor is, first and foremost and every time, a musical instrument and source of real enjoyment and happiness.

Designs of Original Character.

In the case of every set I have designed I have disregarded any prejudices that constructors may already possess, in the belief that a strong case, convincingly applicated, will be given a fair hearing. I have presented technical designs of a highly controversial and original character. Hence my intention to explain and justify every line of the "S.T.500" circuit. I have explained and justified, and more than justified, every control on the panel. Although I may not provide you with an alternative choice, there is no "take-it-or-leave-it" attitude in my presentation of a new design.

It is, however, the function of a designer, in my opinion, to disregard fashionable tendencies if they cripple his progress for better results. Public taste, whether in the matter of knobs, simplicity of control, size of set, number of valves, cabinet designs, can be a hindrance and a pit into which many an able designer has fallen. In search of public approval he might be untrue to himself in order to "give the public what it wants."

The true function of a designer, however, as I conceive it, is not to drift with the tide, but to reverse it if it becomes necessary. The Duke of Plaza Toro in the Gilbert and Sullivan opera always led his men from behind; but I think that the average wireless constructor would prefer to follow a firm, well-built road, even if it leads him into country which is new to him.

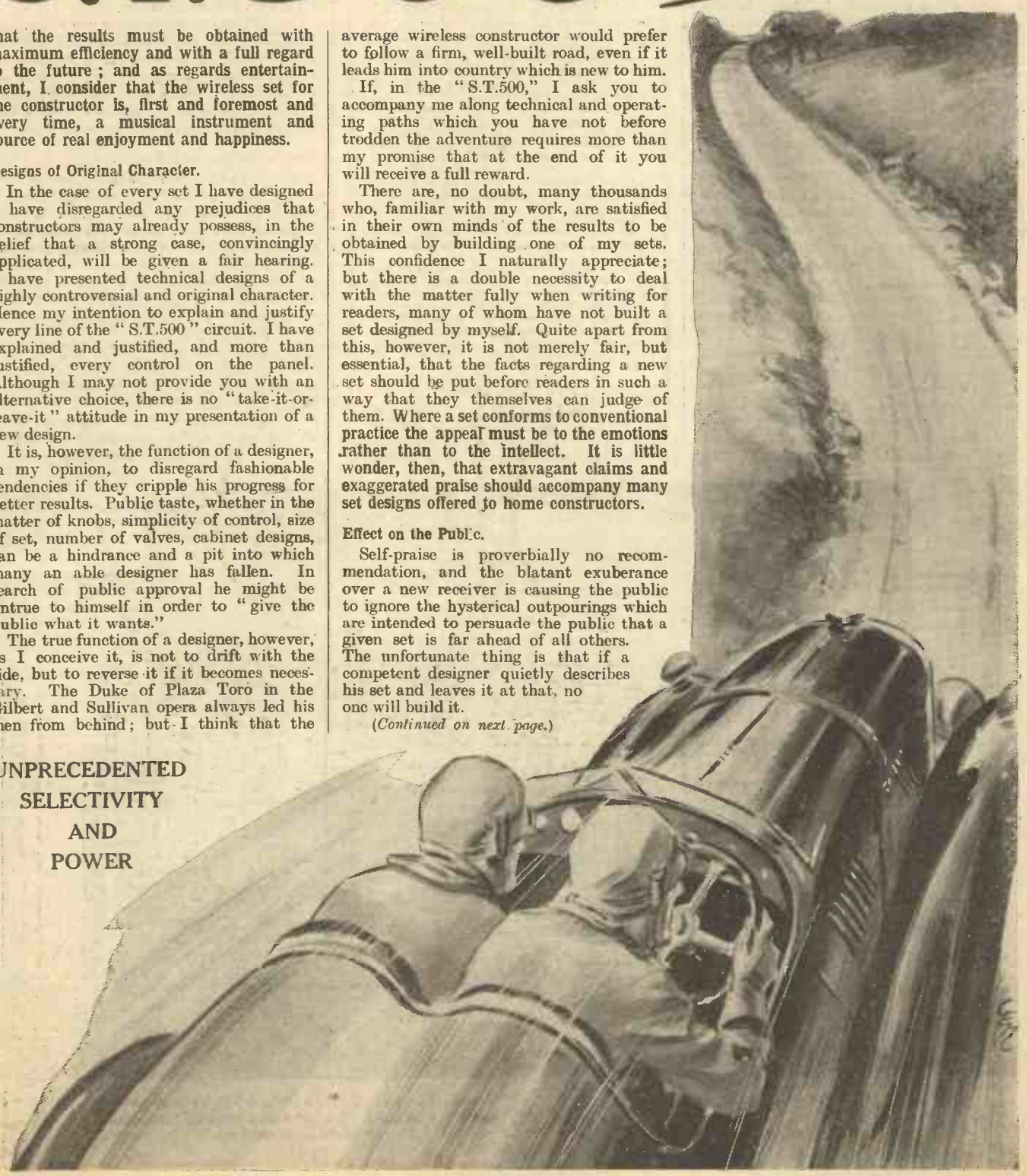
If, in the "S.T.500," I ask you to accompany me along technical and operating paths which you have not before trodden the adventure requires more than my promise that at the end of it you will receive a full reward.

There are, no doubt, many thousands who, familiar with my work, are satisfied in their own minds of the results to be obtained by building one of my sets. This confidence I naturally appreciate; but there is a double necessity to deal with the matter fully when writing for readers, many of whom have not built a set designed by myself. Quite apart from this, however, it is not merely fair, but essential, that the facts regarding a new set should be put before readers in such a way that they themselves can judge of them. **Where a set conforms to conventional practice the appeal must be to the emotions rather than to the intellect. It is little wonder, then, that extravagant claims and exaggerated praise should accompany many set designs offered to home constructors.**

Effect on the Public.

Self-praise is proverbially no recommendation, and the blatant exuberance over a new receiver is causing the public to ignore the hysterical outpourings which are intended to persuade the public that a given set is far ahead of all others. The unfortunate thing is that if a competent designer quietly describes his set and leaves it at that, no one will build it.

(Continued on next page.)



Multiple Controls—The Reason for S.T.500 Success—

(Continued from previous page.)

The public has been fed on the drug of over-praise to such an extent that it at once will notice any restraint and regard it as weakness.

My own experience leads me to believe that, although public taste is often wrong, public judgment is usually right. In other words, if both sides of a case are presented adequately and fairly the public will usually make a correct decision. Where, perhaps, I have departed most in the presentation of a new design is in stating a case and leaving the decision to the constructor.

Build It For Technical Reasons.

In offering the "S.T.500" I have no intention of paying elaborate compliments to my own design; and if I or the Editor make any general statements I suggest that they be ignored. Unless I can convince you that the set should be built for technical reasons fully discussed, then it were better that you should not build the set.

I have had literally hundreds of letters from wireless amateurs who have written expressing gratitude for having roused their flagging interest in what was once a fascinating hobby. They say that I have added life and colour to an occupation which had become stale and uninteresting.

These letters astonished me as an expression of a state of mind which I had overlooked. My object in designing multi-control receivers was simply to produce better sets for the incorporation of new inventions involving some slight sacrifice as regards simplicity of operation.

The general feeling amongst the world's amateurs and enthusiasts is that radio has become too stereotyped, and that the better minds have no opportunity of getting better results. The last year has shown a renaissance in technical matters. We have had iron-core coils, new valves and Class B amplification.

Most of the developments are of greater interest to the set manufacturer than the constructor; but Class B amplification unquestionably is a god-send to the home constructor. Once more it puts him on top. The fight between home construction and factory construction is once more "on."

Home-Construction Research.

Up to 1926, when my laboratories produced the "Solodyne," the first modern screened one-knob receiver, and the "Elstree Six," the set a man could build at home was not merely a cheaper receiver than he could buy, but a better one. The highest-paid technical staff in the country was engaged in the research and design work purely on behalf of the man who made his own set.

It was at this time that I retired from radio journalistic work and confined myself purely to private professional work. But it was the introduction of the mains valve which gave such an enormous fillip to the set-manufacturing industry. The

(*Continued on page* 528.)

"S.T.500"—8 MILES FROM MOORSIDE EDGE.

Dear Sir,—The "S.T.500" is the finest set I've ever heard. It's great—"streets" ahead and "sights" better than any set I've heard, had or seen. Perhaps I ought to introduce myself. I'm 24 years old, but the germ bit when I was 12 years old, so you see I consider myself an "old hand."

I've had all sorts of sets—"P.W.'s" and "W. Constructor's." I've grown with them, and learnt much from the two mentioned papers.

However, I graduated and became a proud owner of the "S.T.300"—it's still a fine set. I made the "300" as soon as it was published.

The "S.T.300" did good and excellent service. Then out came "P.W." with the "500"—just what I wanted. I ordered the necessary components for converting "S.T.300" to the "500." They came dribbling in one at a time, and as I fitted each component I noted the change in quality and selectivity.

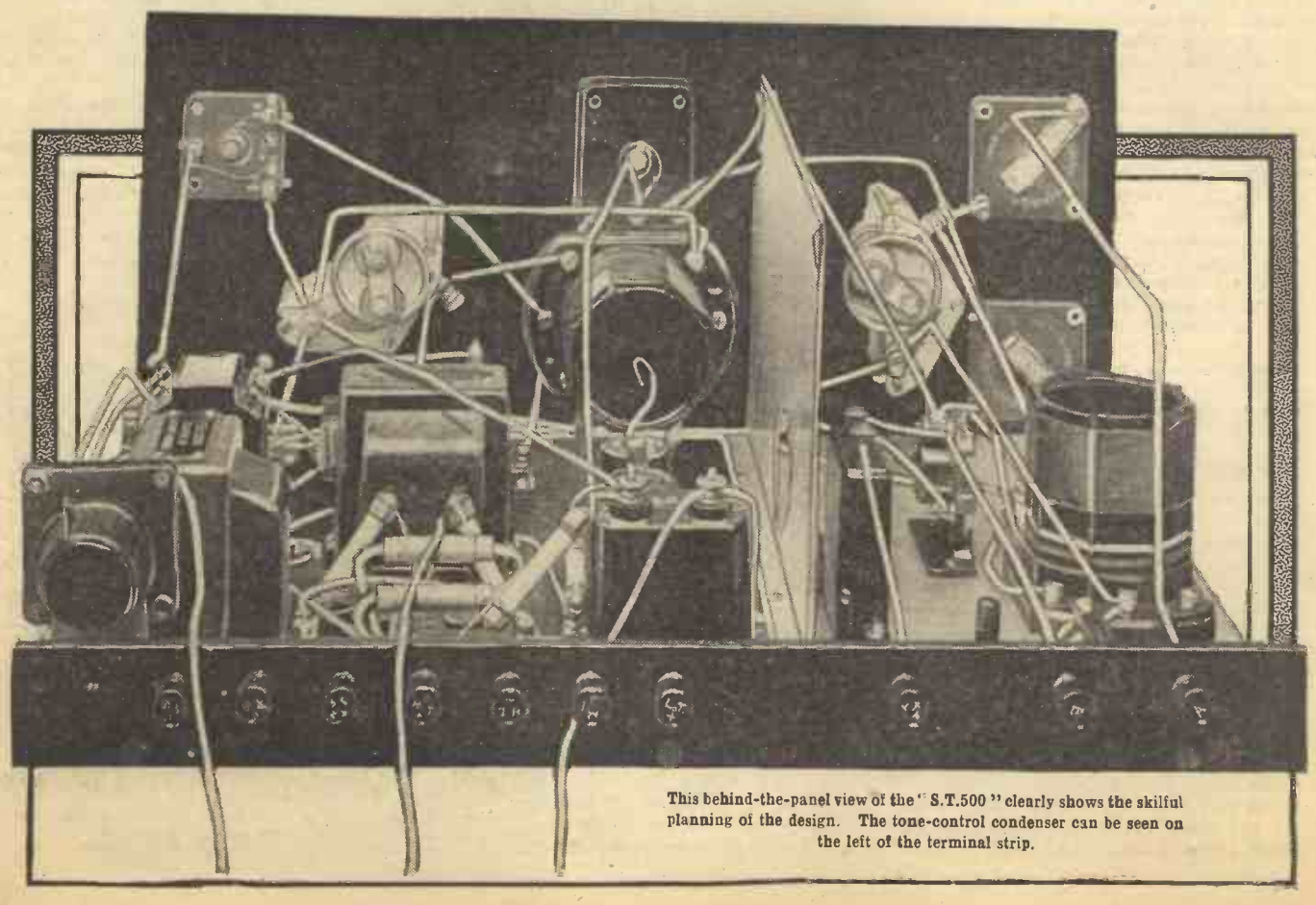
The "S.T.500" is now complete, and almost represents the millennium.

I have retained the '00004 aerial coupler, since I am very near Moorside Edge.

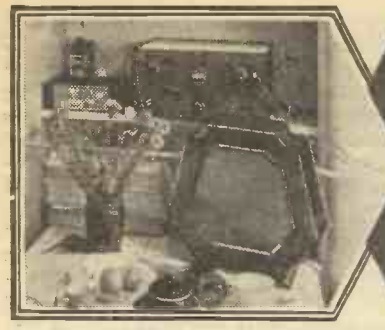
The set has been demonstrated to one or two wireless friends and simply astounded them. I can listen with pleasure to Zeesen with a silent background, when both Daventry and Radio Paris are kicking it out. A ..... straight all-mains 3 v. and many other well-known makes fail hopelessly at this test in Littleborough.

Yours faithfully,
ERIC S. ALLETSEN,
29, Todmorden Road,
Littleborough, Lancs.

P.S.—The aerial reaction is a "gift from the gods"; the tone control perfect.



This behind-the-panel view of the "S.T.500" clearly shows the skilful planning of the design. The tone-control condenser can be seen on the left of the terminal strip.



The £.S.D. of LOUDSPEAKER RESULTS

In a previous article on this subject the difference in cost between Class A and Class B amplification was established. In this contribution the economics of loudspeaker reproduction are gone further into

By MARCUS G. SCROGGIE, B.Sc., A.M.I.E.E.

THE price of milliwatts isn't quite so easy to ascertain as the price of petrol. For one thing, when a petrol can is empty, it is empty (do you agree?) But nobody can say when a battery is empty. Strictly speaking, I suppose it is so when it gives no more current at all. But long before that stage is reached it is quite useless for running a receiver. Just when it does become useless depends on how bad you can stand your reception.

Then the price of batteries per milliwatt (over a given period of time) varies with the maker, and even more so with the size—there is a reduction for quantity!

The Average Cost.

But an average figure for the ordinary small H.T. battery is 1,000-milliwatt hours per penny. So going back to our 500-milliwatt pentode, which you remember required to be fed with 1,500 milliwatts H.T., it is easy to calculate that the running cost so far as H.T. is concerned is three-halfpence per hour.

It is rather interesting to compare this with power from the mains. A thousand-milliwatt hours is, of course, one-watt hour. And 1,000-watt hours is one-kilowatt hour. And one-kilowatt hour is nothing more or less than a Board-of-Trade unit. The price of a unit may be anything from a fraction of a penny to nearly a shilling, according to the district—a state of affairs that the public would not tolerate for a moment with bread or butter or with anything that they can understand.

But at the worst, and even admitting that in a mains-driven set a proportion of the unit is wasted in the rectifier, the case is much brighter than it is for battery drive, which by a glance at the figures above is seen to cost 1,000 pence per unit—£4 and more.

How Many Milliwatts?

In comparison the mains user can feel happy to play about with as much power as he likes, so long as the set doesn't cost him too much to buy or make.

Having now had "the economist in the witness-box" and heard his evidence, we can take a look at some more of the circumstances that affect the power that it is necessary—or at any rate desirable—to have on tap. We have already seen that because the ear can easily get used to a considerable background of noise—just as the iris of the eye closes up when a light is shone on it—the volume from a loudspeaker seems to melt away in noisy surroundings. On the other hand, it is astonishing how easily a faint sound can be heard in a dead-quiet room—the latter experience is so rare these days that we can easily forget it.

Then we have also seen how a "thin" type of programme, such as a piano solo, requires a very high maximum power to give a satisfactory volume without bad

A NEED FOR POWER

"It is well known in actual experience that organ music, of all things, sounds really satisfactory only when piles of watts are being expended on it."

distortion. A 500-milliwatt stage is about the least for a rather pale imitation of a piano even in favourable circumstances; 2,000 milliwatts can make nearly as much noise as a real piano (domestic model), but with enough distortion to worry a listener who likes good music; while 5-watts output is none too much with which to try to imitate the real thing. Of course, all these figures are affected by the other considerations; they are rough estimates for fairly average living-room conditions.

Plenty of Noise.

"Thick" programmes, that have plenty going on all the time, and particularly in the upper and middle registers, give a much greater impression of volume for a given power-handling capacity. This is especially so if the music is *legato* rather than *staccato* or percussion. Apparently, then, an organ would be ideal. But it is well known in actual experience that organ music, of all things, sounds really satisfactory only when piles of watts are being expended on it. That is partly due to the fact that the original is very loud, and in fact requires thousands of watts to drive it; so a faint shadow of it is hardly likely to satisfy. But another interesting point is that, while a few milliwatts of a high note make a considerable impression on the ear, it requires *hundreds of times as many* to impress the ear with a low-pedal note.

What happens when you try to hear the pedal notes on anything less than several watts output is that, though they aren't loud enough for you to get much "kick" out of them, they create such a commotion in the last valve that the poor high notes get all rattled as well, and the result—is familiar to all.

Easily Reproduced.

Speech, although of the staccato type of sound, is not much trouble, for there are no very low frequencies in it—except perhaps when Jetsam (or is it Flotsam?) is on the ether—and nobody wants to hear the human voice as loudly as Foden's Band, even although the B.B.C. apparently think we do.

The effect of the size of the room is probably quite obvious. A portable set may sound very impressive in a modern maisonette, but would fail to provide adequate entertainment in the Albert Hall. What is less obvious, but far more important in practice, is the sort of room and the sort of

(*Continued on next page.*)

AN IMPRESSION OF VOLUME

"'Thick' programmes, that have plenty going on all the time, and particularly in the upper and middle registers, give a much greater impression of volume for a given power-handling capacity."

THE £ s. d. OF LOUDSPEAKER RESULTS

(Continued from previous page.)

things in it. It is universally known that a feeble source of sound is capable of putting up a satisfying performance in a bathroom—look at all those who do it!

If you retort that a bathroom is a small room (usually), try your voice in an empty swimming bath. And then go, bursting with pride, into a well-draped hall of equal size and packed with fat people on plush seats, and see if you can repeat the performance.

An Interesting Comparison.

Even professional singers who could take an audience of several thousands in their stride used to wilt away in the tiny studios of the early B.B.C. Absorption! So do not be afraid of taking your modest receiver into the stately baronial halls of your aristocratic friends, with their oak panelling (the halls' panelling) and hard, uncomfortable furniture. But beware of the rooms, even if small, that are full of things—particularly things like chairs that are good enough to sleep in, curtains, rugs, and stout, Victorianly-dressed ladies. The B.B.C., concert hall had to be fitted with special seats so that the introduction of an audience would be offset by the reduced area of upholstery exposed to the sound waves.

It is remarkable how the milliwatts seem to melt away in such surroundings, the quality goes all dead, and in trying to bring up the volume to an adequate level the power valve is hopelessly overloaded, and you begin to look for serious faults, not suspecting the external conditions.

There is one item on our list that has not yet been considered—the loudspeaker. To be sensible, instead of talking about milliwatts we should be talking about millibars or something that states the actual amount of sound radiated by the loudspeaker. For all the resources of the output stage are of no avail unless the loudspeaker uses them to advantage. The motor engineer is rather stupid about this, too, for instead of telling us how much power can be delivered to the road wheels, he is content to give the power of the engine itself—and not often even that in terms that mean anything.

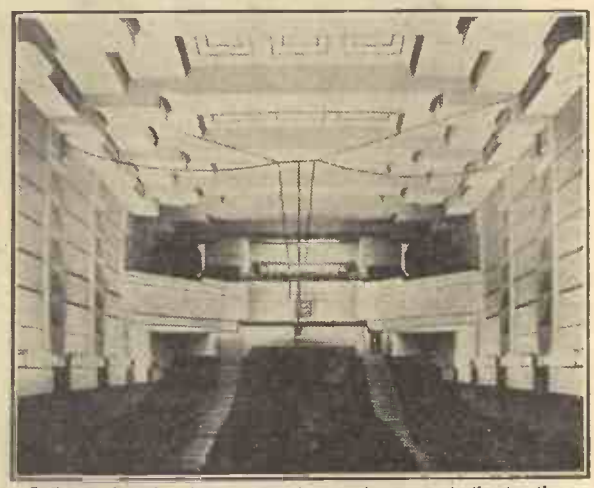
We are left to guess how much is wasted in between—gear box, clutch, differential, etc. But we do know it is nothing like 98 per cent, or the car would soon go up in flames.

Wasted Energy.

But for every 100 milliwatts delivered by a power valve, only about 2 or thereabouts are actually used as sound. Distressing, isn't it? Clearly, if your loudspeaker is 4 per cent efficient it can make as much noise with 100 milliwatts as a 2-per-cent speaker can with 200 milliwatts. So anybody who can produce a 50-per-cent speaker to go in a small wireless set (instead of being about as big as an elephant) is in for a prosperous time.

Of course, the matter of how effective the speaker is depends very closely on the type of programme. But, then, wireless is so beautifully complicated.

THE EFFECTS OF ABSORPTION



Just as a singer's voice appears stronger in an empty theatre than in a full one, so the apparent strength of a loudspeaker varies with the number of people in a room and the type of furnishing.

FRETS WITHOUT FRET

A simple method of designing attractive loudspeaker frets

AT wireless stores and woodworking shops, numerous loudspeaker frets can be obtained, but have you thought of designing one for yourself? Don't let this frighten you, even if you have no knowledge of drawing and design.

Perhaps some of you have plain baffle-boards with a circular opening that would undoubtedly be improved by a decorative front. The following gives you simple instructions for making it more ornamental.

Take a square piece of card, large enough to cover the aperture of your loudspeaker, and draw lines faintly with a pencil, from corner to corner. Then, with a sharp pocket knife, cut partly through the card. Bend the card away from the cut, placing corner to corner, as illustrated in Fig. 1, A to A; then over again (B to B), and you have a triangular shape, as illustrated in the last figure of that diagram.

Draw semi-circles, triangles and points as illustrated in the second diagram, or according to your own fancy. Now cut through *all* the card until every pencilled section has been dealt with; and on opening your card again you will have something quite new and pleasing in fret designs (Fig. 3).

Next colour the card with oak or mahogany stain and clear varnish both sides, as this will tend to stiffen the card. Whilst this is drying, cut out four strips of card with diagonal ends, the longest sides being about half an inch larger than the square fret. Stain and varnish these in the same manner and leave to dry.

Now tack your fret in position and with small panel pins attach the strips round the fret, making sure you make neat joins at the corners, as shown in Fig. 4. If you wish to make a more thorough job you can stretch thin silk behind the fret.

For readers who prefer to make an actual woodfret and yet are unable to design their own, the same method can be used, but thin paper must be employed. When you have cut your pattern, paste the design on your wood and, when dry, cut out.

E. A. B.

WORKING OUT A DESIGN

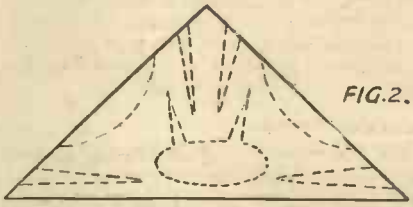
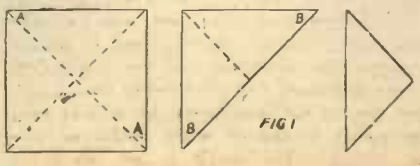


Fig. 1 (below), illustrates the method of folding the card, while (above) in Fig. 2, are shown typical cuts that could be made.



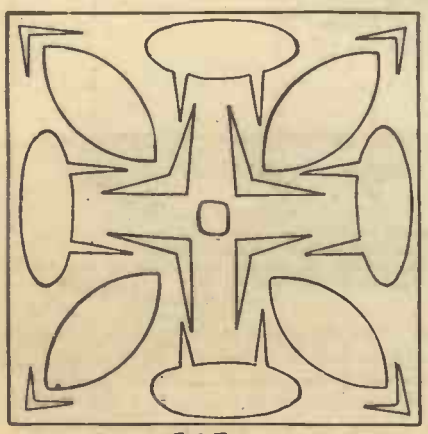


FIG. 3

When the card is opened out after the cutting, a symmetrical and attractive design will appear.

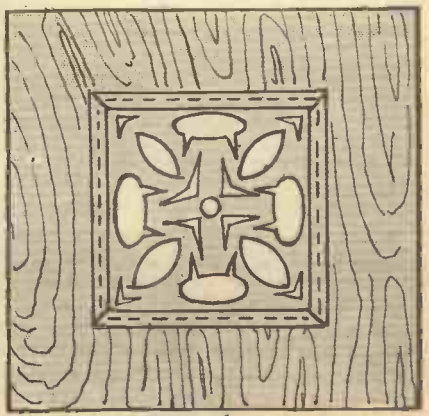


FIG. 4.

The design can be is transferred to a piece of wood, which, after being suitably finished, is fixed to the baffle-board.

ECKERSLEY EXPLAINS-

Our Radio Consultant-in-Chief deals this week with a subject which often puzzles many listeners, namely, why "earth connections" sometimes have nothing whatever to do with the actual ground. Included in his discourse is a particularly clear explanation of how the Hertz oscillator works.

PEOPLE often ask why an "earth" connection is called an earth connection when it obviously does not connect with the earth.

For instance, wireless apparatus is used to allow anyone in an aeroplane to talk to the ground stations, and hence to anyone on the ground. Nothing in the aeroplane can be connected to the earth, but the wireless apparatus still has a terminal labelled "earth."

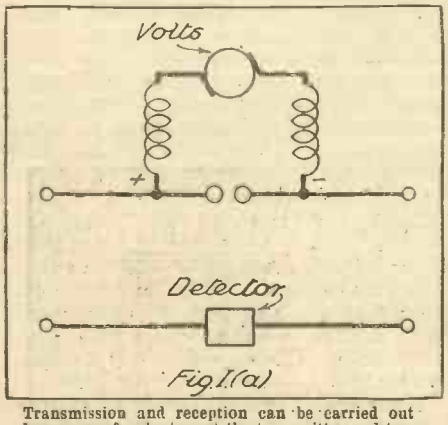
The explanation is that in the beginnings of wireless communication it was found essential for efficiency to connect to the earth. This earth connection was made by burying plates or wires in the earth itself.

The question may still remain in your mind: why is it necessary to have an earth? Well, really it isn't necessary at all. The earth only increases the efficiency of a wireless system. When Hertz first signalled without wires he used antennæ which consisted of two rods symmetrically placed about the source of sending oscillations. Neither was earthed.

The Hertz Oscillator.

He showed that in order to send out waves he had to establish a difference of potential between two (transmitting) rods and then by interconnecting these suddenly by a spark make oscillatory currents flow between them. The first wireless, then, was explained as follows:

WITHOUT AN EARTH



Transmission and reception can be carried out by means of rods, two at the transmitter and two at the receiver, no earth connection whatever being employed.

Look at Fig. 1 (a). The two rods were connected to a source of (lots of) volts. If we put the process into slow motion we see that gradually one rod becomes charged positively and the other negatively. We've got lots and lots of volts, and the process continues and continues until, at last, a spark takes place between the spark balls.

This spark is a white-hot mass of flaming gas. It has only a resistance of a few ohms. The current pours through it, and the positive charge goes surging into the part which was formerly negatively charged, and vice versa. (This is as good an explanation as any other, and I won't have purists talking about electrons!)

Creating Wireless Waves.

But the swapping of charges is so enthusiastic that a moment after one rod has been positive and the other negative, then the vice-versa condition takes place, and the one which has been plus becomes minus, and the one which has been minus becomes plus, because the charges surge and overshoot the equilibrium condition.

So when the spark takes place, the current oscillates up and down between the rods; there is an oscillatory discharge. This creates wireless waves in the ether.

A similar pair of (receiver) rods will be appreciably charged one way and then the next, and any "detector" placed between them can tell that these charges are taking place and that some transmitter is sending out waves.

If the length of the rods is varied, if their inductance and/or capacity is varied, the length of the wave sent out is different. If the receiving system is to be made sensitive to the waves the length of its rods must also be adjusted or the inductance and/or capacity of the receiving rods must be varied to bring them into tune with the frequency of the waves (proportional to the length of the waves) sent out.

Elementary Tuning.

The lengthening and shortening of the rods is what to-day we call tuning, and is done most simply by altering the inductance and/or capacity of the aerial. No earth is concerned in all this.

But it was found, notably by Marconi, that if, instead of two rods, one rod was done away with and the spark joined between the remaining rod and earth (i.e. some conducting thing buried in the earth), then the waves were stronger as sent out, and easier to detect when gathered in—Fig. 1 (b). The earth is not, thus, an essential to communication, but it is helpful in certain cases.

My brother, T. L. Eckersley, showed, about 12 years ago, that you could make a very efficient transmitting system by using a screen of wires close to the earth instead of an earth. The Writtle sending station used an earth screen.

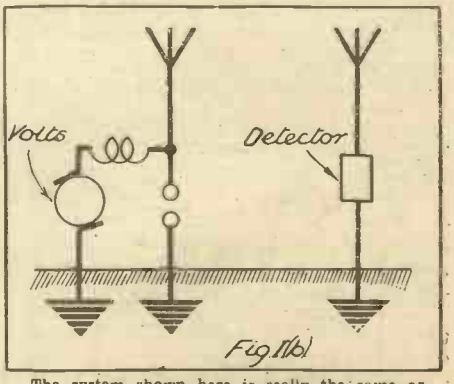
When you use wireless in an aeroplane all the metal parts look like one of Hertz's rods and the trailing aerial like the other. So we call the metal of the aeroplane the "earth." When you find that your many-valved set works just as well with or without an earth you have probably got a combination of two effects.

Effect of Capacity.

Any "earth" has resistance, and when you eliminate it there is less resistance in the system, and so it is more sensitive for this reason. But where is Hertz's other rod? Well, the currents find their way to surge up and down not directly between aerial and earth, but via the capacity of your set to earth.

A metal chassis, a main's transformer,

A MORE EFFICIENT SCHEME



The system shown here is really the same as that in Fig. 1a, but one of the rods at both the transmitter and receiver have been replaced by an earth connection.

and then the mains make quite an efficient earth for high frequencies. High-frequency currents go through a condenser easily.

The real value of an earth, a true earth, is, in some cases, to hold down the potential of earthed and earthy parts of circuits. This stops instabilities.

(Continued on page 531.)

THE MIRROR OF THE B.B.C. By O. H. M.

U.S.A. TO HEAR THE KING

The N.B.C. and the Holy Land—Attacks on Dr. Boult—A New Saturday Feature—Ridgeway's Return.

LAST Christmas there was some ill-feeling in the United States because the B.B.C. declined to allow the Christmas Day broadcast to be relayed outside the British Empire. This year the grievance has been met. When His Majesty gives his message from Sandringham, about 2.15 p.m. London time, every transmitting aerial in the British Empire and in the United States will be putting out his message. Both the N.B.C. and the C.B.S. are planning to clear their programmes for this occasion.

The P.M.G. on the Post Office.

Sir Kingsley Wood is down to broadcast a special talk on the Post Office at 9.20 p.m. on December 27th. I hear that he will have a good deal of new information to impart, and will deal particularly with the work which Sir Stephen Tallent is taking on.

The Bethlehem Bells Bother.

I have just heard of a kind of comedy of errors that nearly deprived British listeners of the relay of the Bethlehem bells, which is to be the special feature of the Christmas Day programme this year. Here is the secret history of the incident: About two years ago the N.B.C. originated the idea of a world broadcast of the bells of Bethlehem, and invited the B.B.C. to co-operate. The B.B.C. declined, without giving a reason, but the objection probably was based on reluctance to dramatise a sacred reminiscence.

Anyway, the N.B.C. was left to its own resources and tried last year to carry out the project for America. But the authorities in Palestine turned down the idea, possibly because the B.B.C. was not involved. This year, however, when the N.B.C. raised the project afresh, Broadcasting House accepted it with enthusiasm: so much so, indeed, that it forgot all about the N.B.C. and proposed at first to put the bells of Bethlehem into a special programme designed for British listeners only.

It must be said for the B.B.C. that as soon as the oversight was noted plans were changed to enable the N.B.C. not only to share credit, but also to provide the North American continent with the thrill to which their enterprise has entitled them.

Fatigue of the B.B.C. Orchestra.

There is much loose talk about the fatigue of the B.B.C. Orchestra. Part of this is due to hostile propaganda from those who would like to see the B.B.C. driven out of public concerts. This effort, of course, must be opposed, if only for the reason that the standard of symphony performance in broadcasting requires successful public performance. There is, of course, some justification for the suggestion that the B.B.C. Orchestra is hardly at the top of its form after the strain of the summer promenade season.

I believe the B.B.C. will meet this point in due course, possibly by the provision of a smaller alternative Symphony Orchestra. For the moment, however, those who gain their music from the microphone—and they are, after all, practically the bulk of the population—should not fail to recognise that "root-and-branch" attacks on Dr. Boult and his magnificent orchestra are not justified.

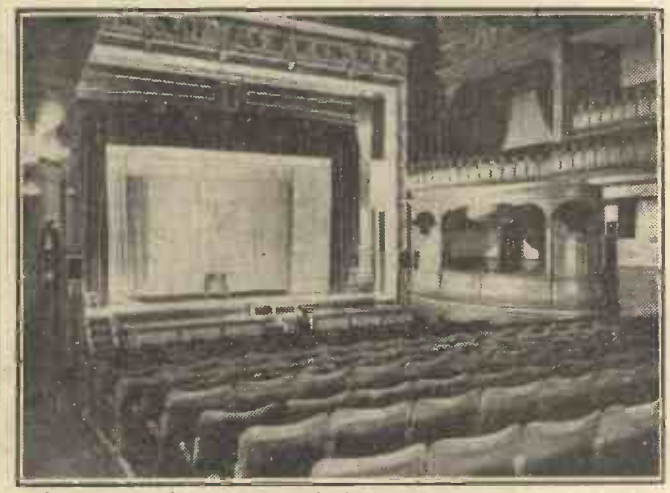
"In Town To-night."

The new Saturday night programme feature which begins on November 18th, under the title of "In Town To-night," looks like being one of the most attractive things the B.B.C. has done for a long time.

Briefly, the idea is to present up-to-the-minute items of what is going on in London, such as tit-bits from new stage performances, interviews with and broadcasts by notable people who have only just arrived in town, new songs, perhaps a "surprise item"—in fact, anything which can only be arranged so late that it cannot be included in the published programmes.

Sir John Reith will be returning from his American trip towards the end of the month. He might easily come on as a "surprise item" if he has any misgivings!

THE NEW STUDIO OF THE B.B.C.



The famous warehouse studio (No. 10) is to be done away with, and so the B.B.C. have leased St. George's Hall, seen above. This theatre was famous as the home of Maskelyne's Magic.

"Red Tabs."

Val Gielgud's "Red Tabs" is next in the series of great plays in the Radio Drama Festival, and two broadcasts will be given to it on Friday and Saturday, December 1st

(*Continued on page 532.*)

Weekly jottings of interest to buyers.

THE success which seems consistently to dominate the progress of Messrs. Lissen is no more than they deserve.

It must have been obvious many times in my notes that I have great admiration for any firm that has the courage to assume the rôle of pioneers in an industry which, on account of the rapidity with which fashions change, is to an extent hazardous. And Lissens, in every sense of the word, *are* pioneers.

Following the well-deserved success which they have achieved in other lines, they now seem to be well on the way to scoring another hit with their car-radio outfit.

It remains to be seen whether car radio will ultimately become universally popular, but at least it is certain that Lissens will benefit tremendously from being one of the first in the field.

Personally, from my own experiences, I feel that there is quite a future for car radio, but only for certain types of installations. In this connection I am firmly convinced that Lissens are on the right track. I consider that theirs is an ideal scheme, and I shall be delighted to arrange for full details to be sent to any interested reader making application in the usual way through our postcard literature service. **(No. 63)**

No Light Matter!

Night work means "light" work—at least, it does as far as the power station is concerned. And when the current fails at two o'clock in the morning in a busy factory compelled to work night shifts in order to keep pace with "S.T.500" orders, etc., it is very definitely no light matter!

My friend Mr. Graham Farish tells me that such was the unfortunate experience one night recently in his factory at Bromley. To make matters worse, the defect was one which could not be remedied immediately, and in consequence the staff had to wend its way home in the early hours of the morning, but not before enjoying a cup of tea by candlelight. That is just typical of the interest which Mr. Graham Farish takes in his staff.

(*Continued on page 532.*)

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way—just quote the number or numbers.

RADIO STEP-BY-STEP

OUR SPECIAL SUPPLEMENT for BEGINNERS

RADIO TERMS

A PRACTICAL REVIEW

By G. V. DOWDING, Associate I.E.E.

Aerial Resistance.

IN transmission particularly this is a very vital factor. The term actually means the resistance of the aerial offered to High-Frequency Electrical Currents.

It comprises (1) Dielectric Loss Resistance. This is occasioned by the setting up of voltages across insulating materials in close proximity to the aerial. In a receiving aerial there might be considerable Dielectric Loss if, for example, an insulated wire were used and this was run over the surface of a wall or roof.

(2) Ohmic Resistance of the wire. However thick the wire, it will have some ohmic resistance, for there is no such thing as a perfect conductor. This factor has no serious bearing on reception in average conditions, though when a bad contact occurs in the connection between the wire and a terminal, or there is a partial break in the wire itself, then it may interfere with reception.

CHANGING DIRECTION

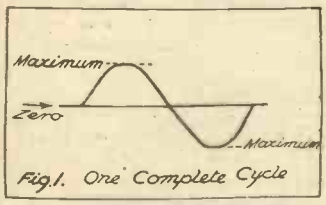


Fig. 1. One Complete Cycle

A special feature of alternating current is the fact that it fluctuates in strength as well as changes its direction. This was fully explained in last week's issue under the heading "What Is A.C.?"

(3) Radiation Resistance. This is of great concern to the transmission engineer. It is, however, a fictitious resistance. It is the resistance which would be required to absorb the same amount of power as is used in the creation of radio waves; and when this Radiation Resistance is large as compared with the Dielectric and Ohmic Resistance, the aerial is an efficient one, as a moment's thought will show.

Alternating Current.

There are two kinds of current—"Direct," which maintains its flow through the circuit in the one direction, and "Alternating," which is continually changing in direction. From zero it rises to maximum in one direction, then falls to zero and rises to maximum in the other direction, finally to fall to zero again, after which the whole operation, or "cycle," as it is termed, is repeated. (See Figs. 1 and 2.)

The number of repetitions per second is termed the Frequency, and sometimes Periodicity. Now, it is of practical importance to note that in an electrical supply of, say, 50 cycles the current changes its direction 100 times per second, for in each cycle there are two changes of direction.

It is a simple matter to discover whether or not a house is wired for A.C. by examining the meter. On this, usually engraved on a small brass plate, the voltage and other details of the supply appear. If there is the word "Frequency," or "Periodicity," or a small sign, ~, followed by a number, then it is certain to be A.C., and the Frequency will be denoted by the number.

Many of the wall sockets now used have three terminals generally marked "Live," "Neutral" and "Earth" (or similarly).

"Neutral" and "Earth" must not be confused. The first two are for circuit connections to the radio set or domestic appliances, and "Earth" is for connecting to protective metal coverings on such devices as vacuum cleaners and so on.

This "Earth" point can also, of course, be used for a radio-set earth connection. You will note that the socket for it is longer and of greater diameter than the mains ones. This is to ensure, first, that the wrong pin cannot be inserted in it; and, second, that the earthing connection is made before those to the mains, and broken after the mains are disconnected.

Alternating Current obeys Ohm's Law, but subject to special qualifications as compared with Direct Current. For example, Impedance replaces Resistance, and is in part composed of Ohmic Resistance, and the Capacity and Inductance in the circuit contribute to it. (These terms will be explained in detail later on.)

The great advantage of A.C. over D.C. is that it can easily be transformed to any desired voltage. The supply to a house may be 200 volts; but with a simple and inexpensive transformer the voltage can be reduced to 4 for working electric bells or to other values for other purposes.

With D.C. low-voltage apparatus can be worked only by reducing the current by means of power-dissipating resistances, and that, of course, is wasteful.

A.C. can actually be stepped up in voltage by means of transformers, and this fact is taken full advantage of in radio.

However, it is frequently necessary to rectify it; in other words, to change it to D.C., as in the operation of radio valves. But this can be done after the voltage has been satisfactorily adjusted.

As Alternating Current is always changing in value, it is measured by its average or Root Mean Square value. This then gives in Amperes the current which would be required with D.C. to provide the same heating effect. The R.M.S. is approximately ·707 of the peak value of the A.C.

A POPULAR TYPE

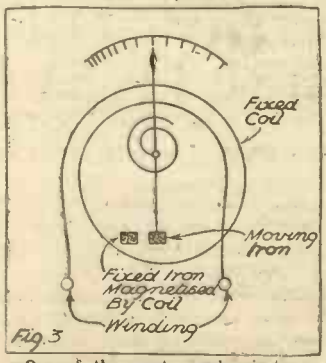


Fig. 3

One of the most popular instruments for measuring current is the moving-iron ammeter, because of its inexpensive construction.

THE CURRENT FLOW

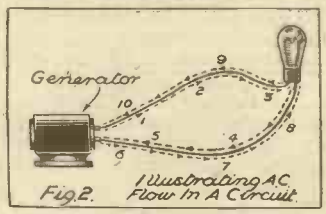


Fig. 2. Illustrating A.C. Flow in A Circuit

The arrows and numbers show how A.C. current flows to and fro in a circuit consisting of a generator and electric lamp.

Ammeter.

An instrument for measuring current in Amperes. Ammeters either work on the thermal principle (in which case the indicating movements are caused by the effect of the heating of a metal strip or wire) or are electro-magnetic in action. There are three electro-magnetic types: (1) Permanent Magnet, (2) Moving Iron, (3) Electro-Dynamometer.

(A Milliammeter is exactly the same in principle, but is designed to measure Milliamperes, i.e. thousandths of an Ampere.)

The moving-iron type of Ammeter (or Milliammeter) is the most popular, because of its inexpensive nature. (See Fig. 3.)

(*Continued on next page.*)

Special Beginners' Supplement—Page 2.

WHAT DO WE MEAN BY POWER?

LAST WEEK we described how the current flowing along a wire depends on the pressure, showing that for a given length of wire (assuming the resistance to be the same) an increase in pressure will produce an increase in current.

Thus it is evident that current and pressure (voltage) are closely related. A current cannot flow unless there is a voltage to drive it.

Electrical Energy.

This brings us to the question of electrical energy. What causes an electric lamp to glow brightly when the switch is pressed? The answer is that the energy flowing through the filament of the lamp bulb does work in overcoming the resistance (this is analogous to friction) offered by the filament (the filament is that portion of the lamp which glows and gives off light).

AN ANALOGY

When a man lifts a weight he is doing work, the power expended being equal to the number of lbs. lifted multiplied by the distance the weight is moved in feet and the time taken in minutes.

Released as Light.

The electrical energy, in doing work (trying to force a current through the filament), renders the filament luminous. Part of the energy is transformed into heat, and part—the greater part—into light. The filament does not burn away because the supply of oxygen is shut off by the vacuum existing in the lamp bulb.

But the fact that work can be done by electricity flowing through a wire tells us very little unless we know something about the time taken to do the work.

Take, for example, two men moving a heavy weight. One of them manages to lift it but does so with an effort. It takes him an appreciable time to move the weight through a distance of, say, one foot.

The other man has no such difficulty. He picks up the same weight and moves it through the same distance in a fraction of the time taken by the first man. Obviously the second man is much stronger than the first. He is far more powerful.

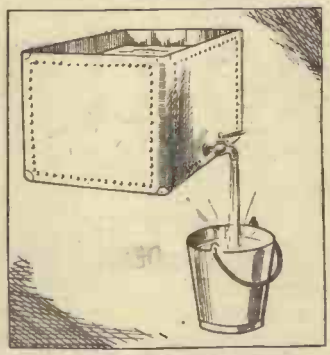
Power is simply the *rate of doing work*. If a man raises a weight of 100 pounds one foot into the air in one minute, he is doing work at the rate of 100-foot-pounds per minute.

He would do the same amount of work if he were to raise twice the weight through a distance of six inches in the same time or fifty pounds through one foot in thirty seconds.

Therefore power, or rate of doing work, can be expressed in terms of foot-pounds-per-minute, i.e. weight multiplied by distance multiplied by time. But to get things right we must adhere to our units of feet, pounds and minutes. One *horse-power* is equivalent to 33,000 foot-pounds-per-minute of work.

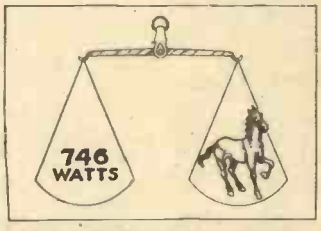
In electricity power is pressure multiplied by current, the pressure being volts and the current amperes (often called amps.). Electrical power is expressed in watts; thus 100 volts multiplied by 10 amperes is 1,000 watts.

A COMPARISON



The water-tank forms a good analogy for current flow. The amount of water passing the tap in a given time is equivalent to amperes of electricity. Power is amperes flowing multiplied by pressure or driving force (volts), and is expressed in watts.

ONE HORSE-POWER



Electrical power has its equivalent in mechanical power. One mechanical horse-power is equal to 33,000 foot-pounds of work per minute. This is the same as 746 watts of electrical power.

But to refer to thousands of watts, as would be the case when speaking of a large amount of power, is rather cumbersome, so engineers have got over this by calling 1,000 watts a kilowatt. One and a half kilowatts is simply 1,500 watts.

Volts multiplied by amperes, as you will remember from last week, takes into consideration driving force (pressure), the amount of electricity (coulombs) and time (seconds), so that mechanical and electrical power are very similar.

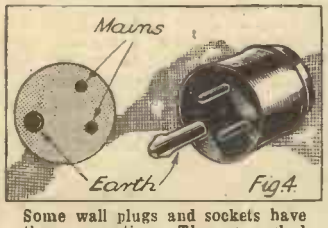
It is, in actual fact, quite easy to convert watts to horse-power because there are 746 watts in one electrical horse-power.

RADIO TERMS

(Continued from previous page.)

As the ammeter is a measurer of current, it is connected in series, so that all the current flowing in the circuit passes through it. A simple series connection is illustrated at Fig. 5. Practical notes on the choice of Ammeters and other electrical measuring instruments will appear under the heading "Meters."

THREE CONNECTIONS



Some wall plugs and sockets have three connections. The one marked earth is for joining to protective metal coverings on devices such as vacuum cleaners, etc.

Ampere.

The practical unit of Current. It is not a quantity measurement pure and simple, but is the unit of rate of flow, and can be compared with "gallons per second" in water engineering. Coulomb is the unit of quantity (think of this as the gallon), and one Coulomb flowing in one second equals one Ampere.

Ampere-Hour.

This is one of those convenient portmanteau terms. It is quite self-explanatory, providing you know what an Ampere is. If an accumulator is capable of providing one ampere of current for one hour (a small accumulator that would be, by the way), then that accumulator has a capacity of 1 Ampere-Hour. A 20-Ampere-Hour accumulator should be able to deliver 1 ampere for 20 hours, ½ ampere for 40 hours, and so on, although there are certain practical limitations which will be discussed when we come to the subject of Batteries.

The Ampere is, then, an electrical unit of quantity used for rating the capacities of accumulators.

Amplification Factor.

This indicates the maximum voltage amplification that can be given by a valve, and is the ratio of the change of anode voltage to the change of grid voltage that will provide the same anode-current change.

Supposing, for example, changing the anode volts from 100 to 110 altered the anode current from 8 to 9 milliamperes. That would be a 1-milliampere anode-current change. You then find the grid-volt change needed to result in a similar anode-current variation.

If it were 2 volts, then the amplification factor of the valve would be 10 : 2, and that is 5.

This amplification factor is based on the static characteristic of the valve and takes no account of working conditions. Therefore it must not be regarded as a direct indication of the "goodness" of a valve.

Replacing one valve for another having an amplification factor twice as great does not necessarily mean that, in practice, twice the amplification will result.

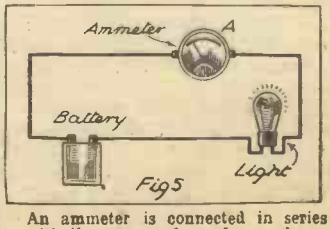
Amplifier (H.F.).

There are both high-frequency and low-frequency amplifiers. The former are usually styled H.F. units. They are not used nowadays to the extent they used to be. Their popularity was greater during that period when the screened-grid H.F. valve began to be universally used.

In fact, the H.F. unit bridged the gap between obsolescence and up to dateness for all those having detector L.F. types of sets.

Its object is, of course, to amplify the energy before it is rectified by the detector valve.

JOINED IN SERIES



An ammeter is connected in series with the source of supply, as shown in the above diagram.

Ohm's Law Simply Explained

PRESSURE, current and resistance are closely interlinked. In our previous articles we have shown how current is dependent upon the voltage or electro-motive force and also how the resistance of a wire affects the flow of current.

So far we have not used the word *conductor*. A conductor is a material which permits the flow of an electric current. Thus any material, such as a length of copper wire, is referred to as a conductor. There are also non-conductors of electricity.

These are materials which offer a very high resistance to the flow of electricity and are known as *insulators*. We mention this point because the words conductor and insulator will be used very freely in this series, and it is as well for the beginner to become acquainted with their meaning at this early stage.

Adding Resistance.

Now, resistance can be incidental or deliberate. That is to say, it can be the inherent property of a conductor, because every conductor—however good it is—possesses resistance to some extent.

Alternately, the resistance can be deliberately inserted in the path of the current. This is often done for special reasons and is common practice in radio.

A poor conducting material is a high resistance; hence it is quite easy to choose a suitable material and to insert it in a circuit so that it impedes the flow of current.

TAKING TAPPINGS

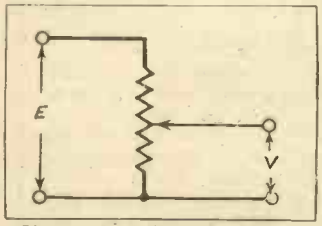


Fig. 1. One method of obtaining a desired voltage is to connect a resistance across the source of voltage (E). Then by means of a slider or plug and sockets the desired voltage (V) can be tapped off.

The unit of resistance is the ohm, and the law relating pressure, current and resistance is known as *Ohm's Law*.

Extremely Useful.

It is a very simple Law, but one which is of the greatest value to electrical and radio engineers.

By its use we are able to find out:

(*a*) How much current will flow when the voltage and resistance are known.

(*b*) What voltage will be needed to drive a given current through a known resistance.

(*c*) The resistance offered to the flow of current provided the value of the current and the electro-motive force are known.

Ohm's Law says that the current in amperes is equal to the electro-motive force (pressure in volts) divided by the resistance in ohms. It is usually expressed in the form I=E/R. I stands for current (always in amperes), E for electro-motive force (in volts) and R for resistance (in ohms).

There is one thing that you should remember when dealing with any calculations involving current. It is this: The current flowing is the same in every part of the circuit. That means that if you have a length of wire (a conductor) connected to a source of electricity, such as a battery, the value of the current will be the same in every part of that wire.

There is no decrease in one part and increase in another.

Now let us see how we can apply Ohm's Law to simple calculations

It is useful to employ small diagrams in connection with any little problems in resistance, current or voltage. They are a great help and enable one to picture in one's mind what is happening.

How They Are Drawn.

Resistances are normally represented by a zigzag line like those we show in the figure. If the line has an arrow passing through it, it means that the resistance is variable. A potentiometer is depicted like P in the diagram.

The best method of explaining Ohm's Law is to give practical examples. Suppose we do this now. Take, say, a battery which has a voltage of a 100 (an ordinary dry H.T. battery, for instance). Let us assume that the resistance of the conducting wire to which its terminals are joined is 25 ohms.

Ohm's Law tells us that the current in a wire is 3 amperes and the resistance of that wire 10 ohms.

An Example.

The voltage is equal to the current multiplied by the resistance, and in this case is three times ten, or 30 volts.

(E=IR; i.e. E=3×10=30.)

VOLTAGE DROP

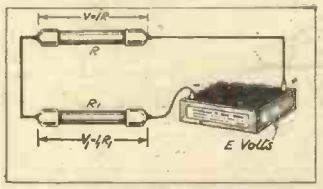


Fig. 2. When two resistances are joined so that the current flows through each in turn, voltages will be developed across them. The magnitude of the voltages will depend upon the value of the resistance and the current flowing.

We can now express Ohm's Law another way, this time to find the resistance. Suppose we have a battery of 100 volts available and we discover (after measurement with a suitable meter) that the current is 2 amperes.

The Law says that resistance equals volts divided by current (amperes). Thus we have one hundred divided by two, which equals 50 ohms.

$$(R=\frac{E}{I};\ \text{i.e.}\ R=100\div 2=50.)$$

Ohm's Law is particularly useful in radio for working out voltages which are developed across resistances. In Fig. 2 we show a battery giving E volts joined to two high resistances which have been deliberately inserted in the conducting wire. One of these resistances is shown as R and the other as R_1.

Now, the current will be the same through R as through R_1. We can assume for the purposes of explanation that it is one-hundredth of an ampere. We can also assume that R has a resistance of 1,000 ohms and R_1 2,000 ohms. E, the voltage of the battery, we will say is 30 volts—an easy value to work with.

DIFFERENT TYPES

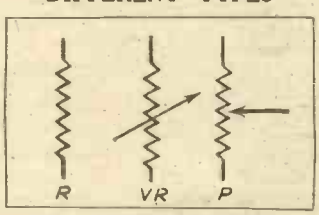


Fig. 3. In a theoretical diagram a resistance is represented by a zigzag line, as in R. VR is the method of showing a variable resistance, and P a potentiometer.

To find out the voltage (v.) developed across the resistance R (it is called the voltage drop) we multiply 1,000 by the current, which is one-hundredth of an ampere. The answer is 10 volts.

$$(V=IR;\ \text{i.e.}\ 1{,}000\times\frac{1}{100}=10.)$$

Similarly for R_1 we have V_1: the voltage drop equals 2,000 multiplied by one-hundredth which is 20 volts.

($V_1=IR$; i.e. 2,000×1-100=20.)

Ohm's Law is utilised in practice to a very large extent. In radio it is employed for finding the values of voltage-droping resistances. For example, suppose there is a voltage of 200, whereas the correct voltage for certain valves in the receiver is, say, 120.

Fractions of an Ampere.

We can easily find out from the makers of the valves what current they will consume at the voltage in question (120 volts). We then divide the voltage to be dropped, viz. 80 volts in this case, by the current in milliamperes, and multiply the answer by one thousand. This gives the value of the resistance required.

A milliampere is a thousandth of an ampere, and the H.T. current consumed by valves is expressed in milliamperes, because this is much more convenient than saying a hundredth or some other fraction of an ampere. A hundredth of an ampere is 10 milliamperes.

But in working out examples of Ohm's Law it is essential to keep the units correct. They must be volts, ohms and amperes.

Hence, if the current should happen to be in milliamperes, it must be divided by 1,000 to bring it to amperes.

A SIMPLE CIRCUIT

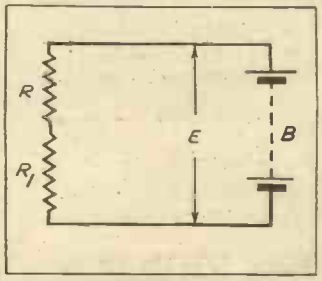


Fig. 4. This shows how the Fig. 2 arrangement would be depicted in the form of a theoretical diagram. B is the battery, R and R_1 are the two resistances.

Multiply by a Thousand.

In the case of the example for finding the resistance to drop a certain voltage, multiplying the answer by 1,000 after dividing by the number of milliamperes is the same as bringing the milliamperes to whatever fraction of an ampere they happen to be before dividing into 80.

All the interesting news and views of current short-wave practice.

THE "D J B Mystery" remains unsolved, although two or three readers have had different attempts at it. The most ingenious idea is that of "G. E. C." (Sheffield), who suggests that the big, steady station in the middle was W 8 X K, and that the little wobbly ones on either side were, respectively, D J B himself and W 2 X A D, all relaying the same programme!

It Might Happen.

I should be inclined to turn this down, because I have never yet found a night on which W 8 X K was strong and steady while W 2 X A D was weak and wobbly! But D J B certainly *does* broadcast to America sometimes, and such a thing might easily happen.

V. I. E. (Liverpool) suggests that it is the well-known phenomenon that sometimes occurs when a transmitter goes out of adjustment and radiates a series of "squiggles." Maybe; but there are generally more than two of the extraneous carrier-waves. So we won't worry about D J B any more.

The Story of Y V 2 A M.

I had hoped to illustrate this page with a picture of Y V 2 A M, the station that was not allowed to be "amateur" and had to become "broadcast." Unfortunately, the photograph was not quite good enough for reproduction. The story, though, is quite interesting.

Two young fellows in Maracaibo, Venezuela, wished to instal an amateur transmitting station, purely for communication with other "hams." But the Venezuelan Government stepped in and *restricted* them (my italics!) to broadcast work.

The result is that Y V 2 A M is now operating as a low-power broadcast station in the 40-metre amateur band. All short-wave fans in this country are asked to look out for these transmissions, on 42 metres, between noon and 3 p.m. on Sundays. Unfortunately, this is about the worst possible time to try to hear *anything* on 40 metres, thanks to our Continental friends, some of whom have strange ideas about modulation. But during a lull in the gramophone and vocal exhibition one might possibly hear something interesting.

Reports may be sent to me or to Mr. G. Edwards (G 2 U X), 159a, Hillingdon Street, London, S.E.17, to whom I am indebted for this brief description of his friends' adventures.

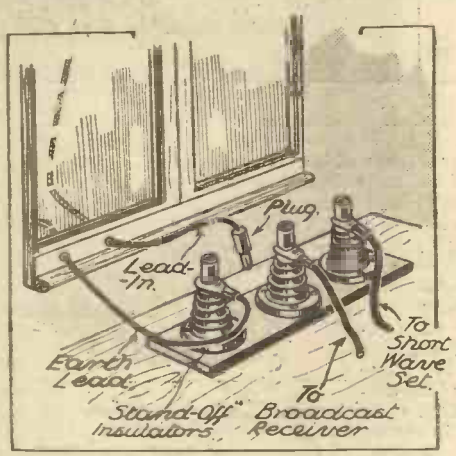
A Real Enthusiast.

N. P. (New Milton, Hants.) wants, among other things, two issues of "P.W." filled completely with short-wave articles! Very nice for those who like them, undoubtedly, but you must remember, N. P., that we are still a mere handful compared with the hosts and hosts of broadcast listeners.

As it is, "P.W." caters quite generously for the short-wave man. We can't expect to trespass too much on the other folk's preserves.

Your note about the separate reactor valve is interesting, as I happen to be playing with that very circuit at the present moment.

CHANGING OVER THE AERIAL



IT often happens that short-wave enthusiasts want to have at their disposal a ready means of changing over their one aerial from the short-wave set to the broadcast receiver, with a third position for "earthing" it.

An easy and efficient way of doing this is to do away with the usual double-pole double-throw switch and to use plugs and sockets instead. The lead-in is terminated in a banana plug, and three sockets—short-wave, broadcast and earth—can be mounted on a strip of ebonite.

Alternatively, "stand-off" insulators, with sockets fitted in their tops, can be used. This makes a very neat job of it. Naturally, there is no limit to the amount of switching that can be done in this way.

OVERCOMING DIFFICULTIES

Valuable tips for the home constructor and experimenter.

IMPROVISED TOOLS.

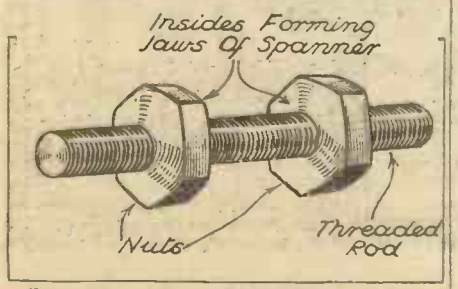
THE average constructor does not usually possess a kit of tools suitable for every wireless requirement, but in quite a number of cases excellent substitutes can be improvised by using other tools and parts available.

For instance, the sharp sides of the tang of a file can be utilised for reaming a hole in an ebonite or wooden panel, and the point of the tang can be used as a substitute for an awl to make the necessary holes in a baseboard for starting wood screws.

Similarly, an adjustable spanner can be quickly made by means of a threaded rod and two nuts, as shown in the accompanying sketch. One nut is fixed into position and the other is turned until the distance between them is equal to the width of the nut to be tightened.

The inside surfaces of the nuts then form a spanner and the "gadget" makes quite a good emergency tool in the absence of the genuine article.

AN ADJUSTABLE SPANNER



Two large nuts on a threaded rod can often be used to undo other nuts.

PREVENTING VIBRATION.

TROUBLES due to box resonance are often experienced when a speaker is mounted in a cabinet. These can be largely overcome by adopting one of the special forms of cabinet baffles.

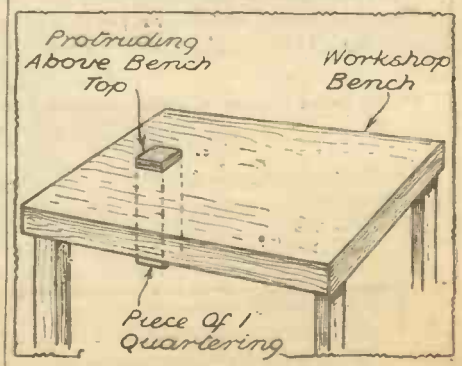
In some cases a rattling effect is caused by the mounting rim of the speaker vibrating and so rubbing against the baffle. This can be prevented by placing a ring of felt or sponge rubber between the speaker mounting rim and the baffle. The fixing bolts or screws will pass through this rubber, but they must not be tightened too much.

FITTING A BENCH STOP.

MOST workshop benches are provided with a suitable bench stop, but in some instances where this is not included one can very easily be fitted with the aid of a 1-in. wood chisel and a piece of 1-in. quartering.

A hole 1 in. square is first of all cut in the bench top, as shown in the diagram. The quartering is now inserted until the portion above the bench top is sufficient to meet the individual requirements of the constructor. When not in use the quartering can be lowered into the bench.

SIMPLE TO ARRANGE



Making a stop for your bench.

COLUMBIA create RADIOGRAM SENSATION!

A Standard COLUMBIA RADIOGRAM FOR 23 GUINEAS

EUROPE'S LARGEST RADIO FACTORY IS YOUR PLEDGE OF COLUMBIA'S RELIABILITY

Hundreds of these instruments have been sold in the past few weeks. Hundreds of people are enjoying for the first time the delights of a luxury radiogram — combining both radio and gramophone in one cabinet — all the worth-while stations, plus electrical reproduction of your own records. And the reason why they are buying this model is simply that never before have Columbia made such an instrument at such a price. Have you got yours yet? If you have promised yourself a radio-gramophone 'some day,' NOW is your chance to get it! Remember that this model, No. 620, is a standard product of the Columbia factory — proved by 1093 tests. Ask to hear it! Write for literature.

SPECIAL FEATURES. 1. Band-pass circuit. 2. Flood-lit scale calibrated in wavelengths with station-finder. 3. Energised moving-coil speaker. 4. Provision for additional speaker. Pick-up with reversible head, for easy needle-change. 6. Universal automatic brake. 7. Volume control common to both radio and gramophone. 8. Induction motor. 9. One knob tuning with induction gear. 10. Three aerial tappings. 11. Mains aerial device. 12. Low running costs.

-AND FOR THOSE HOMES WITHOUT ELECTRICITY

A NEW BATTERY RADIOGRAM *with all-mains performance*

AMAZES THE EXPERTS! Embodying the new principle of Constant Quality Amplification (C.Q.A.) this new Columbia Model No. 1003 demonstrates for the first time that a Battery Radiogram can be the full equivalent of an all-mains instrument in its volume and quality of reproduction. Ask to hear the Columbia C.Q.A. Battery Radiograph. Price 20 GNS. or by hire purchase.

Columbia

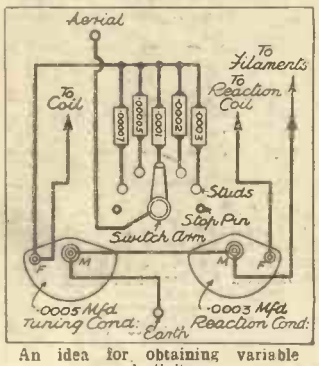
RADIO AND RADIO-GRAPHOPHONES

The Columbia Graphophone Co., Ltd., (Dept. P W 181133) Clerkenwell Rd., E.C.1

A TUNING TIP.

THE following idea, which I have fitted on to my panel, works very satisfactorily. It comprises an old switch arm and five studs, with two stop pins attached to studs.

I am using five fixed condensers of different capacities; they are: ·00007, ·00005, ·0001, ·0002 and ·0003. When I tune in on Stud No. 1 I get the local station well down the dial, about 20° giving me a choice of stations further up; then, by turning switch arm to Stud No. 5, I get the local 50° or 60° higher up, allowing me to tune in Athlone, North Regional and others, which I could not get when using one condenser in series.



An idea for obtaining variable selectivity.

I can also make contact with two studs, bringing the switch arm between them, getting various readings. I can set the switch arm on any stud and know just exactly where stations come in. On Stud No. 2 I get two or three stations below Radio Normandie, which I also get on same stud very clearly. My set is a three-valve battery-operated, and my aerial is a spring mattress.

I have been a constant reader of your paper for years, and hope that this little wrinkle will prove worthy of your attention.

ADDING A MILLIAMMETER.

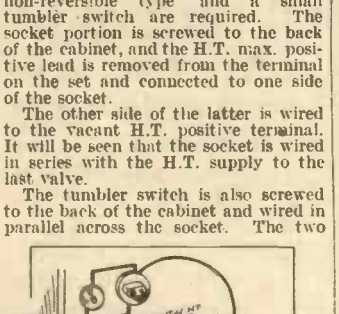
IT is often desired to connect a milliammeter in the anode circuit of the last valve of a set to trace overloading, etc., and I have found the following device very useful:

A two-pin plug and socket of the non-reversible type and a small tumbler switch are required. The socket portion is screwed to the back of the cabinet, and the H.T. max. positive lead is removed from the terminal on the set and connected to one side of the socket.

The other side of the latter is wired to the vacant H.T. positive terminal. It will be seen that the socket is wired in series with the H.T. supply to the last valve.

The tumbler switch is also screwed to the back of the cabinet and wired in parallel across the socket. The two terminals of the milliammeter are connected by pieces of flex to the plug portion.

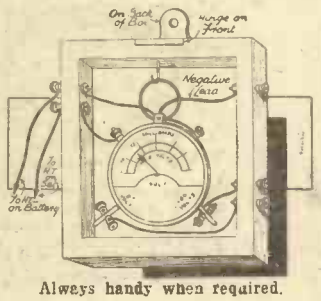
If the plug is inserted in the socket and tumbler switch opened the milliammeter will register the anode current of the last valve; when the reading has been taken the switch can be closed and the set functions in the normal manner. If the needle of the milliammeter kicks downwards the flexes leading to the plug should be reversed.



A simple method of testing for valve overloading.

HANDY FOR TESTING.

THE sketch below will be found quite the thing for anybody who has one of those voltmeters that one cannot fix on the set. I have made a box with a glass front (which can be lifted up if required). The meter is hung on a cup hook, and all terminals from meter are connected by wire to phone terminals screwed on to the box.

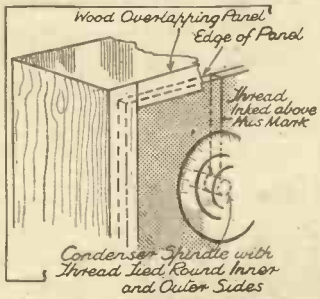


Always handy when required.

I have this meter fixed on to the wall above the set, so I can quite easily see if the set is working O.K. For testing batteries you only need two flex leads which are joined to the requisite terminals on the meter.

"HAIR-LINE" TUNING.

A GOOD method to effect "hair-line" tuning, with the advantage of not damaging the panel, is as follows:



This scheme will help you in locating the various stations.

Tie the end of a thin piece of white thread to the inner side of the condenser spindle, carry this thread over the top of the panel and tie the remaining end to the outer side of the condenser spindle—i.e. close to the panel.

After replacing the dial, leave ¼ to ½ an inch of the thread as it is, and blacken the remainder with ink. Being close to the panel, the blackened part of the thread is practically unseen, and the short white part stands out clear and thin against the panel.

A HANDBRACE GRINDER.

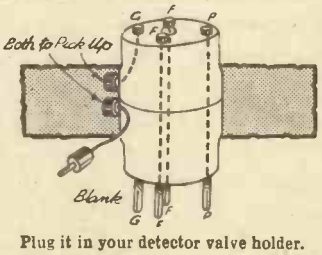
THE ordinary handbrace when gripped in the vice forms a very useful tool. It can be used for tapping small nuts and also holes in small jobs. It can be used for polishing small jobs such as valve legs, terminals and for lacquering.

Small jobs can be filed up as in a lathe. But if you have a geared handbrace, obtain a small emery or carborundum wheel and mount it on a small spindle which will suit the brace chuck. If the wheel is about six inches in diameter a good speed can be obtained and many small jobs can be ground up.

FITTING A PICK-UP.

PROCURE two valve bases, take out the four pins of one of them, and in the holes left by the pins insert four sockets.

Drill an eighth of an inch hole through the middle of both bases and insert a bolt to keep them together. Before bolting them together wire up as follows: plate pin to plate socket, filament to filament, pins to sockets; the grid pin leave blank.



Plug it in your detector valve holder.

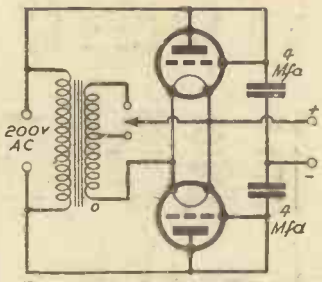
Drill two holes in the side of the base which has the sockets and insert two terminals. Join one of the terminals to grid socket. And to the other terminal fix a length of flex with a wander-plug for giving detector valve 1½-volts grid bias.

When made take out the detector valve from set, insert adaptor in holder, then put valve in the adaptor.

TRY THIS RECTIFIER.

A VERY useful circuit for obtaining D.C. from A.C. mains is shown in the figure. This circuit is only suitable for energising moving-coil speakers of the high-resistance type, as no transformer is connected between the mains and the D.C. output.

The valves used are any old ones that may come to hand; the transformer is an ordinary bell type, costing about 3s. 6d. If the valves are 2-volters they should be connected in series and the 4-volt tapping on the transformer secondary used (this is generally very clearly marked); if 4-volt valves, connect in parallel and use the same tapping.

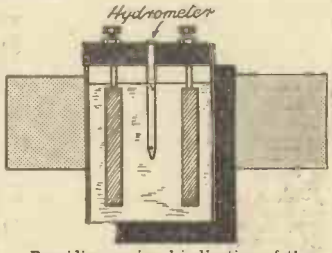


For mains-energised moving-coil loudspeakers.

The condensers should be of the high-voltage-working type and of 4-mfd. each.

AN L.T. INDICATOR.

OWNERS of those small accumulators containing two or three plates only can easily fit this simple indicator:



Providing a visual indication of the state of your L.T.

Obtain a small "three-ball" hydrometer (this costs only a few coppers) from any wireless trader. Empty the acid from the accumulator into a jar or other receptacle. A hole is then bored in the pitch or composition top of the accumulator just large enough to take the glass tube of hydrometer.

Fix this in with a little seccotine so that the top of it is just level with the surface of the top of the container. Wash out the accumulator, replace the acid, drop the three balls into the tube and you have a charge indicator which is easily read, unbreakable and always there when you want it.

LOUDSPEAKER FRETS.

HAVING been experimenting with a number of different speakers on baffleboards or in cabinets, I have often wanted some silk, etc., to place behind the fret and keep dust off the cone, etc.; but as the womenfolk generally kept the workbox locked up I had to devise a scheme to save journeys to drapers to buy odd pieces.

This scheme will even save troubling to cut fancy frets in your baffleboards: Obtain a piece of ordinary lace curtain, of close mesh, large enough to cover the circular or square aperture in the baffle, and fasten it by drawing pins over a piece of stiff brown paper and keep it taut and flat.

Then paint it with ordinary gold or aluminium paint and leave it to dry thoroughly. The varnish or spirit in the gold paint will make the piece of curtain dry stiff, and if the curtain is "patterned" the result is very pretty.

(*Continued on next page.*)

ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear?

The best Wrinkle last week was sent by Mr. J. Cuttle, 75, Russell Road, Buckhurst Hill, Essex.

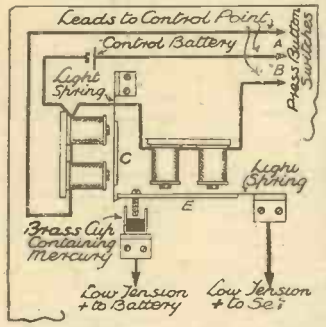
RECOMMENDED WRINKLES

(Continued from previous page.)

A REMOTE CONTROL.

HERE are details of a remote-controlled switch for operating a wireless set from some distant point. The diagram explains itself. Two old electric bells will supply nearly all the parts, or they can be made separately.

The resistance of each pair of coils is 15 ohms; hence, using a 6-volt control battery, the consumption is only ·4 amps. Three wires are run to the control point; if the loudspeaker is in same room as control the 'speaker leads may be utilised.



For switching your set at a distance.

To switch the set on, press button A. This causes the left-hand pair of coils to become magnetised and they momentarily attract the armature C, thus allowing the armature E to fall and make contact with the mercury.

To switch off, press button B. This lifts the armature E clear of the mercury, and it is held in this position by the armature C, with which it automatically engages.

As current only flows when either switch is pressed the consumption is very low.

GLASS PANELS.

HERE is a tip for those readers who would like a glass panel to their set:

Obtain a piece of glass of the required size and ¼ in. or ⅜ in. thick. Make a paper template the size of the panel and mark the holes required on this.

Next get a small three-cornered file and grind the sides of this down until it comes to a sharp point, as illustrated below.

Home-made tools for drilling glass.

Put the glass on a *flat* surface with a sheet or two of paper underneath; put on the template and mark the centres of the holes with point of the file. Very little pressure is required if the file is sharp.

Now get some turpentine and powdered camphor and apply a little of each on the place to be drilled, and drill with the file. Keep applying the turpentine and camphor as it dries up.

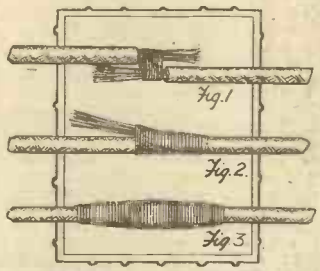
Do not rotate the "drill" too quickly and don't press too hard. Holes may be countersunk by the same method with a file broken in two and one end ground as shown. Any kind of brace will do.

A GOOD JOINT.

HERE'S a joint for stranded wire that is really neat. Every single strand makes good contact with both wires, and it will stand as much pulling as the wire itself.

Lay the two pieces of wire together, overlapping about 2 in. Take a single strand and bind it tight round both wires (Fig. 1). Follow down with all strands, binding them one at a time, and tighten with pliers.

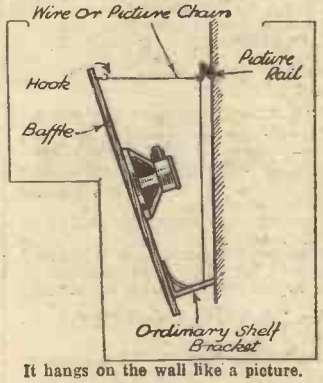
You then get the same effect as in Fig. 2. Now do the same the other side, and you get a joint that *is* a joint.



An ideal method of ensuring good connections between stranded conductors.

SUSPENDING YOUR SPEAKER.

TWO ordinary hooks are screwed in the baffle about 6 ins. from the top, and then two ordinary shelf brackets are fitted about 6 ins. from the bottom. Then I fixed some picture chain from the brackets to the screws, and at a convenient place fastened it to two hooks in the picture moulding. This enables the speaker to be kept away from the wall.



It hangs on the wall like a picture.

A WATER-SPOUT AERIAL.

I KNOW it is against ordinary practice, but a temporary aerial I had to rig up has astounded me by the results, and, if anything, I am greatly surprised to find quality has improved, and this is the verdict of the household. My aerial pole will not be re-erected.

As alterations were being made in the garden, my aerial (iron mast) had to be taken down for a while. Wondering whether to get a temporary strut screwed up to the top of bedroom window to get "height," I noticed that a downspout passing down the wall near my aerial lead-in was fastened to wood staples, about 6 in. from the house wall, and with the length of roof gutter formed a "T" of about 40 ft. I therefore clamped a piece of copper round the pipe near the window and screwed the lead-in wire to the circular copper band.

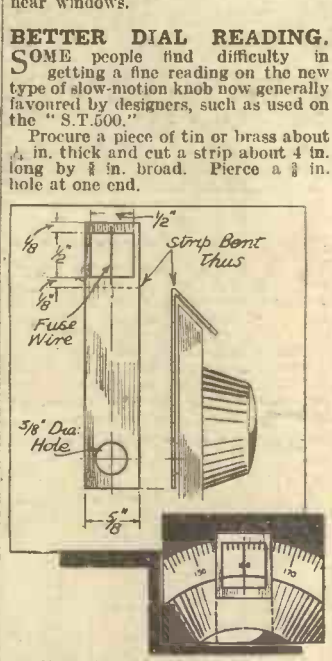
When I first tried it, the weather was fine, and had been so for some days, but I was surprised to find that by some means or other the quality had improved (energised moving-coil speaker), and also less reaction was required on foreigners. Downspout finishes about a foot from ground. In fact, the set appears 30 per cent louder. Then, again, in wet weather there is no loss through leakage by the downspout being so near to the house, and thus causing leakage to earth.

The above wrinkle may be a boon to flat dwellers who do not want to fit up an inside aerial round the ceiling, but want the effect of an outside aerial. There is nearly always a downspout near windows.

BETTER DIAL READING.

SOME people find difficulty in getting a fine reading on the new type of slow-motion knob now generally favoured by designers, such as used on the "S.T.500."

Procure a piece of tin or brass about ¼ in. thick and cut a strip about 4 in. long by ⅝ in. broad. Pierce a ⅛ in. hole at one end.



It provides very accurate tuning.

Remove knob from set and secure this strip below the fixing nut of condenser. Replace knob and mark a line where the circumference cuts the strip.

Remove strip from panel and make an aperture about ⅛ in. square, ⅛ in. away from this line, and cut strip off ⅛ in. away from side of square hole.

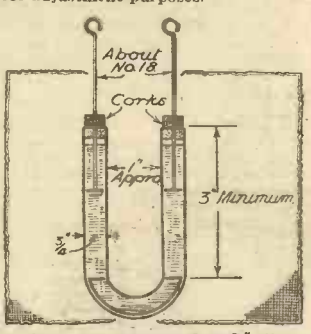
Fix a strip of fuse wire across aperture, with the length of the strip, replace strip on panel and then replace knob and bend the strip over at mark where it cuts circumference.

This forms an excellent hair-line visor for an awkward control and saves scratching the polished ebonite panel.

LIQUID RESISTANCES.

LIQUID type resistances can be conveniently and cheaply made by most amateurs.

Obtain a glass U tube, four or five inches in depth and ¼-inch diameter. Solder two electrodes of thin copper, say ½-inch diameter, on to the ends of stiffish tinned copper wires. The wires may be run through corks which are to fit into the top ends of the U tube, and should be arranged to slide up or down for adjustment purposes.



You can make variable resistances of any value.

The sketch shows the apparatus in simple form. Mount the tube in any suitable way for convenience.

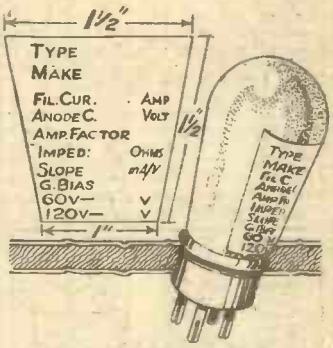
The liquid mixture will depend on the ohmic values of the resistances required. As a guide, mix one grain of salt in a gallon of *distilled* water. This solution will give a resistance of about 6,250 ohms for every inch of liquid between the electrodes in a tube of ¼-in. diameter.

The above mixture can, of course, be diluted or strengthened so that resistances may be obtained from quite low values up to a megohm or more as required.

A NEAT VALVE LABEL.

THE trouble and annoyance experienced when the type letters on a valve have become indistinct may be overcome by gumming a slip of paper on to the glass part of the valve, as shown in the accompanying sketch.

The characteristics, etc., should be written on the paper before gumming; and as the hand will not touch it when inserting or withdrawing the valve from its socket, it will not become finger-marked, as would a strip gummed around the base.



All the particulars you need are always available.

EMERGENCY CONDENSERS

VERY often a condenser of small value is required for a temporary job, and nine times out of ten the experimenter has to waste valuable time hunting in his junk box for one near the required value.

Here is a wrinkle for making condensers out of quite commonplace articles.

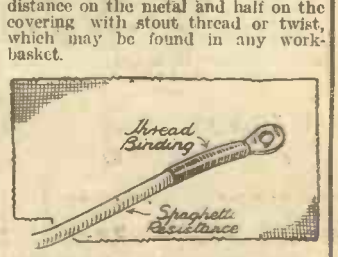
The materials required are: a common lead pencil, tinfoil from a cigarette packet, paper, and some bare wire.

The tinfoil is wrapped round the pencil and paper of any description, or any other insulating material is wrapped round the foil. The whole is then surmounted by another layer of foil which is tied in position with string or even an elastic band. The two sheets of foil are the two plates of the condenser, and depending on what material is used for the dielectric the capacity is approximately ·0001-mfd. per 1 in. of length.

There are many variations of this idea. For instance, the outside piece of foil could be replaced by bare copper wire wound round the pencil; but if this is done it is necessary to ensure that all turns are in intimate contact. This can only be done by soldering. If more time is spent on their manufacture good, permanent, and efficient condensers can be made on these lines.

STRENGTHENING SPAGHETTIS.

SPAGHETTI resistances may be considerably strengthened at their weakest point—that is, where they enter the metal ends—by binding these ends for about an inch, half of this distance on the metal and half on the covering with stout thread or twist, which may be found in any workbasket.



Binding thread round the ends strengthens them considerably.

This will take the strain and prevent an abrupt bend when carelessly placed under a terminal and screwed down.

BRITISH RADIOGRAM

B.R.G. PROVED KIT FOR THE S.T. 500

READ WHAT THIS SATISFIED CUSTOMER writes:

Liverpool.

Dear Sir,

I feel that you deserve more than a little praise for the wonderful S.T.500 Set I now have, assembled from a B.R.G. Kit of Parts. After reading what Mr. John Scott-Taggart said about it in "Popular Wireless," I came to the conclusion that the S.T.500 was ideal for my purpose and, upon the recommendation of a wireless expert, I purchased your Kit from Mr. ————, a shop in this City. I connected it up and think you will be pleased to hear that I have already received more than 30 stations at full loudspeaker strength. My expert friend was surprised that such a good performance could be obtained with a set assembled at home. I am recommending your firm to all my friends. Please send me the B.R.G. Accumulator for it will come in as a useful spare when my own is being charged.

Yours faithfully,
J. B.

MATCHED
TESTED
GUARANTEED

● ***DEALERS! B.R.G. are the largest WHOLESALE stockists of Mr. John Scott-Taggart's First Specified Parts.***

Immediate Delivery. Two trade references with initial order for ledger account

READ THIS AMAZING S.T.500 OFFER

Every Sealed B.R.G. S.T.500 Kit contains a coupon which entitles you upon request to a B.R.G. Guaranteed Long Life 2-volt Accumulator.

COMPLETE KIT
£4-10-0
Excluding Valves and Cabinet

● COMPRISES: High Grade Tested Components, including Colvern, W.B., Graham Farish and Erie; all Terminals, Connecting Wire, Plugs, Screws, Metaplex Baseboard, Ready-drilled Ebonite Panel and Terminal Strip **with S.T. 500 issue of "Popular Wireless," and Full-Size Blue Print.**

COLVERN COILS AS SPECIFIED

B.R.G. KITS ARE OBTAINABLE FROM EVERY DEALER.

In cases of difficulty, write direct to:

BRITISH RADIO GRAMOPHONE CO. LTD. PILOT HOUSE, CHURCH STREET, STOKE NEWINGTON, N.16.

WHOLESALE DISTRIBUTORS FOR PILOT AUTHOR KITS, SPECIFIED METAPLEX BASEBOARDS AND TELSEN PRODUCTS.

ANOTHER B.R.G. S.T. RADIO KIT

Important Notice

The M-O. VALVE COMPANY Limited,

who are the Manufacturers of "Catkin" Valves and Registered Proprietors of the Trade Mark "Catkin", No. 535589 and also the Registered Proprietors of Letters Patent No. 378994 give notice to all whom it may concern that in an Action in the High Court of Justice (Chancery Division) between The M-O. Valve Co. Ltd., Plaintiffs, and Super Radio Company (Bradford) Ltd. of 39 Bank Street, Bradford, and the Super Radio Company of 2 Bank Street, Bradford, Defendants (1933, M. No. 2966), upon Motion for an Injunction, the Plaintiffs and the Defendants agreeing by their Counsel that the Motion should be treated as a Motion for Judgment and consenting to that Judgment, the Court granted to The M-O. Valve Co. Ltd. on the 10th October, 1933, an **Injunction** for the life of Letters Patent No. 378994 restraining the Defendants from infringing such Letters Patent by advertising, offering for sale or selling valves manufactured pursuant to the said Letters Patent at prices below the prices fixed by the Plaintiffs.

The Court also awarded The M-O. Valve Co. Ltd. **Costs** and directed an enquiry as to **Damages.**

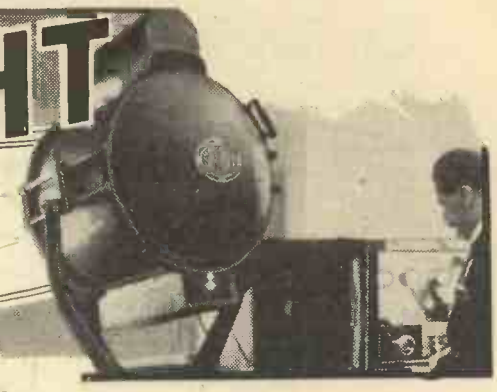
THE TRADE AND PUBLIC ARE WARNED

that "Catkin" Valves are manufactured under certain Letters Patent (including the said Letters Patent No. 378994) the property of The M-O. Valve Co. Ltd., and such Valves are only licensed for resale in accordance with the conditions of the Limited Licence particulars of which are printed on every carton. Any sale of such a valve in breach of these conditions constitutes an infringement of the Letters Patent and renders the seller liable to an action for damages.

Announcement of The M-O. Valve Co. Ltd.,
Electra House, Victoria Embankment, W.C.2.

Proprietors : THE GENERAL ELECTRIC CO. LTD. AND MARCONI'S WIRELESS TELEGRAPH CO. LTD.

SEARCHLIGHT RADIO



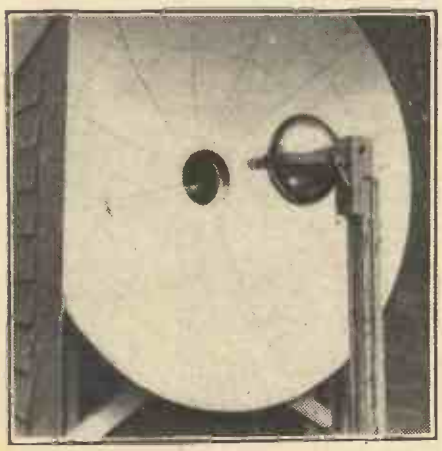
By G. S. MARLEY

Transmission on a wavelength of about ·6 of a metre is receiving a great deal of attention at present, but do you know that this wave was used as long ago as 1888 ? That is but one of the interesting facts our contributor reveals in his absorbing article on micro-waves, as they are termed.

IN some respects radio is getting back to where it was in 1888. That may sound rather incredible to those who imagine that it started about the time of the War. Yet one of the "newest" developments (in fact, one of those blazed abroad by the daily Press as a "New Wireless Wonder") is actually in essence the very oldest, going back nearly half a century.

Every year recently has seen tracts of shorter and shorter wavelengths opened up and put into service, and the tendency is to think of them as regions where, as the Irishman said, "the hand of man has never left his footprints." Ten years ago 100-metre transmission was something of a novelty; this year 5-metre working is common. But Marconi's experiments have resulted in 0·6-metre wireless being adopted as a standard method for certain duties—a frequency of 500,000 kilocycles per second!

A SOLID REFLECTOR



The cross-Channel telephony transmitter, which was installed for communication from Dover to Calais at the beginning of this year, operated on a wavelength around 18 centimetres and employed this solid-type reflector. It is interesting to compare it with the open type for ·6 metre shown on the next page.

These micro-waves, as they are called, are reflected like beams of light from a searchlight; and it was just in that very way that Hertz, nearly 50 years ago, demonstrated that wireless waves are similar to light, only of relatively long wavelength.

This type of communication must not be confused with "beam" wireless, which has been in use for a number of years for trans-oceanic work. It is true that reflectors are used in the beam system, but they work on an entirely different principle from, say, the parabolic reflector in a motor-car headlight, and really constitute a special type of aerial, requiring a large expanse of ground for erection. The micro-wave reflector can be carried about in pieces and set up in an hour or two; one was shown on the Post Office stand at Olympia this year.

A "Herring-Bone" Affair.

It is a parabolic reflector, but instead of a continuous metal surface such as is necessary for concentrating light (which has a wavelength of only about 0·0005 *millimetre*), a sort of herring-bone is used, formed of a number of straight copper tubes about a foot long, supported by a copper "backbone" bent into a parabola. The whole thing is supported on a teak and glass-tube framework, and could be got into an ordinary room.

This sort of reflector is effective only when the wavelength is considerably smaller than the reflector's dimensions. If, for example, the same thing were attempted on the ordinary broadcast wavelengths, say 300 metres, the reflector would require to be at least a mile high; which would involve serious practical difficulties!

But micro-waves have the advantage that the cost of the aerial system is almost negligible compared with that needed for a long-wave station, or even a beam transmitter with its elaborate arrays of suspended wires. Moreover, it is quite easy, if necessary, to move the reflector about; in fact, it is a true radio "searchlight" and can be "shot" in any desired direction. The radiation in other directions is so small that secrecy is practically assured. And, of course, it is obviously a tremendous economy in cases where reception is wanted only at one point. By contrast, the ordinary method is like filling a glass by flooding the whole house.

Two Main Reasons.

You may ask why, if this ultra-short wave reflector system was known in 1888, it is only just being turned to good account in 1933. There are two main reasons. The first is that it was supposed that the range was limited to visual distance. And for such ranges there are usually other more convenient ways of communicating from point to point.

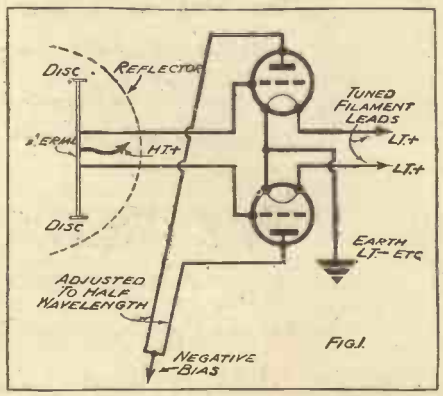
Recent tests up to nearly 200 miles seem to show that the theory has gone wrong somewhere. You remember that until Marconi received signals across the Atlantic it was confidently declared to be quite impossible to communicate more than about 60 miles on *any* wavelength. It looks as if history has repeated itself once again.

Improved Methods.

Then—and this is probably why the foregoing fact has only just been discovered—the early methods of generating and receiving signals were very crude and feeble, and more modern methods have hitherto been inapplicable.

You see, the ordinary valve, with all the persuasion in the world, cannot be hustled to generate much more than 200,000 kc. per second—the electrons simply cannot cross from filament to anode quickly enough—and so quite another type

TUNED WIRING IS USED



In order to allow the two valves (which are joined together in a sort of push-pull circuit) to oscillate, the connecting leads have to be tuned in accordance with the wavelength in use.

of valve is used, although even yet there is a good deal of disagreement as to exactly how it works. Still, it does work; and that is the main thing.

It is not very efficient as valves go. Only about 5 per cent of the power supplied to the filament and grid finds its way out as useful radiation. The filament is rather a heavy one, taking 4 amps., and the grid is made *positive* and connected up to the aerial. The anode, on the other hand, is relatively idle and is given a negative bias.

Great trouble has been experienced in getting a valve to stand up to the fierce electronic bombardment of the grid while

(*Continued on next page.*)

SEARCHLIGHT RADIO

(Continued from previous page.)

turning out enough power to be useful. The radiation is only 1½ watts—rather a contrast to the thousands of watts from broadcasting stations—and to get more a number of units must be coupled up together.

Research is still proceeding, and will probably solve the problem of combining efficiency and long life in a higher-powered valve. Even the present valves are not happy unless a constant blast of cold air is fed on to them from a motor-driven blower. The power for the valves comes from batteries.

Special Arrangements.

As you may imagine, the ordinary coils and variable condensers are useless at these wavelengths. Strange to say, the wavelength is controlled by the *voltages* applied to the filament and grid. In order to oscillate at all, however, the leads to all electrodes must be tuned by making them of a certain definite length. Two valves are joined together in a sort of push-pull circuit (Fig. 1).

The aerial is only a few inches long, with discs at each end not much larger than pennies. This aerial system can be adjusted to the focus of the reflector, just like the lamp bulb in a motor-car headlight (which, by the way, consumes somewhere about the same amount of power as the transmitter).

In contrast to these somewhat unconventional arrangements, the control panels are mounted in very businesslike vertical rack formation, with meters for checking the valve operation, numerous rheostats and potentiometers for critically adjusting the supply voltages, and amplifier and telephone equipment for linking to the ordinary land line or for local speaking as required.

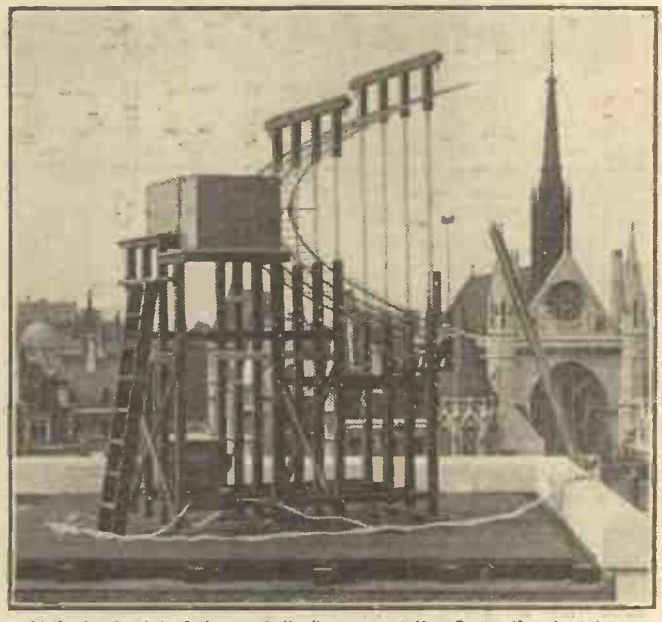
The system is particularly suitable as a wireless link in a telephone system where a line or cable would be more expensive. There are islands separated by comparatively narrow but very deep channels, where the cost of a cable would be unreasonable, and ordinary wireless also very costly, and not secret without the use of special elaborate equipment.

To check the wavelength another little rod-and-disc aerial is mounted in the path of the beam emerging from the reflector. When the wavelength resonates with this a large amount flows to and fro in it and heats up a thermo-junction, which gives a deflection on a milliammeter.

The receiver, too, is very different from what we are accustomed to. Those of you who do short-wave work know very well that one of the chief difficulties is the extremely fine adjustment of wavelength necessary to keep a signal in tune. On a 0·6-metre wave a change in wavelength of one part in 50,000 is 10,000 cycles per second—enough to make a beat note go practically out of audibility. And, of course, ordinary valve circuits are quite impossible, just as they are at the transmitting end.

So the receiver is very much the same as the transmitter, and the super-regenerative system is used partly because it is the only one that can be made to work at all effectively, and partly because it is less selective. The latter might hardly seem an *advantage*, unless it is remembered that the question of interference, either "man-made" or atmospheric, does not arise.

THE AERIAL SYSTEM FOR MICRO-WAVES



At the focal point of the parabolic "open-work" reflector the short transmitting aerial with its round disc ends can be seen. This particular aerial system has been erected on the roof of the new Marconi building on the Embankment.

How It Works.

Oscillation of the receiver is quenched and restarted about 10 million times a second by feeding a local 30-metre wave to the valve; and as the growth of oscillation in these circumstances is dependent on the distant signal, reception is obtained and can be amplified up in the usual way.

To emphasise the insignificance of the selectivity problem it may be noted that between 0·5 and 0·6 metres there is room for 100 times as many channels as the whole broadcast waveband! And that takes no account of the relatively short range and the beam concentration which would enable unlimited stations to work independently on the same wave if they wanted to.

AVOIDING RADIO RISKS

By B. WILLIS.

Some practical hints on safeguarding your set.

BY taking a few simple precautions against accidental damage you can avoid a good many radio troubles and, at the same time, cut down costs by minimising the need for replacements.

Valves are obviously the most vital items in a set, and also, perhaps, the most vulnerable. As they are comparatively expensive to replace, especially so in the case of the more elaborate types such as screen grids, pentodes, etc., it behoves you to avoid exposing them to any risks that may impair their efficiency or shorten their lives.

Removing Valves.

Mechanical damage can be avoided by exercising reasonable care in handling the valves. Beginners may need to be reminded that one should always make a point of gripping the moulded base or cap of a valve (other than the catkin type) when withdrawing it from its holder, especially if the valve pins are a tight fit in the sockets. Pulling the valve out by means of the glass bulb may loosen the cement securing the glass to the base, and break the internal connections to the legs.

Similarly, in the case of screen-grid valves the lead to the terminal on top of the valve should be so arranged that it is not liable to be jerked or tugged accidentally, as any such strain may easily pull the terminal mount off the glass bulb and sever the concealed wire.

The high-tension battery is, of course, another vulnerable accessory that can be ruined very easily by momentary carelessness unless suitable precautions are taken. Fuses afford a cheap and simple means of safeguarding an expensive battery against the sometimes disastrous consequences of "shorts," etc.

Separate Fuses.

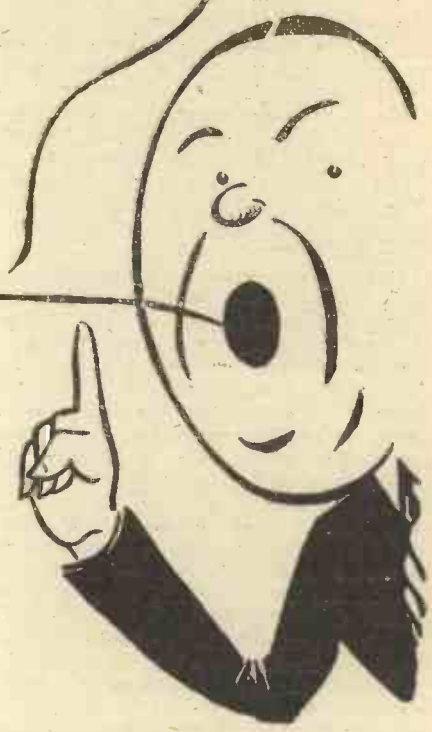
If there are several positive H.T. leads going to intermediate tappings on the battery it is usually worth while to insert a separate fuse in each, to prevent damage to a section of the battery in the event of a "short" occurring between two of the positive leads. Where, however, no tappings at intermediate voltages are in use, the usual single fuse in the H.T. negative lead is sufficient.

Of course, one should never pull out the G.B. wander-plugs while the set is in operation; it should always be switched off before making any adjustments to the grid bias. But an equally important point to remember is that any accidental breakage in the grid circuit that results in the interruption of grid bias will have exactly the same consequences as the deliberate removal of a G.B. wander-plug.

A Safety Condenser.

To avoid blowing out fuses through reaction condenser plates "shorting" the H.T. supply to earth, it is generally advisable to connect a fixed condenser (say ·002 mfd. or more) in series with the reaction condenser. If the latter is of the differential type the "safety" condenser should be so placed that it safeguards both sections of the differential.

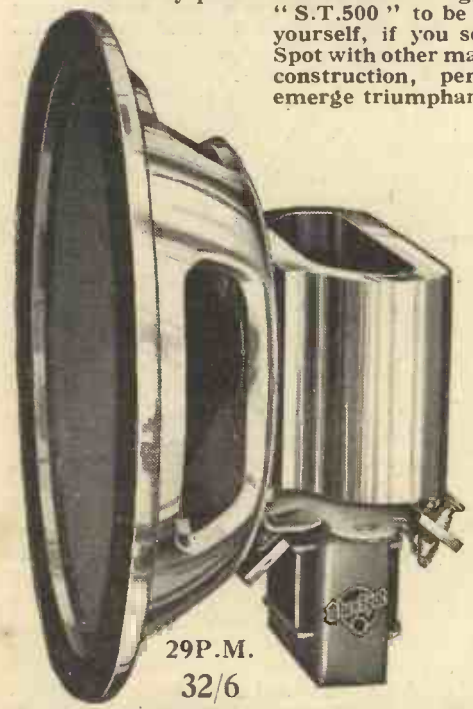
Don't Forget—
Blue Spot Speakers are
SCOTT TAGGART'S
FIRST CHOICE
for his S.T. 500



NOT only did Scott-Taggart place on record his high opinion of Blue Spot Speakers by choosing them FIRST AND FOREMOST for his "S.T.500" (the STAR set of the year), but he also recommends Blue Spot Speakers for his other set—"S.T. SUPER." Such is the reward of quality.

Blue Spot put their faith in deeds rather than words. They designed Blue Spot Speakers to be the last word in the science of modern sound reproduction. They set the seal of quality on their achievement by using the very best materials and a standard of construction which is the highest in the industry.

The result is there for all to hear in a range of speakers unequalled on every point. Follow Scott-Taggart's advice if you want your "S.T.500" to be a real success. Check up for yourself, if you so desire, by comparing Blue Spot with other makes. On any test—appearance, construction, performance—Blue Spot will emerge triumphant.



29P.M.
32/6

MOVING COIL SPEAKERS

29P.M. 32/6 45P.M. 45/- 99P.M. 59/6

available in cabinet form and without transformer if desired.

OTHER TYPES 12/6 - 42/-

CLASS B

66RB 30/- · Cabinet 44RB 42/-

S.T. 500
will operate
SEVERAL SPEAKERS

Make the most of your S.T.500. Instal Blue Spot Speakers in your Dining Room, Kitchen, Bedroom, etc., and have music everywhere.

22 P.M.
(29 P.M. Movement) 45/-.

Blue Spot
REGISTERED TRADE MARK

See advt. on page 519.

THE BRITISH BLUE SPOT COMPANY LTD

BLUE SPOT HOUSE · 94/96 ROSOMAN STREET · ROSEBERY AVENUE · LONDON · E.C.1

Telephone: Clerkenwell 3570. *Telegrams: "Bluospot, Isling, London."*

Distributors for Northern England, Scotland and Wales: H. C. RAWSON (Sheffield and London) Ltd., 100 London Road, Sheffield; 22 St. Mary's Parsonage, Manchester; 177 Westgate Road, Newcastle-upon-Tyne; 37, 38, 39 Clyde Place, Glasgow.

CUT COUPON FOR CATALOGUE No. P.W.89.S.

To receive a free copy of illustrated catalogue featuring ALL Blue Spot Products, write your name and address in the margin, cut out and post in open envelope (½d. stamp).

THE LATEST PENTODES

Recently the various valve manufacturers have been particularly active in producing new types of valves. The latest additions to this list include some pentodes which are here reviewed

By K. D. ROGERS.

DURING the last few months we have heard a great deal about the battery H.F. pentode, but it is only within the last week or two that it has become generally available to the public. So far only one type is obtainable—the VP21, from the factories of Marconi and Osram (price 15s. 6d.).

The valve is designed specially for use as a bias-controlled amplifier, being of the multi-mu variety, or as a detector. It has a mutual conductance of 1·1 at minimum bias, falling away to ·008 ma./V when the bias is increased to about —9 volts.

Useful in Superhet. Circuits.

In order to make the valve as useful as possible the various electrodes, and even the metallised bulb covering, are brought out to separate pins, so that individual connections can be taken to the three grids, anode and filament of the valve. In this way it is particularly useful as a mixer valve in superhet. circuits, for the suppressor grid can take an active part in the circuit, if desired, instead of being anchored to the filament of the valve.

The separation of the electrodes necessitates the use of six pins, so that the valve is fitted with a standard seven-pin base, similar to that used on the Class B valves, and one of the pins is left vacant.

FROM HIVAC'S FACTORY

Here are two new Hivac pentodes. On the left is the Z.220, a battery valve in the 2-volt class, giving an output of 750 milliwatts, while on the right is the Y.220, which is a similar valve but delivers a smaller output, namely, 500 milliwatts.

The normal H.T. potentials are required—namely, 150 volts maximum for the anode and about 60 volts for the screened grid.

The screen voltage is fairly critical, having a large effect upon the mutual conductance and anode current of the valve. For instance, if the screen volts are 60 the mutual conductance has a maximum of about 1·1 and the valve's anode current is about 2·8 milliamps. If the screen voltage is dropped to 50 the mutual conductance drops to ·9 ma./V, while the anode current is lowered to 1·9 milliamps. The anode potential is kept at 150 volts, of course, while the screen current is of the order of ·7 and ·4 for the two cases.

The makers recommend that a minimum bias of ·5-volt negative be used when the valve is employed as an H.F. or I.F. amplifier to avoid grid current, the whole of the bias necessary for the control of the valve being obtained from a 9-volt battery.

With each valve is supplied the usual card giving the chief characteristics and also the connections to the seven-pin base, so that those who think of going over to the H.F. pentode in sets that at the moment have multi-mu S.G. valves will be able to make their connections right away as soon as they have substituted for their four-pin valveholder a seven-pin one.

Increased Amplification.

The change from the S.G. to the pentode should result in increased amplification in most sets, but care will have to be taken in some that the increased mag. does not cause instability due to insufficient screening between anode and grid circuits.

In using the H.F. pentode for ordinary amplification the suppressor grid and the coating terminals of the valve holder are connected to the negative filament terminal.

In the course of development work on universal mains receivers we hear that Tungsram have found that a demand exists for H.F. pentode valves of lower efficiencies than those (H.P.2018 and H.P.2118) previously introduced, and accordingly they have released two such types in the H.P.1018 and H.P.1118, which have 10 v. 0·18 a. heaters.

The Grid Goes to the Top.

The first-mentioned valve has "straight" characteristics, while the second is of the multi-mu type, with a working grid base of about 52 v. Both are suitable for use in receivers such as midgets, where space is limited, for they have greater stability than the original valves. Following American practice, the grid connection is taken to the top terminal in each case, and this is claimed still further to increase stability.

The H.P.1018 is designed for a maximum anode voltage of 250, a screen voltage of 150, and, with the correct G.B. of — 3 v. applied, passes a normal anode current of 2·3. The amplification factor is above 1,500, the A.C. resistance is 1·5 megohm, and the mutual conductance is 1·25 a/v. In the case of the variable-mu pentode, the maximum anode and screen voltages are 250 and 125 respectively, whilst the anode current at minimum bias is 10·5 m/a. The maximum slope is given as 1·64 ma/v.

A very useful size of L.F. pentode has just been released by Hivac in the Z.220. It is a 2-volt battery valve with a mutual-conductance of 2·2, an optimum load of 7,600 ohms and an anode current maximum at 150 volts H.T. of 18 milliamps. But it gives the useful figure of 750 milliwatts A.C. output, which should be very valuable to battery-set owners who favour a pentode output valve.

For the Small Battery User.

When used with an economiser it takes an average H.T. current of but 12 milliamps, so that it then comes within the scope of a double-capacity dry battery. The bias required is —9 volts at 150 volts H.T. and —7·5 at 120 volts.

Released with the Z.220 is a smaller brother pentode, the Y.220, which has an output capacity of 500 milliwatts, with an H.T. current consumption of 11·5 at 150 volts H.T. The optimum load at 150 volts H.T. and —4·5 volts grid bias is 12,000 ohms. The mutual conductance of the valve is 2·2 ma./V. Used with 120 volts H.T., the anode current is only 9 milliamps, well within the requirements of the small H.T. battery user.

THE VP21

The VP21 was the first battery H.F. pentode to be released. It should prove a very useful valve.

Another pentode I have received for test is the Mazda A.C.2/Pen, an indirectly heated A.C. valve of astounding powers, of which I shall be writing more later on. At the moment it will suffice to appease your curiosity if I state that from a grip input peak voltage of *three* the valve will provide an undistorted output of 3,400 milliwatts!

SHORT-WAVE COILS

Useful particulars regarding the coil sizes required to cover various wavebands.

READERS who are in the habit of constructing their own coils will find the following table of assistance when they turn their attention to the short waves.

The number of turns refer to the grid and reaction coils respectively, and the waverange, which is approximate only, is for a variable condenser having a capacity of 100 micro-microfarads (·0001 mfd.).

Waverange	Turns	Turns
18 to 30 metres	4	4
30 to 60 metres	9	6
60 to 120 metres	20	10

The diameter of the coils should be 2½ in., and the spacing between turns about $\frac{3}{16}$ to $\frac{1}{4}$ in.

F. B.

AN ALL-BAND SHORT-WAVE RECEIVER

Designed and Described by F. BRIGGS.

This inexpensive, easy-to-build short-wave receiver covers all wavelengths between 16 and 200 metres, and among its outstanding features is a particularly pleasing reaction control. The original model is now being exhibited in the radio section of the Science Museum at South Kensington, where it forms part of a complete amateur transmitting and receiving station lent to the museum by "Popular Wireless."

A SUCCESSFUL short-wave receiver differs in many respects from an ordinary broadcast receiver. Its requirements are far more critical, for, as a rule, it has to deal with transmissions coming from great distances—in fact, from the very ends of the earth.

The fascination of listening to programmes direct from New York, South Africa or even Australia has to be experienced to be appreciated. Then you can listen to amateurs talking to fellow-amateurs in far-off countries. In fact, the wealth of interesting things below the 200-metre mark is so vast that even the hardened enthusiast finds it full of thrills.

One of the essentials of a successful short-waver is that all the controls must be really smooth in operation. For instance, the reaction must be free from all "ploppiness," for it is upon the efficient use of reaction that the success of the set depends.

Good Vernier Control.

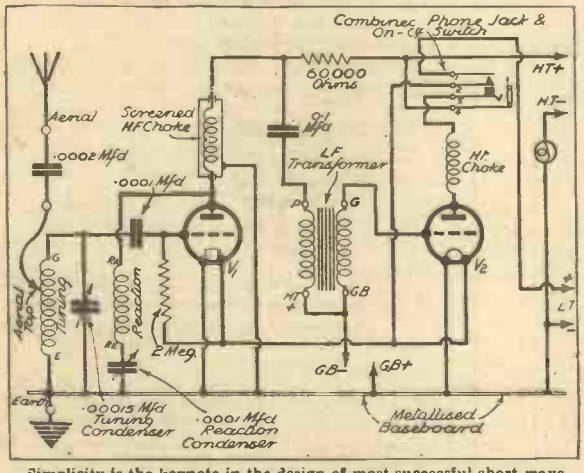
Tuning is also quite sharp, a fraction of a degree on the tuning dial being sufficient to bring quite a powerful transmission in and out again. Therefore a good vernier control is almost indispensable.

So what it really boils down to is that a short-wave set has to be much more carefully designed and built than an ordinary broadcast receiver, and, provided the various little points referred to are carried out, you will never give up the short-wave game.

The short-wave receiver described in this article possesses all the features that go to make a good set. It is enclosed completely in a steel cabinet, thus ensuring that it is efficiently screened. This in itself is a most desirable feature, as it provides an entire freedom from hand-capacity effects.

It covers a waverange from approximately 16 to 200 metres, the various bands being covered by means of a number of plug-in coils. Although the use of plug-in coils may at first sight seem crude, it is actually the ideal arrangement for the shorter waves, as it precludes all chances of dead-end effects.

A STRAIGHTFORWARD CIRCUIT



Simplicity is the keynote in the design of most successful short-wave receivers, and the lack of complications in this latest set is evident from the above diagram. Note that a parallel-fed transformer is employed, thus obviating any risk of threshold howl.

General-Purpose Set.

The set is actually a general-purpose short-wave receiver that will appeal to the novice and experienced amateur alike. In addition to covering the usual short-wave broadcast bands, it will tune in the 20-, 40-, 80- and 160-metre amateur bands, from which many enjoyable hours of listening can be obtained.

The original receiver is now being exhibited at the Science Museum, South Kensington. It is shown as the receiver of a complete amateur short-wave station which has been lent to the museum by POPULAR WIRELESS.

No doubt many readers who are interested will be going along to see it, so perhaps a few words about the apparatus will not be out of place. It should provide a means of spending quite an enjoyable afternoon, for the radio section of the museum contains a most interesting and instructive collection.

In the heading to this article you see a photograph of the complete station as it now appears at the museum. You should easily be able to recognise the receiver, which is situated in the centre of the whole outfit, the cover being removed.

The transmitter proper is located on the extreme left, and it comprises a crystal-controlled oscillator which drives a 10-watt power amplifier. It is designed for operation on the 160-metre amateur band.

Amplifying Speech Currents.

The modulator, which is really a large low-frequency amplifier, is situated alongside the transmitter. This part of the installation is used only for telephony transmissions, and serves to amplify the speech currents up to sufficient magnitude to modulate the carrier-wave. The output valve in this amplifier is a D.A.60, and is capable of giving an undistorted output of 10 watts. It has 500 volts on its anode.

The microphone can be seen to the right of the receiver and just in front of the switchboard which controls the various circuits, including the electric gramophone motor on the extreme right. Accumulator-charging arrangements are also included in this board.

In the near future it may be possible to give a detailed description of the station for the benefit of those who are interested.

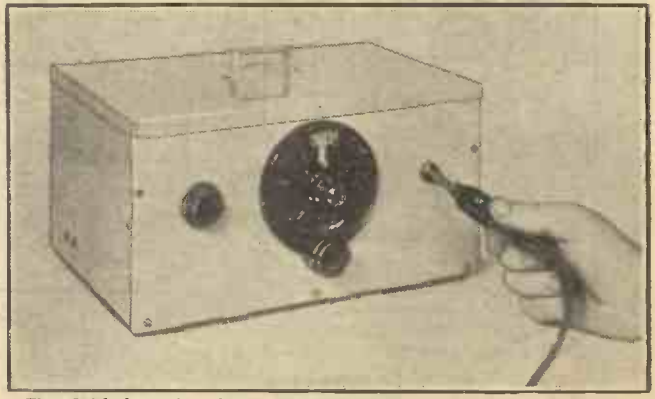
For Headphones or Speaker.

Now, getting back to the receiver, a glance at the theoretical circuit diagram will show how simple an arrangement it really is: Two valves only are employed—a detector and an output valve.

The set was primarily designed for use with headphones; but by employing a small power valve in the last stage good loud-speaker reproduction can be enjoyed from

(*Continued on next page.*)

SEE IT AT THE SCIENCE MUSEUM



The finished receiver has a very business-like appearance. It is completely screened, being enclosed in a special steel cabinet, and the low-tension is automatically switched on and off by the insertion and withdrawal of the phone plug.

AN ALL-BAND SHORT-WAVE RECEIVER

(Continued from previous page.)

the more powerful transmissions. Full details regarding the types of valves to use are included in a special list on this page.

This is a most useful feature, as it assures that there is no chance of the set being left switched on. Withdrawing the phone plug automatically turns the L.T. supply off.

The feed from the aerial comes through a small fixed condenser having a capacity of ·0002 mfd. Then, by means of a crocodile clip, the desired number of turns can be tapped off to provide the right amount of coupling.

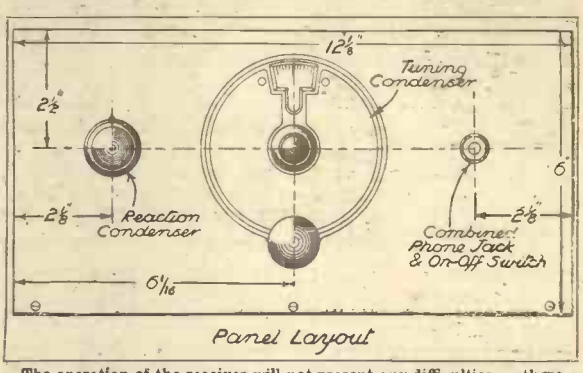
This receiver is completely free from threshold howl, by virtue of the fact that a parallel-feed arrangement has been provided for the L.F. transformer. Absence from threshold howl is very important where sensitivity is concerned, because this effect usually takes place just prior to oscillation, namely when the set would otherwise be in its most sensitive state.

Another common short-wave fault that has been obviated is head-capacity effects. This is generally caused by H.F. getting back into the phone cords, and in this set it has been prevented by the inclusion of a short-wave H.F. choke in the anode circuit of the output valve.

HERE ARE THE VALVES WE RECOMMEND

Make	Detector	Output	
		Headphones	Loudspeaker
Mullard	P.M.1H.L.	P.M.2D.X.	P.M.2A.
Mazda	H.L.210	L.210	P.220
Cossor	210H.F.	210L.F.	210P.A.
Marconi	H.L.2	L.210	L.P.2
Osram	H.L.2	L.210	L.P.2
Tungsram	P.D.220	L.G.210	—
Hivac	H.210	L.210	P.220

SIMPLE CONTROL IS A FEATURE

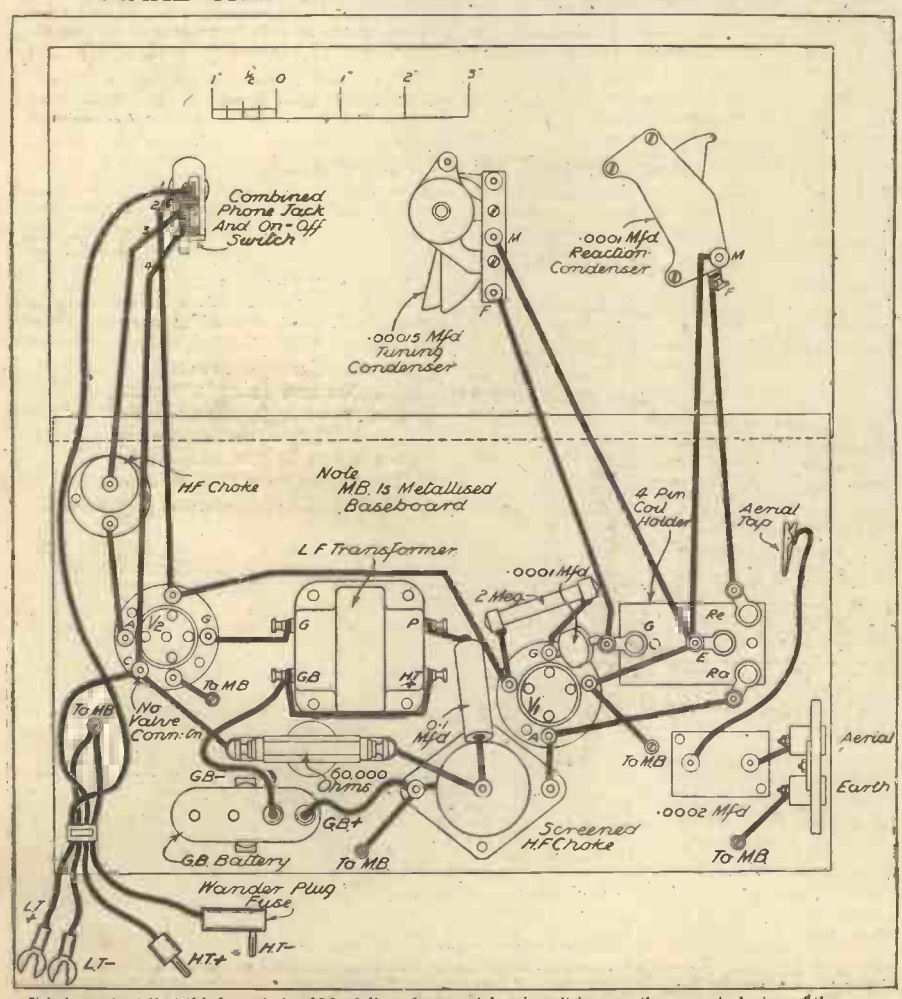


The operation of the receiver will not present any difficulties, as there are but two controls on the panel, the reaction condenser to the left and the tuning dial in the centre. The metal cabinet ensures against any hand-capacity effects.

You will probably have noticed that no on-off switch is provided on the set. The reason for this is that the set is automatically switched on when the phone plug is inserted in the jack seen on the right-hand end of the front panel.

The reaction control is situated on the left-hand side of the front panel. It takes the form of a small variable condenser with a capacity of ·0001 mfd. in series with the reaction coil. The control is delightfully smooth.

MAKE THIS YOUR GUIDE WHEN WIRING UP



It is important that this layout should be followed accurately, since it is upon the correct placing of the components that the lengths of the various wires depend. In all short-wave receivers it is highly advisable to keep certain leads as short as possible.

Employs a Metallised Baseboard.

There is nothing very difficult about the construction of the receiver. It follows normal lines, a metallised baseboard being used to take all the earth returns. Follow the original closely and you will not have any trouble.

SUGGESTED ACCESSORIES

HEADPHONES.—B.T.H.

LOUDSPEAKER (if required).—Rola, W.B., Blue Spot, Marconiphone, R. & A., Celestion, G.E.C., Ferranti, Atlas, Amplion, Ormond.

BATTERIES.—H.T. 120 volts: Ediswan, Lissen, G.E.C., Ever Ready, Marconiphone, Pertrix, Drydex, Hellesens, Block.
G.B., 4½ volts: Siemens, Pertrix, Lissen, Hellesens, Ever Ready.
L.T. 2 volts: Ediswan, Block, Oldham, Exide, Lissen, G.E.C.

AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," Radiophone "Receptru" down lead, Bulgin lightning switch, Graham Farish "Filt" earthing device.

It is strongly advised that you buy the panel (and cabinet, if desired) from Messrs. Burne-Jones. It will then be already drilled to take the specified components.

Care should be taken, however, to see that the paint is carefully scraped away where the panel components make contact. This applies to the tuning and reaction condensers.

The Headphone Jack.

There is one panel component that should not be earthed, however, and that is the headphone jack. This should be insulated from the panel very carefully by an ebonite bush, otherwise the H.T. will be shorted.

You should also make sure that the panel

(Continued on page 516.)

"No Tears with a PILOT AUTHOR KIT"

S.T.500

PILOT AUTHOR KIT
EXACT TO SPECIFICATION

The Pilot Kit SERVICE was founded in 1919.

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

For detailed list of Parts SEE OUR PREVIOUS S.T.500 ANNOUNCEMENTS Oct. 21st and Oct. 28th issues, or sent upon request by return of post.

CASH — C.O.D.

£5-5-0

OR YOURS FOR **9/6**

Balance in 11 monthly payments of 9/6.

S.T.500 CONVERSION KITS

YOURS FOR **5/-** BALANCE IN 8 MONTHLY PAYMENTS OF 5/3

CONVERTS YOUR S.T.400 into the new S.T.500

Comprises: 1 Peto-Scott Baseboard; 3 G.F. ·0005 mfd. Condensers; 1 J.B. ·0001 preset; 1 J.B. ·00005 preset; 1 Telsen Driver Transformer; 1 Telsen Output Choke; 1 G.F. 7-pin valve holder; 2 Dubilier 5,000-ohm 1-watt Resistances; 2 Dubilier 10,000-ohm 1-watt Resistances; 1 G.F. 250 Ohmite Resistance; 2 T.C.C. ·005-mfd. Condensers; 1 G.F. ·0005-mfd. Condenser; 1 Lissen ·00005-mfd. Condenser; 1 T.C.C. 1-mfd. Condenser; 1 B.R.G. Bracket; Wire, screws, flex, etc. WITH COPY OF "POPULAR WIRELESS," 21/10/33 AND BLUE PRINT. CASH or C.O.D. Carriage Paid, 42/-, or 5/- Deposit and 8 monthly payments of 5/3.

H.P. TERMS: Complete Kit with Valve—12 monthly payments of 5/3.

CONVERTS YOUR S.T.300 into the new S.T.500

Cash or C.O.D. **51/-** Carriage Paid. Or 6/- Deposit and 9 monthly payments of 5/6. **H.P. TERMS: Complete Kit with Valve—12 monthly payments of 6/-.**

S.T.500 STRUCTAKIT

CASH or C.O.D. Post Free. **7/6**

Comprising Peto-Scott Baseboard with Metaplexed Section; Ready Drilled Panel and Terminal Strip; "S.T.500" Screen; B.R.G. Mounting Bracket with Free copy of Popular Wireless, and OFFICIAL BLUE PRINT

IMPORTANT *Parts, Kits, Miscellaneous Components, 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 all Post Charges Paid.*

KIT "A" Comprising Mr. John Scott-Taggart's Kit of FIRST SPECIFIED Components, including Telsen "Class B" output Choke, Peto-Scott Metaplex Baseboard and Ready-drilled Panel and Terminal Strip. Less Valves and Cabinet. With FULL-SIZE Blue Print and copy "Popular Wireless," Oct. 21st. Cash or C.O.D. Carriage Paid **£5-5-0**

or 12 monthly payments of 9/6.

ALL KIT AND FINISHED INSTRUMENT PRICES INCLUDE BATTERIES.

"S.T.500" Battery Equipment:

120-volt Drydex, Orange Triangle, Triple Capacity; 9-volt Drydex G.B. Battery and Peto-Scott 2-volt 45 amp. L.T. Glass-cell Accumulator. Cash or C.O.D. Carriage Paid, £1-11-3; or add 3/- to First and each Monthly Payment.

KIT "B" As Kit "A" but including 4 Specified Valves. Cash or C.O.D. Carriage Paid **£7-10-3**

or 12 monthly payments of 13/9.

KIT "CT" As Kit "B" but including Peto-Scott Specified Walnut Table Cabinet. Cash or C.O.D. Carriage Paid **£8-9-9**

or 12 monthly payments of 15/6.

KIT "CC" As Kit "B," including Peto-Scott Specified Walnut Consolette Cabinet. Complete with Baffle Baseboard Assembly, but less Speaker. Cash or C.O.D. Carriage Paid **£8-18-9**

or 12 monthly payments of 16/3.

If Peto-Scott Permanent Magnet Speaker required add 15/- to Cash Price or add 1/3 to each monthly payment.

FINISHED INSTRUMENTS

"S.T.500," complete in Peto-Scott Walnut Table Cabinet, exact to Mr. John Scott-Taggart's FIRST Specification. Aerial Tested. Complete with Valves. Cash or C.O.D. Carriage Paid. **£10-0-0**

or 12 monthly payments of 18/3.

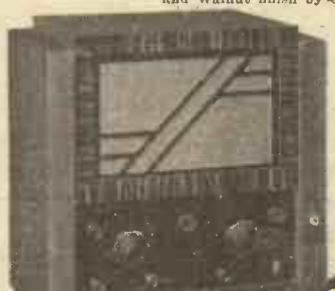
"S.T.500," complete in Peto-Scott Walnut Consolette Cabinet, exact to specification. With Peto-Scott Moving-Coil Speaker. Complete with Valves. Ready to Play. Aerial Tested. Cash or C.O.D. Carriage Paid. **£11-5-0**

or 12 monthly payments of 21/-.

PETO-SCOTT S.T.500 CABINETS

EXCLUSIVELY SPECIFIED BY MR. JOHN SCOTT-TAGGART

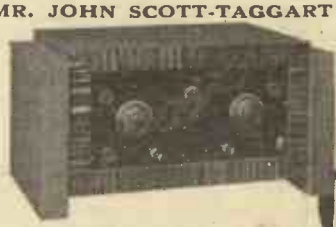
Consolette Model. An outstanding example of cabinet craftsmanship. Hand French polished. Veneered Macassar and Walnut finish by experts.



Cash or C.O.D. 25/-. Carr. & Packing 2/6 extra, or 6/- Deposit and 4 monthly payments of 6/- (including carriage and packing). Baffle-Baseboard Assembly, 3/6 extra.

25/-

Regd. Design No. 787.010



Regd. Design No. 781,011.

19/6

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.)*

Send to-day for copy of 1934 Cabinet Catalogue.

PETO-SCOTT CO. LTD. 77 CITY ROAD, LONDON, E.C.1. Telephone: Clerkenwell 9406/7.

West End Showrooms: 62 High Holborn, W.C.1. Tel.: Holborn 3248.

Dear Sirs,—Please send me CASH/C.O.D./H.P.: S.T.500 KIT "A" S.T.500 KIT "B" S.T.500 KIT "CT" S.T.500 KIT "CC" with/without SPEAKER.

for which I enclose £.....s.....d. CASH/H.P. Deposit.

NAME.....

ADDRESS.....P.W., 18/11/33.

ANY ITEM SUPPLIED SEPARATELY—ORDERS OVER 10/- SENT C.O.D. CARRIAGE AND POST CHARGES PAID

AN ALL-BAND SHORT-WAVE RECEIVER

(Continued from page 514.)

makes metallic contact with the body of the box, otherwise you will have an unearthed screen around the set, a most undesirable state of affairs. The same remarks apply to the lid of the set.

There is nothing more liable to cause bad crackling in a short-wave receiver than bad contacts. So make assurance doubly sure by attending to these points. Also make certain that all the wiring connections in the set are really tight.

Keep the Grid Leads Short.

If you prefer, there is no harm in soldering most of the joints. The best scheme is to obtain a number of small soldering tags, and then fix them on the ends of the wires. It is not advisable to solder direct on to the terminals, as the heat of the iron is liable to damage the components.

Remember that with a short-wave receiver it is most important to keep the detector grid lead as short as possible, and also the wires between the tuning condenser and the coil. The inductance and capacities being dealt with are so small that the effect of a piece of wire a few inches long can be quite considerable, so follow the wiring diagram carefully.

There is one further point that should be mentioned, and this concerns the valve holder for the output valve. You will notice that it is of the five-pin variety.

Using a Pentode.

The reason for this is so that you can use a pentode output valve if you wish. It is already wired for the purpose, the extra terminal being taken to H.T. plus.

If you do wish to use a pentode it should be employed only with a loudspeaker. Normally, however, the small power valve should be quite sufficient. The type of pentode recommended is the Marconi or Osram P.T.2, or the Mullard P.M.22A. The Mazda and Cossor equivalents being Pen. 220 and 220 H.P.T. respectively.

There are any amount of interesting things to hear with a receiver of this type. Schenectady W 2 X A D on 19·56 metres is one of the most entertaining on the lower band, and can be tuned in late in the afternoons. At times he will provide quite good loudspeaker reproduction, even on a small two-valve receiver like the one being described.

Then there is Pittsburg W 8 X K on 19·72 metres, in fact a whole host of transmissions originating from all parts of the world all around the 20-metre mark. Also a large number of amateur transmissions.

If you inspect a list of short-wave stations, you will see for yourself the long list from which you can select your stations. Of course, you must not expect to be able to tune in any station at any time, that would be asking too much. Different parts of the world come in best at certain times of the day. And then, wavelength is a very important factor. As a rule it can be considered that anything below about 25 metres is a daylight wave, while those transmissions above this figure come in best after dark.

If you would like to hear a few of your local amateurs, you should listen between 150 and 170 metres on Sunday mornings. The largest coil will be the one for this band.

The operation of the set is perfectly straightforward. But for best results searching should be carried out with the set right on the edge of oscillation.

Some Hints on Tuning.

If it is oscillating too strongly the carriers will be comparatively weak, and therefore easy to miss, so the nearer you can keep it to the "just-not-oscillating" point the better. Tuning will, of course, be quite sharp, so turn the dial very, very slowly.

And don't forget to pay that visit to the Science Museum at South Kensington, where the original set can be seen. As I said before, you will find it as part of a complete amateur transmitting station in the radio section.

The museum is open to the public between the hours of 10 a.m. and 6 p.m. every weekday, and between 2.30 p.m. and 6 p.m. on Sundays.

A BEHIND-THE-PANEL VIEW OF THE RECEIVER

This photograph illustrates the inside of the finished receiver. The detector valve is on the right, while the output stage is to the left. Note that the crocodile clip on the grid coil is located about half-way from the grid end: this will normally be the best position.

ALL THE PARTS YOU WILL REQUIRE ARE INCLUDED IN THIS LIST

Component	Make used by Designer	Alternative makes of suitable specification recommended by Designer.
1 Metal panel, 12½ in. x 6 ins.	Magnum	—
1 Metaplex baseboard, 12 ins. x 7 ins.	Peto-Scott	—
1 Metal cabinet	Magnum	—
1 Coil holder	Bulgin SW.8	—
1 Set short-wave coils	Bulgin SW.2, 3, 4, 9 and 10	—
1 4-pin valve holder	W.B.	Benjamin, Telsen, Lissen
1 5-pin valve holder	W.B.	Telsen, Lissen, Benjamin
1 Vernier dial	Igranic Indigraph (Cat: VINIL)	—
1 ·00015 mfd. tuning condenser	J.B. short-wave	—
1 ·0001-mfd. reaction condenser	Polar No. 4	—
1 ·0001-mfd. fixed condenser	Dubilier 665	T.T.C., Igranic
1 ·0002-mfd. fixed condenser	T.C.C., type S	Telsen, Dubilier, Lissen
1 ·1-mfd. fixed condenser	T.C.C., type 250	Erie
1 2-meg. grid leak, with wire ends	Dubilier 1 watt	Goltone, Lissen, Igranic
1 60,000 - ohm resistance, with horizontal holder	Graham Farish "Ohmite" 1½ watt	Dubilier
1 Screened H.F. choke	Telsen W.342	Graham Farish
1 S.W. H.F. choke	British Radiogram	Bulgin, Igranic
1 L.F. transformer	Lissen "Hypernik"	R.I., Igranic, Telsen
1 Jack	Igranic, No. P.65	—
1 Plug	Igranic, P.40	—
1 Insulating washer for above	British Radiogram	—
1 G.B. battery clip	Bulgin No. 3	—
1 Twin plug strip	Bulgin, P.30 AE	—
3 Wander-plugs	Goltone	Belling & Lee
1 Wander-fuse	Belling & Lee	—
2 Accumulator tags	Belling & Lee	Goltone
1 Crocodile clip	Bulgin Nickel	—
3 yards 18 S.W.G. tinned copper wire	Goltone	—
2½ yards insulated sleeving	Goltone	—
Flex, screws, etc.	Peto-Scott	—

This is probably the most widely read review of new apparatus appearing in radio journalism to-day. Instead of presenting test reports on dry as dust conventional lines, "P.W.'s" Technical Editor discusses the various components from practical points of view, and incidentally manages to crowd in an enormous amount of interesting and useful information of a general nature.

A NOVEL H.T. BATTERY

IT often happens that certain cells of an H.T. battery depreciate much more rapidly than others. Indeed, this is inevitable in certain cases, quite apart from any irregularity in the lasting qualities of the cells themselves.

It is obvious that if, say, a 90-volt tap is serving all the valves except the power valve, which takes a full 120, those cells which provide the final 30 volts do less work than the others.

Such unevenness of discharge can be countered easily by the Precision Unit Cell H.T. Battery, made by Watson & Henderson, Ltd., of Gateshead.

This comprises a substantial case fitted with separate 1½-volt cells, which, because they are connected together by ingenious snap connections, can easily be replaced as and when they are discharged.

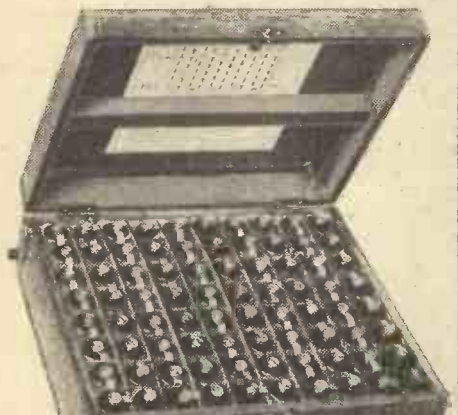
Another ingenious feature is the voltage selector which obviates the use of wander-plugs and provides a convenient method of quickly selecting desired voltages.

It is a scheme that deserves close consideration on the part of constructors. I have examined and tested a sample battery and find it to be a sound proposition.

IGRANIC FIXED CONDENSERS

It is extremely difficult, if not quite impossible, to classify the components of any radio set in an order of importance. It is true that troubles caused by faults in some are often more noticeable than the evidence of failings of others.

For example, a badly designed coil may result in a complete swamping of long-wave stations by medium-wave stations, whereas the breakdown of a



The Precision Unit Cell H.T. Battery, in which individual cells can be replaced as this becomes necessary.

grid leak might evince itself in only a barely perceptible distortion.

But for a first-class performance every part of the set has to be beyond criticism.

Simply because fixed condensers sometimes appear almost haphazardly to be sprinkled over a circuit, some constructors may jump to the conclusion that they are in the nature of refinements and that they need not necessarily be chosen with the care of the other components.

This is quite wrong. Probably every one of those fixed condensers has got a well-defined and important duty to do. I say "probably" because I think at times even some set designers tend to fall into the evil habit of regarding the relatively inexpensive fixed condenser as a kind of finishing touch, to be dropped in there and clipped on here as the momentary fancy—and not too much thought—dictates.

"It's only a by-pass," is the sort of remark one hears about the underrated fixed condenser. Certainly a "by-pass" condenser may not find an important place in the theoretical conception of the essential principles of a circuit, but in practice it can easily be a most vital component.

Upon its "humble" shoulders may rest the responsibility of keeping the set free from instability or hum. A major fault in its construction could, perhaps, cause a battery to be short circuited and ruined and an expensive team of valves to be destroyed.

If you bear this in mind I am sure you won't be tempted to buy "any old make," but will make sure that the fixed condensers you do purchase have the brand of a reputable, trustworthy concern.

All the foregoing remarks are due to an Igranic fixed condenser which I am holding in my left hand as I pen these very words, which are written subsequently to my testing the article in our Research Department.

While I was doing this I was interrupted by one of our engineers who was quite burning with indignation about another fixed condenser (not Igranic) which had let him down badly in an experimental mains outfit!

One of the Igranic range of fixed condensers, which are reliable and well made.

The particular Igranic fixed condenser under review was found to be perfectly satisfactory in every way, and I'd have no hesitation in using it in my own set—could I say more than that?

It is a 2-mfd. of non-inductive construction. It is often vital that a fixed condenser in the H.F. stages of a set should be non-inductive. The old "Mansbridges" sometimes possessed quite a lot of inductance due to the methods employed in their construction.

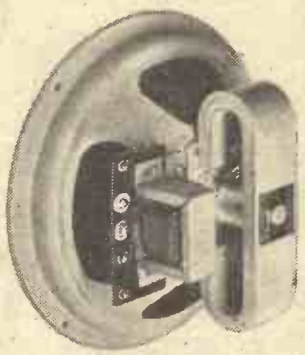
Modern high-efficiency sets demand strict attention to such details as this, whereas at one time it would have been almost laughable to suggest that one should look out for *inductance* in a *condenser*.

But the admittedly not large inductance of an ordinary large-capacity condenser can seriously upset some of our present-day circuits if such an inductance happens to appear in the wrong place—as by the very nature of things it is liable to do.

However, it is easy to avoid such trouble—the Igranic Non-Inductance Fixed Condenser points the way.

A MAGNAVOX SPEAKER

Though most of us, I think, are apt to consider the moving-coil principle as being the very epitome of modernity, it was actually invented in 1898 by "P.W.'s" Scientific Adviser, Sir Oliver Lodge. So as a principle it is as old as wireless itself.



Magnavox M.C. speakers have been made for 20 years. Here is one of the latest senior models.

As a matter of fact, Magnavox moving-coil loud-speakers were being made over twenty years ago. Therefore it is not surprising that, with such a long tradition of development behind it, the Magnavox stands well to the forefront to-day.

But it is still cause for wonder that you can now buy for the competitive price of 37s. 6d. a permanent-magnet Magnavox, complete with input transformer and all ready for fixing into a cabinet or on to a baffle.

That certainly is Progress with a capital P, and provides a clue to the overwhelming popularity of this type of instrument. It is within the reach of all and is no longer the rich man's luxury.

Benjamin Electric, Ltd. make the Magnavox, and recently they sent me one of their Senior models, the type 252, which retails at £3 3s.

One of the things that tends to make one uneasy in the case of many "M.C." speakers is the almost light-hearted manner in which the question of matching is dismissed.

Good matching between the speaker and the output valve of the set is extremely important. The Magnavox incorporates a fine scheme for enabling this to be done by even non-expert listeners.

Its transformer has a number of screw terminals, and each is provided with a coloured disc. The instructions for matching, therefore, do not necessitate mention of a bewildering number of ratios, but merely refers to colour combinations: blue-red for this type of valve, black-white for that type of valve, and so on.

Six methods of connection are possible, including Class B and push-pull circuits. So all operating conditions can be well met.

The speaker on test gave impressive results, and on that difficult treble range it retained excellent brightness and attack.

But it almost seems superfluous to make remarks like that about a Magnavox!

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes and on microphone personalities of the moment.

THE greatest thing in the film industry, says the expert, is the story. I agree; and it's the same with radio-drama. Compton Mackenzie's "Carnival" was a conspicuous success, and this success was largely due to the fact that it was a good story. I cannot believe that it was all due the to excellence of the cast, because each of the preceding plays in this festival series was just as well cast.

* * *

It could be argued, of course, that the play was made by the way it was produced. This is more likely, perhaps, for there were evidences of very clever and careful work by Val Gielgud. He allowed not the smallest interruption in the continuity of the story, and with so many events this might have been thought inevitable. Never have I appreciated the effects of music in radio-drama more than I did in "Carnival." It was a long play, too, and most critics deplore the long play. "Carnival" wasn't a minute too long. It gripped me for the whole 110 minutes it was in progress. It is this fact that persuades me to believe that it is mainly the story that places "Carnival" so high in the list of broadcast plays.

* * *

I think instinctively of "The Green Goddess," which was broadcast some time ago now. In most respects this play bore no resemblance to "Carnival," but it had at least one feature in common with Compton Mackenzie's play—it was a good story.

* * *

Since the programme builders have let us know some of the difficulties of their job I've been more sympathetically disposed towards them, though I can't always accept their arrangements without a frown. I frowned horribly, for instance, when I had to switch over from the Lionel Tertis - Solomon recital on the Regional to hear Mr. S. P. B. Mais on the National.

* * *

You see, I wouldn't miss Mais for worlds. He is one of the biggest events of the week, in my estimation. Solomon is just as big an attraction, too, and I wouldn't miss him for worlds either. But the B.B.C.'s arrangement forbids me to listen to them both in their entirety.

* * *

It was all the more irritating because it could have been so easily avoided. If the B.B.C. chamber

(*Continued on page* 531.)

FITTING A CLOCK TO YOUR RECEIVER

An electric clock is a very useful accessory for any radio set; and below details are given of the best ways of fitting this valuable "extra" to your receiver.

By G. E. MOORE, A.M.I.E.E.

THOUGH time plays so important a part in reception, it is curious that there has never been any general trend towards fitting radio sets or "radiograms" with timepieces. It is true that in many households there are already too many clocks and watches—all, maybe, at variance!

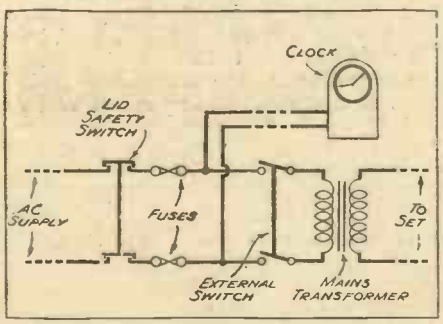
Yet a clock which is immediately adjacent to the receiver is very useful, both for broadcast-programme purposes and also for serving as the standard timepiece of the household (being, of course, checked and set by the "pips").

The Most Attractive Type.

If it is possible to embody a timepiece, the receiver is given a unique utility. Many kinds of compact clocks may nowadays be purchased. With little, if any, modification these may either be mounted in the form of an external addition or, more ambitiously and effectively, sunk into the face of the receiver.

Perhaps the most attractive form of clock—attractive because simple, electrical

HOW TO WIRE IT UP



Above you see one method of connecting an electric clock to a receiver. Another scheme is to connect it to the mains side of the safety switch with its own pair of fuses, so that opening the lid or the blowing of the receiver fuses will not stop the clock.

and requiring no winding or other maintenance—is the synchronous-motor clock, costing not a great deal more than an S.G. valve.

The fingers in this clock are steadily moved by an uncomplicated train of gears, the motive power being that of an extremely small electric motor that takes about $\frac{1}{50}$th the energy of a moderately sized domestic lamp.

Watch the Supply.

The motor rotates at a steady speed; its speed in terms of time is not fixed and maintained by a mechanism such as a governor, but by the pulses or alternations of its alternating-current supply. It is "synchronous" with the supply pulsations.

These pulsations, in technical parlance, are stated as frequency, or cycles per second. In choosing a synchronous-motor clock it is necessary, as in the case of all one's domestic appliances, to stipulate the pressure in volts. But it is also necessary to ensure, first, that the supply is of alternating current and, second, that it is 50 cycles.

Erratic Timekeeping.

There is a third proviso, worthy of special explanation. The pulsations (or *speed*, if you care to regard it so) of the supply may not be maintained exactly at 50 by the electricity undertaking. And thus it may be found that the timekeeping of the clock may be erratic or consistently fast or slow. If, however, the electricity supplier is "time-controlling" the pulsations, then the clock will prove to be an excellent timekeeper.

It should, however, be remembered that in the generating station endeavours can only be directed at keeping the *average* frequency (that is, speed and "time") correct. Further, some kind of ordinary clock, itself sometimes at fault, must act as the standard, and may periodically be checked and set by the broadcast time signals.

The purchaser of a clock, therefore, should inquire as to whether his A.C. supply is time-controlled. This will give him considerable assurance that he will get perfectly satisfactory results. As time goes on it is certain that results throughout the country will become better still, especially as the electricity will be derived from a common source—the national "grid."

Mounted on the Set.

Those electricity systems which are not of 50 frequency or are not maintaining the 50 cycles per second accurately will come into line. Should a 50-cycle supply be available, the writer suggests that a clock may in any case be bought, but the foregoing remarks must be borne in mind.

The electric clock may, of course, be put into service by connecting it to a near-by plug-point with as little loose flexible wiring as possible.

Both in this country and abroad it has, of course, been possible for a year or so now to obtain receivers which embody electric clocks. This, however, rather limits one in various ways. The writer's course has been to mount his clock upon the set, as is shown in the photograph.

The clock is fitted with the usual bakelite case, while the receiver is a Ferranti-band-pass in mahogany; thus the complete arrangement, being all-insulated, is shock-proof.

The rear cover of the clock was removed. After stuffing a cloth within the case, to shield the internal parts, three holes were bored through the base—one for the wires and two for the fixing screws.

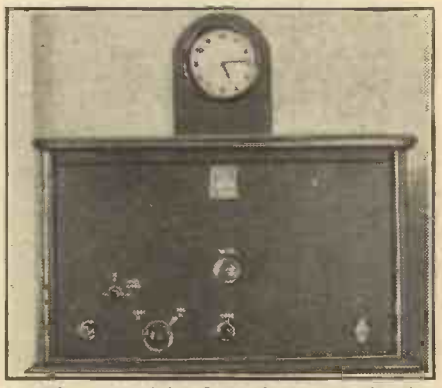
A wiring hole was also bored through the receiver's lid, and the clock was then screwed in place. Part of the flexible wire supplied with the set was then pushed through the lid and the clock cover replaced.

Inside the lid the flex, secured by small insulated staples, passed to the hinge side of the lid; then by a loop to the body of the receiver, and thence to the internal supply point. Thus, with this arrangement, no accessible clock wiring is employed.

Properly Safeguarded.

Supply to the receiver must, of course, be maintained. Many sets are, as a rule, controlled by the switch mounted upon them. If, as in the writer's case, the receiver is immovable and the supply circuit to it permanently installed, the scheme is quite satisfactory; but where the receiver, though normally standing in the same position, is supplied by flexible means, every care must be taken that the loose insulated wires are as short and inaccessible as possible and kept in good order—for it

ALWAYS ACCURATE



With a controlled A.C. supply accurate time is always available. This is a great boon, especially when it is desired not to miss certain items in the programmes.

must always be remembered that the cores are alive.

There is one special advantage in this arrangement. An electric clock, to be properly safeguarded, should be protected not by the ordinary fuses of the domestic installation, but by fuses which (electrically speaking) are much smaller.

The protection within a receiver fitted in the recommended fashion with its own fuses is much more suitable for the clock than the ordinary fuse.

ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

(*Continued from page* 491.)

his opinion that the Echometer will (1) record the presence of herring when swimming in shoals, (2) give the exact depth at which the shoal is moving and (3) give some idea of the density and extent of the shoal.

So successful was this skipper in his use of the Echometer, and such was his confidence in it, that he says: "If we do not *see the fish upon the machine* it is useless to put out the net." My italics!

I Acknowledge a Gift.

SOME anonymous well-wisher has presented me with a book entitled "A Handbook of Wine." And whilst I thank him for giving me anything at all I fail to trace the connection between wine and these Notes, which are written strictly on the coffee-wagon.

If the idea is that wine would brighten up my pages I reply that I should require not books, but bottles. But there! Maybe my patron is short-sighted and thought that the book is all about *wire*—a very dry subject!

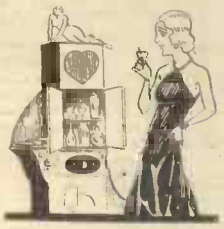
Two Great Inventions.

MY paragraph about record-changers, in which I expressed the wish that someone would invent a device for changing records from one side to the other, brings a letter from a Bristol reader who says that in 1929 he invented and patented that very thing and sold the patent to one of the leading gramophone companies.

Hi! Why is it not on the market? Which is the guilty party? Another attractive invention, for the signalling of Morse by an operator ignorant of the code, was exhibited recently at the Central Hall, Westminster. I wish I could have a gadget to enable me to speak French!

French Radio News.

THIS year's Paris Radio Salon brought no novelties to light. Observers state that the sets shown exhibited a more marked tendency to uniformity than heretofore, and that their sizes were reduced. Practically no battery sets were shown, and one-knob sets appeared to be considered as *le dernier cri*.



In the company of a large array of "midgets"—American influence?—there was a mighty *ensemble* consisting of a cocktail bar, table, gramophone and radio receiver.

Progress of a Society.

I AM glad to say that the Radio, Physical and Television Society (Sec., Mr. F. J. Bubear, 67, Nassau Road, Barnes, S.W.13), which I paragraphed some weeks ago. has experienced a considerable increase in its membership, but new members are still cordially invited.

I note that amongst the forthcoming lectures before this society are two entitled "The Spectrum of Radiant Energy" and "The Measurement of Light"—good, meaty subjects, i' faith! The society meets on the second and fourth Fridays each month at 72a, North End Road, West Kensington.

The "S.T.500."

IN the face of the convulsions of nature which have almost lifted the paving-stones of Tallis Street over this "S.T. 500" business, I may well hesitate to intrude my feeble, flippant pen and ask what you think of our last few numbers.

Speaking for "Ariel's" department, I can only register admiration, tinged with envy, of the journalist with the S.T. output—and such an output! I believe that he writes in his sleep. I do myself sometimes, but I cannot remember what I have written when I wake up.

Ha! whenever the component makers think that they have a quiet five minutes, "P.W." comes along with a stick of dynamite and spoils the dream.

SHORT WAVES

THAT EXPLAINS IT.

In a recent broadcast programme ballot in America only fourteen people voted in favour of political speeches.

It appears that no other politicians voted.
—"Sunday Pictorial."

* * *

"Something new in the way of music is announced for Wednesday, when the Victorian Police Band will broadcast." states a provincial paper.

This should be an "arresting" performance.

* * *

"Programmes of this kind are not accepted if they are of a sufficiently high standard."—Reported statement by the B.B.C.

A cynic says he has long suspected this.

* * *

"Sir, I would like to marry your daughter."
"What is your occupation?"
"Radio announcer."
"Take her. You're the first man who ever said 'Good-night' *and meant it*!"

* * *

BRIGHTON'S "B.P.C."

Oh, what a thrill in the kitchen to-day
At beautiful Brighton-by-Sea!
Cooks say that coppers are good as a play,
And press them to supper and tea.

For ev'ry one carries a radio set,
With wonderful music to spout.
"Walk in!" is the cry of the cooking coquette
Who was once all agog to walk out.
"Answers."

Watch Your Step.

VERILY the ice upon which the public speaker treadeth is almost as thin as that on which the writer of weekly running commentaries disporteth himself.

When the Lord Mayor of Manchester, at the opening of the Radio Exhibition in that city, said that wireless poles look like a regiment of drunken soldiers he meant to convey the thought that the poles, as usually seen in perspective down a vista of back gardens, give one the impression of a row of soldiers which, usually associated with the idea of perfect alinement, had fallen from that lofty ideal and, in short, had gone skee-wiff.

Believe me or believe me not, but an ex-serviceman had to write to a newspaper to say that he resented the remark as unworthy of his Lord Mayor. By Heck-mondwike!

The Highest Station?

THE St. Bernard monks who are going to found a hospice in the Himalayas are reported to have arrived at their destination after months of painful travel.

They are now in the Si-La Pass at an altitude of 13,000 ft., and as the Marchese Marconi has presented them with a wireless station the question arises whether it is not the highest in the world.

However that may be. I can imagine that some of our ultra-short-wave friends will consider the monks' opportunities for long-distance working with envy.

A Lusitania Memory.

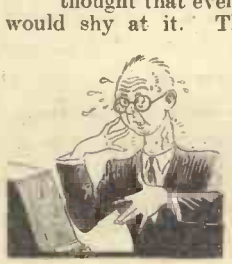
A SAD reminder of the Lusitania disaster is provided by the recent death of poor Leith, who was the chief wireless operator of that ship when she was torpedoed and sunk by the Germans. The then assistant operator, who was relieving Leith for lunch, escaped also, and is, I believe, very much alive to-day.

Unless my memory has played me false, this young man had the nerve to take a snapshot of the sloping and disordered decks *before* he saw about finding a spot of dry land.

The film was slightly spoiled by sea-water, but enough of the scene was left for publication. By the way, I lost sight of H. S. Bride, sole survivor of the Titanic wireless staff, after the war. Where is he?

A Bad Egg.

THE latest radio story from America is a very bad egg, and I should have thought that even an American editor would shy at it. The yarn concerns a Washington listener whose body is so affected by radio waves that within two minutes of his radio set being turned on his face becomes grey, his head twists from side to side and the tendons of his neck stand out like "steel cords," whilst his eyes take on a glassy stare.



Very, very sad! Any kind of cords would do, but steel ones are preferred. Now, surely the youngest "fan" knows that we are all under the influence of radio waves during every second of the day, even if the nearest receiver is a thousand miles away, and that set has nothing to do with the matter!

ARIEL.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos.

Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so

QUESTIONS AND ANSWERS

IMPROVING STRENGTH OF RECEPTION WHEN INDOOR AERIAL IS USED.

L. W. F. (Strood).—"Quite by chance I have discovered that I can get far better strength of reception from my set by a small modification, which involves the altering of the aerial connection.

"Please tell me if there is any objection to this—which seems out of the question, considering that I have been using the method to my complete satisfaction for two or three weeks—and also explain why it is not generally adopted.

"It seems to me that if people only knew the benefits of the method everybody would do as I have done. It is easy enough. I simply remove the aerial clip (attached by flex lead to aerial terminal) from its recommended coil-unit terminal and fix it instead to the unit's G. terminal, which remains connected as before to grid of valve, etc.

"Result, *twice the volume*, which is a big consideration where an indoor aerial is used, as in my case."

There is no objection, L. W. F., and in your position we should do exactly as you are doing. For *when an indoor aerial is used* it is commonly advantageous to connect the aerial lead "higher up" the coil than when an outdoor aerial is employed. Especially if you are situated, as you are, at a considerable distance from the nearest broadcasting station.

Most sets, however, are designed for use with outdoor aerials. And if a good or even a very moderate outdoor aerial is connected to the top of a coil (G. terminal) the strength goes up, certainly, but the selectivity is so poor that you get chunks of unwanted programmes mixed up with the one you want to listen to.

So the coil manufacturers provide terminals giving varying degrees of selectivity, and the user can choose which suits his own aerial and conditions best.

If he happens to use a short or inefficient indoor aerial, as apparently you are doing, even the highest tapping may not be high enough to give full strength consistent with sufficient selectivity, and in such a case it is possible to connect the aerial right up at the top of the grid circuit (G. terminal), as you have done with advantage.

But not everyone can do it. The location and efficiency of the aerial are the governing factors of the situation.

HOW TO MAKE A TUNING CHART.

M. K. (Swansea).—"What I should like to try my hand at is one of those home-made tuning charts, like the ones that the set makers often supply with a new set.

"By means of the milliammeter connected in the plate circuit of the detector valve I am able to tune in very accurately now—far

(*Continued on next page.*)

"P.W." PANELS, No. 144.—PARIS, EIFFEL TOWER.

Eiffel Tower was one of the world's first high-power wireless stations. Its transmitter is underground, and is controlled by the French Government.

* * *

Under the reorganisation of French broadcasting it will probably be used almost entirely for official purposes, leaving Radio Paris as the chief long-wave programme provider.

* * *

The wavelength used for broadcasting is 1,446 metres, and the power 13 kilowatts. The name is generally announced as "Tour Eiffel." Distance from London, 214 miles.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

better than when relying on the ear for the dial reading. And as the number of stations is simply amazing I feel that the only hope of getting them identified is to do the job properly and get them drawn out on paper.

"If you are not this week giving an illustrated article on how to do this perhaps you can explain by words. I've got the general idea, but am not quite sure of the proper way to set about it."

Drawing up a tuning chart is a most interesting business, and it enables you to identify with certainty dozens of stations that would otherwise remain unknown.

All you need is a wavelength list of Europe's stations, some graph (squared) paper, a sharp pencil and an india-rubber. Be sure to make a *large* chart, as greater ease and accuracy are obtained by this means.

Two sides of it must be marked out as the framework, one covering the range of dial readings and the other the range of wavelengths. On a typical set for medium waves these might be respectively 0 to 100° and 200 to 550 metres.

If the paper is large and the squares on it are small you can arrange the marking so that every degree on the dial is represented by a line up and down the chart, commencing in the left-hand corner with 0 and finishing near the right-hand corner with 100.

Similarly, the wavelength scale can be marked up at the side of the chart, 200 metres being at the bottom and 550 at the top.

Each across-the-chart line then represents one (or two) metres, according to the number of metres you have to fit into a given number of lines on the chart.

When this framework of the chart is filled in the next step is to draw the tuning curve. For this you need as many accurately taken dial readings as possible.

What you have to do is, first, to note the exact dial reading of a given station and place a dot on the line that represents that number of degrees of the dial. *This dot must also correspond exactly with that station's wavelength, as ascertained from the list of stations.*

London Regional, for example, may come in at 50 degrees, so the dot for London Regional must go on the 50 up-and-down line, and *also on the line corresponding to* 356 *metres*, because that is the wavelength of this particular station.

In the case of London National, if the dial reading were 15, the dot would go at the point where the line representing 15 degrees crosses the line representing 261·6 metres (i.e. a little more than halfway between the 261- and the 262-metre lines). And so on.

When a number of dial readings, accurately taken, have been transferred to the chart in this way it will be seen that the dots for the various stations have all spread themselves out into a sweeping curved line across the chart. Not quite straight, perhaps, but in the form of a curve, with only a very gentle deviation from the straight.

If any dot falls unexpectedly out of line with the others you can be fairly sure that something is wrong—either that dial reading has been carelessly taken and is inaccurate or else that station is working off its allotted wavelength.

In the latter event, of course, you can do nothing, except to pride yourself upon the case with which your curve showed up the discrepancy. But as wavelength wandering is comparatively rare this particular cause will trouble you but seldom, if at all.

In the former event—wrong dial reading—the remedy is obvious.

The final step in making the tuning chart is to pencil in the curve lightly, joining up all the dots. When this has been done every degree on the dial is linked with its appropriate wavelength by means of the curve.

Thus the "What-station-was-that?" problem is solved completely. If you know the dial reading of a station, but not its name, you simply ascertain from the curve what wavelength that dial reading covers, and your station is the one working there.

Similarly, if you want a particular station you first determine from the list of stations the wavelength upon which it works, and then you see from the chart what dial reading corresponds exactly to that.

Adjust the dial carefully to that reading, apply the final touches to the set (reaction, etc., if used, not forgetting to retune very slightly to compensate) and out of the welter of surrounding transmissions you find you have picked out the very one you wanted. Good old tuning chart!

DO YOU KNOW—

the Answers to the following Questions?

There is no "catch" in them; they are just interesting points that crop up in discussions on radio topics. If you like to try to answer them, you can compare your own solutions with those that appear on a following page of this number of "P.W."

(1) Of the total population of the British Isles, about what proportion has taken out licences for radio reception?

* * *

(2) Which European country has the unenviable distinction of having the smallest proportion of licensed radio listeners?

* * *

(3) About how many actors and actresses do you think are registered with the B.B.C.'s Productions Department for radio plays?

* * *

(4) If a biasing resistance of 500 ohms has to carry a current of 30 milliamps, what voltage is developed across it?

THE "S.T.500"—DRIVER AND CLASS B VALVES.

A. E. J. (Hayes, Kent).—"I am now all agog to begin on the 'S.T.500.' I suppose the Class B output could not easily be changed over to use an ordinary output valve or a pentode.

"And if it has got to be Class B, is it absolutely essential to keep to all the parts mentioned in the article? For instance, could I use a different transformer for the driver valve?

"I am sure many of your readers must be wondering the same thing, and don't know whether a small alteration would make a little or a lot of difference to results."

It is *certainly* not advisable to attempt to substitute an ordinary output stage, using a power or a pentode valve, for the Class B output of the "S.T.500."

For satisfactory working of a Class B stage it is essential that the combination of the driver valve, Class B valve and driver transformer be correctly arranged.

(Continued on next page.)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

If any deviations from the original "S.T.500" specification are made the driver transformer ratio must be suitably chosen for the particular driver and Class B valves. Information on this point can be obtained from the catalogues of the makes of the transformer it is intended to use or direct from the valve makers.

It should be noted that Class B valves, other than the B.21 originally specified, do not require grid bias.

MAKING YOUR OWN MAINS UNIT FOR CLASS B.

F. L. (Streatham, S.W.).—"Realising the importance of using only the approved apparatus, I want to be sure that even if I build the 'S.T.500' exactly as described by Mr. Scott-Taggart I am not going to use a wrong mains unit.

"The one I had in mind was the 'Class B Mains Unit,' which you gave details of in POPULAR WIRELESS dated September 23rd. Is this suitable?"

An A.C. or a D.C. mains unit may be used to supply the "S.T.500" with H.T., *providing it is of a type having particularly good voltage regulation* and is capable of giving a maximum output of 50 milliamps. In your own case a unit such as the "Class B A.C. Mains Unit," described in POPULAR WIRELESS for September 23rd, 1933, is suitable, as are some specially designed commercial mains units.

For the man on D.C. supply a suitable unit is the "D.C. Class B H.T. Unit," which was described in "The Wireless Constructor" for November, 1933.

IS AN OUTPUT FILTER AN IMPROVEMENT WHEN A MOVING-COIL LOUDSPEAKER IS USED?

W. M. S. (Much Hadham, Herts.).—"Being specially keen on the quality of the reproduction, my question may be a bit unusual. But I am out for the very best results I can get, so I want to know if an output filter is an improvement when a moving-coil loudspeaker is used.

"To be quite candid, I am very pleased with the results I already get, but if I can better them I want to 'go the whole hog.' And it occurs to me that an output filter is one well-known method of improving quality of which I am not taking advantage.

"Mine is a ——— loudspeaker, with its own transformer, and I have nothing but praise for it. Nevertheless, I should not mind running to a choke and condenser if you think that will be advisable.

"Perhaps I ought to add that as the set and loudspeaker are used quite close together in the same room, there will be no effect of long leads to consider, so it is simply a matter of quality. And, as I say, I do not mind the expense if you think there would be any improvement."

We *don't* think so, W. M. S. In fact, we disagree with your statement that an output filter is one method of improving quality of which you are not taking advantage.

For there are two kinds of output filter in general use—one employing an L.F. choke with condenser coupling, and the other employing an output transformer of suitable ratio.

Your moving-coil loudspeaker, you say, embodies its own transformer. And presumably you are using the correct output valve for it, with the transformer's terminals arranged to suit, if variable ratios are available for the different types of output valve.

Such an arrangement constitutes a very efficient output filter. And to add a choke and condenser arrangement would be gilding the lily and spoiling a good job through over-enthusiasm.

Having got a good set and a good loudspeaker, properly matched, the best way you can ensure good quality is to watch voltages and current consumption closely, by means of a good voltmeter and milliammeter (or by using a good combination instrument) which will keep a check on these for you.

And don't forget the tip given in "Eckersley Explains" regarding the advisability of hearing bands, etc. at first hand, whenever you can, and comparing results critically.

IS YOUR SET BEHAVING ITSELF?

Perhaps your switching doesn't work properly? Or some mysterious noise has appeared and is spoiling your radio reception? Or one of the batteries seems to run down much faster than formerly?

Whatever your radio problem may be remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers its unrivalled service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an Application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS, PLEASE NOTE: Inquiries should NOT be made by 'phone or in person at Fleetway House or Tallis House.

THE ANSWERS

TO THE QUESTIONS GIVEN ON PAGE 525 ARE GIVEN BELOW.

(1) Between 10 and 11 per cent.

* * *

(2) Spain. The proportion of listeners to the total population of Spain is only about ·2 per cent.

* * *

(3) Approximately five hundred actors and five hundred actresses are available, giving the producers a choice of four or five alternatives for every part they may wish to present.

* * *

(4) By Ohm's Law $V = I \times R$. So if I = ·03 amp. and R = 500 ohms the voltage, V, will be 15.

DID YOU KNOW THEM ALL?

WHAT S.T.500 BUILDERS SAY

"VOLUME IS TREMENDOUS"

From G. J. Millard, 65, Beech Grove, Acomb, York.

"I feel I must write and tell you how delighted I am with the 'S.T.500.' I built both the 'S.T.300' and 'S.T.400,' and managed to refrain from writing of my appreciation, but this was impossible after the first evening with the new set.

"The 'S.T.300' was good; the 'S.T.400' was better; but the 'S.T.500' is in a different class altogether. The sensitivity, quality, and volume is tremendous, while the selectivity is as good as you have claimed it to be.

"It is indeed a thrill to tune in a very weak signal to the same volume as an ordinary S.G. set would give, and then 'turn up the wick' with aerial reaction, until full loud-speaker strength is obtained.

"Just one point which I think will interest hundreds of 'S.T.300' and 'S.T.400' users. I am supplying H.T. through an Ekco K.25 eliminator, and there seems to be no trace of voltage instability. Constructors who use this particular unit, therefore, need not hesitate about building their new sets.

"As the receiver is installed in a large radio-gram cabinet, I put the tone-control condenser on the panel in the position previously occupied by the 'S.T.400' reaction distributor. The results on records, by the way, are as excellent as on radio.

"In conclusion, allow me to thank you for producing this wonderful design. You have once again kept faith with all your followers, and newcomers to the ranks will realise what they have missed through not building your sets before."

[*I am pleased to note the remarks about the mains unit, although I definitely prefer readers to use an H.T. battery. The excellent results obtained by this reader on this particular model are, however, of considerable interest to others possessing this model.*—J. S.-T.]

"THAT WORD IS THANKS!"

From J. Foster, 11, Lexington St., W.1.

"I have just finished and tried out the 'S.T.500.'

"Whilst countless more able pens than mine will sing its praises, there is just one word of appreciation that I, a humble follower of truth, and knowing it when I have found it—can sincerely offer to 'P.W.' and to J. S.-T.

"That word is Thanks!"

"A WONDERFUL AFFAIR"

From W. Burnett, 39, St. Helen's Road, Westcliff-on-Sea, Essex.

"Your 'S.T.500' is really a wonderful affair. Never have I heard the foreigners come bounding in as they do on 'S.T.500.'"

"WHAT BEAUTIFUL TONE!"

From T. Gee, 61, Army Street, Clapham, London, S.W.4.

"I must thank you for the change I have just carried out on my 'S.T.400' as I am very pleased with your latest design. I was an S.T.300 enthusiast—and what results! Then on to your 'S.T.400' and, 'Oh! Boy,' some circuit! But I guess the 'S.T.500' is 'IT' and what beautiful tone and volume!"

MULTIPLE CONTROLS—THE REASON FOR S.T.500 SUCCESS

(*Continued from page 494.*)

perfection of the indirectly-heated valve left the home constructor miles behind. It would almost seem as though he gave up the struggle.

We are all familiar with the great gap in civilisation between the fall of the Roman Empire and the Renaissance. For hundreds of years civilisation was submerged. Learning was of no account. Cruelty and barbarism were rampant. There was no order, no art, no spiritual life. Only in secluded quarters was the flame of civilisation kept burning. False ideals flourished; quackery, witchcraft and magic swept over Europe.

The idea may be far-fetched, but to me it seems that—except in isolated places—there was no progress in improving the standard of reception during the years 1927 to 1930. The set manufacturers forged ahead, but the average movement of technical efficiency on the part of home constructors was backward.

Vast numbers of the older wireless experimenters gave up wireless as a hobby; but their ranks were filled by new enthusiasts who were encouraged to regard simplicity as the be-all and end-all of wireless-set design. The era of this false simplicity is over. May it never return!

J. S.-T.

All builders of the S.T.500 should read the important note on page 536.

ROUND THE RECORDS

A review of some of the more outstanding of the recently released records, of special interest to all users of radiograms or pick-ups.

I AM writing this a few days after a certain musical play was introduced to London theatre-goers—"Gay Divorce"; but though the play may be fresh to the audiences who have crowded the foyer at the Palace, I'll warrant the music was not, except perhaps to the first-nighters. In fact, it is already almost hackneyed, thanks to the gramophone and broadcasting.

I can never make up my mind whether the pre-release or simultaneous release of the star musical numbers of a show detract from that show's box-office returns, or whether the "plugging" they often receive results in quickened interest. Probably they act as valuable "trailers."

"Night and Day."

If so, then "Gay Divorce" ought to be one of the most successful shows extant, for its almost annoyingly haunting "Night and Day" has already received full attention from dance band, crooner, light orchestra and pianist. It has been "canned" and broadcast in a variety of ways that immediately label it a "hit," and no uncertain one at that.

Apart from the broadcasting of it by Henry Hall, Harry Roy, Lew Stone and others, I have so far come across excellent recordings by Paul Whiteman (H.M.V. 12-inch), Leo Reisman (H.M.V.), Scott Wood (Regal-Zono), Val Rosing (Rex), Leslie Hutchinson (Parlophone), The Comedy Harmonists (H.M.V.), Richard Tauber (Parlophone), Morton Downey (Broadcast), Ambrose (Brunswick), Fred Astaire (Columbia). No doubt we shall soon have others, and by the time you read this the list will be very much longer. "Night and Day" is a "hit," and it has hit very hard. It has been plugged vigorously since the word "go" on November 1st.

"Dinner at Eight" is being pushed as much as, if not more than, "Night and Day," but I doubt if it will become the craze of the latter.

Other Good Numbers.

As a matter of fact, we seem to be having quite a glut of good numbers, with a variety that is unusually wide. Thus we have such diversity as the two already mentioned, "The Last Round Up," "Who's Afraid of the Big Bad Wolf" and "The Wedding of Mr. Mickey Mouse."

Of these I like best Ambrose playing "The Last Round Up" (Brunswick), Jay Wilbur and Henry Hall in "The Wedding of Mr. Mickey Mouse" (Rex and Columbia) and Lew Sylva in "Who's Afraid of the Big Bad Wolf," on Rex.

For those who like plenty of band let me prescribe the massed dance-band recording of "Don't Blame Me," "Isn't it Heavenly," "Lazybones" and "Call it a Day," on Decca. Here we have the united efforts of the bands of Jack Hylton, Lew Stone, Ambrose and Roy Fox. It is a very

(*Continued on next page.*)

ROUND THE RECORDS

(Continued from previous page.)

fine recording, and considering the number of instruments is remarkably crisp.

To get on to something different, have you heard the Rex recording of "Sandy Powell the Film Star"? It is a double-sided ten-inch disc of the popular comedian whose ideas never seem to run out. Goodness knows how many things he has "been" in his time—fireman, plumber and so forth. Now he is a film star acting with a lady who is excellently caricatured and of whose identity you are left in no doubt.

A Great Favourite.

Here is a story of the inimitable Gracie Fields that is of special interest. Last year's "Gracie's Christmas Party" record is still a favourite in many homes, and thousands will be glad to have another festival record from the same artiste.

As before, Gracie has gathered the Fields clan together before the microphone, necessarily some two months before Christmas, to prepare another fireside character record.

The incident took place in the H.M.V. studios at St. John's Wood, where Tommy and Betty Fields, Gracie's brother and sister, her father and mother and the famous comedienne herself were assembled.

"We are a very sentimental family," said Gracie, "and whatever happens we are always together at Christmas. We sit round the fire in the evenings and sing old favourites in harmony, and I thought it would be a good idea if we recorded these just as though they were taking place at home. We always wish we could invite all the old friends from Rochdale down to Telscombe for Christmas, but, as we have so many, it is impossible. This year, however, they will be able to be with us through a gramophone record."

The recording manager explained that it was originally intended that the recording should actually take place down in Miss Fields' home at Telscombe. As it was thought, however, that an orchestral accompaniment would be of benefit, it was decided that a studio recording would be preferable owing to the difficulty of accommodating an orchestra with the recording gear in an ordinary living-room.

Recording a Kiss.

Betty, Tommy, mother, father and Gracie all grouped themselves round the microphone. The red lamp flickered and the recording started. The family greeted each other, and Gracie gave her mother a kiss.

This simple action produced complications. The buzzer sounded; the recording engineer popped his head out of his little room. "It sounded like a thunderstorm," he said; "you are too close." A few kissing rehearsals took place, and in a couple of minutes the recorded kiss had been brought to perfection.

After a short discussion about the plum pudding, mother started off by singing "My Mother's Name was Mary," and all the family joined in for the first chorus.

At last it was all over, and the wax blank was carefully sent off down to Hayes to undergo the plating process. In due course we shall see the imprints of the record in the gramophone dealers'—and it will be sure of a most ready sale.

K. D. R.

THE LISTENER'S NOTEBOOK

(Continued from page 518.)

concert had been at 8 p.m. and the Leslie Sarony hour at 9, then all would have been O.K. I expect to be told that it isn't as easy a matter as this. To which I reply, "Then it should be."

* * *

Quite obviously the B.B.C. themselves consider the Mais talks one of their biggest things this autumn. Therefore from the start they should have seen to it that nothing else of exceptional interest clashed with him.

Without being disrespectful to Leslie Sarony, I think it would have been less of a sacrifice to have to forgo his hour (or a portion of it) than it was to miss some of Solomon. And this only because these light musical programmes are so plentiful.

* * *

This is a bit hard on Leslie Sarony and his concert party, as they are a particularly bright crowd. No concert party wants a better pair of comedians than Leslie Sarony and Arty Ash. There's more than a spice of originality about them.

The show was remarkable for the number of funny songs heard over the air, I should say, for the first time. I shall be very surprised if we don't hear more of that number, "When the old black sheep went Baa!"

* * *

An old-world type of song—"Dolly Varden"—was another gem, while the two sketches, or quickies, as the compère preferred to call them, should be reproduced in many family circles this Christmas. I liked Hazel Shelley, too; her step-dancing might easily make the Eight Step Sisters Nine. A very good show, well compèred, and comparing well with the best concert-party performance yet put on.

* * *

One of Mr. Mais' greatest difficulties, I should say, is his having to squeeze a week's doings into a talk lasting only 20 minutes. There must be many things he has to leave unsaid, for he couldn't accelerate even one word more per minute without risking a crash. One thing he never omits. He never fails to mention the colour of his landscapes. He must have a wonderful eye for colour.

* * *

One hears on all sides appreciative remarks about the season's talks, especially from the younger generation. Admittedly, present talks do reach a very high standard, which may account for their popularity.

But there is also the fact that listeners are becoming more expert in the art of listening. In the case of the younger generation I wonder how far the broadcasts to schools are responsible for this progress.

* * *

I once looked on the studio audience with great disfavour. Many critics do so still. But mine is a real conversion. Radiolympia opened my eyes. Ever since those epoch-making performances I've thought a good deal about the question, and I've discovered that the measure of my enjoyment of a variety or a music-hall hour is determined by the size of the audience present.

As the quality of each bill is pretty much the same, that side of the question doesn't come into the argument. A variety with no audience is as dull as ditch-water to me. A relay from a theatre is my ideal, of course, for there you have the audience par excellence.

ECKERSLEY EXPLAINS

(Continued from page 497.)

It is useless to imagine that with valve sets there is much to be gained by making a very elaborate earth; a good one will do. It is useful, however, to see that the earth (if it must be used) is good. In a great number of cases, and particularly with battery-operated sets (where the absence of mains may mean an absence of capacity effect to earth), the earth is essential.

With crystal sets or where there is little or no retroaction you must make a very good earth. A waterpipe makes a very good earth provided you can join the wire to the pipe properly. A plate, say, 3 square feet, buried vertically in the moist ground, is good.

Leave the tip of the plate above ground so that the joint—wire to plate—is always visible and not easily corroded. The long copper tubes driven into the ground are good. Keep it all wet. No experimenter ought to be without a good earth.

THE LINK BETWEEN

(Continued from page 498.)

As a matter of passing interest, I am assured by Mr. Graham Farish that, despite the over-night delay, a big spurt was put on the next day, and within twelve hours the lost time was entirely made up. Constructors of the "S.T.500" (and who isn't?) need therefore have no fears of a possible delay in the delivery of G.F. parts. The position is entirely normal, and supplies have not been interrupted despite the delay. Good work, G.F.!

Cossor's Latest.

I can remember the time—and not so very long ago—when the superhet method of reception was a matter for great controversy. But what a very different story presents itself to-day!

What with the advent of new valves and new circuits, the superhet has now emerged as one of the few types of sets that can really be said to fulfil the modern requirements of high selectivity and sensitivity plus simplicity of operation.

These thoughts have been brought to mind by a leaflet which has just come to hand from Messrs. A. C. Cossor, and in which is described their range of superheterodyne receivers.

There are two of them, the model 635 for A.C. mains and the model 634 for battery operation, and, knowing the high quality of all products bearing the name of Cossor, I am amazed at the extremely modest prices at which they are offered.

The battery model, which employs Class B output and single-dial tuning, and which is supplied complete with valves and a permanent-magnet-type moving-coil speaker in a pleasingly modern walnut-finished cabinet, costs only £13.10s.

The price of the A.C. version, which, of course, is also inclusive of valves, speaker and cabinet, is 14 guineas, a figure which in many cases is appreciably lower than one would have had to pay twelve months ago for a quite ordinary three-valver.

Those of my readers who are interested in complete receivers would no doubt welcome further details of these two fine sets, and I am therefore going to make the descriptive literature available under our postcard scheme. **(No. 64)**

After-Sales Kit Service.

I have always been keen on the kit method of buying parts for the construction of a set, simply because, apart from the question of convenience, there are few kits these days which do not carry with them a guarantee of performance.

The kits which are now being offered by Messrs. Marcus Overton Radio, Ltd., are no exception to the rule. A guaranteed performance plus after-sales service are the two principal features of these new "Ace" sealed kits; and Mr. Marcus, who has for many years been connected with home constructors' kits, will be personally responsible for the prompt dispatch of every order.

All inquiries relative to these new kits should be addressed to 62, Borough High Street, London, S.E.1.

THE MIRROR OF THE B.B.C.

(Continued from page 498.)

and 2nd, respectively (National and Regional).

The Drama Director of the B.B.C. will not produce the play himself, but has entrusted this work to Howard Rose. "Red Tabs" was first broadcast in 1930. Another play, with which some listeners are already familiar through previous broadcasts, is Dulcima Glasby's "Obsession," which will be heard on Monday and Tuesday, November 20th and 21st, respectively.

Philip Ridgeway's Popularity.

While most artistes are willing to take as many engagements as the B.B.C. will offer them, our old friend Philip Ridgeway is in the position of having to ask the Corporation to postpone his next booking.

Throughout the summer Philip did excellent business with his Parade entertainment at the seaside resorts up and down the country. Even then he was well fixed up for some months ahead, but thought it would be all right to accept a broadcast engagement for next January.

Now he finds that his show is in such demand that he has asked to be allowed to put it off until the end of May.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

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

Tone-Correcting Transformers.

I WONDER how many of you use the so-called "tone-correcting" low-frequency transformers. These, as you know, enable you to "tune" the low-frequency side of the set in much the same way as you tune the H.F. side for the incoming signal wavelength. It is not really quite the same thing, because with the tone-correcting transformer what you really do is to compensate for the tone or quality rather than tune to any actual wavelength.

This brings up the old question about the quality which you can get on the reception of foreign or distant stations. Generally, long-distance reception involves not only sensitivity but (in these days) also a high degree of selectivity. As everyone knows, when you make the set very selective you are apt to cut out sidebands, and with the sidebands goes the quality, particularly owing to the loss of the higher notes. There are all kinds of dodges for reinstating the lost higher register, and really the tone-correcting transformer comes, I suppose, under this heading.

Balancing the Tone.

In this transformer there is a variable resistance which is operated by means of a control knob. By altering the resistance you can diminish the response to the bass register, and so by comparison you emphasise or bring up the higher register.

I have often tried this type of transformer on different sets and got some very good results. The results, however, depend largely on the type of set with which the component is used, some sets showing a much greater improvement with it than others.

If the set is one which relies largely upon reaction, you will generally find much greater improvement by using a tone-correcting transformer. I have also used this transformer with sets of very high selectivity and found a very marked improvement in the quality owing to the partial suppression of the bass and the relative enhancement of the upper register.

In fact, you can juggle about quite a lot with the tone, and can adjust it to give you something to suit your own individual requirements. I should say that some people rather favour a preponderance of bass in the reproduction, as they think that this gives a kind of "mellow" tone, but personally I think it is much more natural when there is a fair amount of the upper register mixed with it.

"Mellowness."

The passion for mellowness, amounting sometimes really to boominess, explains why so many people are fond of loud speakers which have this characteristic.

It is all very well to have a sort of giant bass voice booming out of the speaker, but to me it gets very tiring after a time, and, if the truth were known, the voice is really

(*Continued on next page.*)

TECHNICAL NOTES

(Continued from previous page.)

quite unlike that of the announcer or artiste who is speaking at the studio. Once you get a nice balance of tone you will find that it really never becomes tiring, since it is so closely akin to the natural speaking or singing voice.

Short-Wave Reaction.

One of the commonest complaints of readers is that they cannot properly control reaction. This is very important for working on the medium waves, but is, if anything, still more important if you work on the short-wave band.

In fact, it is no exaggeration to say that the sensitivity of a short-wave receiver depends almost entirely on the proper smooth working of the reaction. If the detector is not working under proper conditions the reaction will be "ploppy."

One of the simplest ways to get over this is to use a lower anode voltage on the detector. This should not, as a rule, be more than 60 volts, and sometimes distinctly less than this value will give you the best results.

A Question of Bias.

If, however, the trouble is not due to the detector voltage, have a look at the positive bias on the grid and try a lower value. Another dodge you might try is to use a higher value grid leak, which will often work wonders. For short-wave purposes the grid leak may be increased to quite a large value, even up to as much as 5 megohms, whilst the condenser to go with it may be, round about ·0003 microfarad.

Speaker Effects.

A week or two ago I said something in these Notes about using a moving-coil loudspeaker with its back close to a wall, and about how this tends to interfere with the quality of the reproduction, as well as the volume.

I have had several letters from readers about this, describing similar experiences. I haven't space to deal with them all, but I would like to quote one reader who says that, in using a mains-driven moving-coil speaker in a radiogram, he found that if the cabinet was placed with its back against a plaster wall, reproduction was very muffled, whilst he got a "boominess" on low notes and a curious "piercing effect" in the higher register.

In addition to all this, the reproduction of the high notes was very weak, and it seemed as though some kind of absorption was taking place. When the cabinet was placed at an angle in the corner of the room, so that there was a good space between the back of the speaker and the wall, there was a great improvement in quality and also a noticeable increase in volume, especially on the high notes

A Useful Sounding Board.

Another interesting thing which this particular reader mentions is that he tried placing the cabinet with its back against one of a pair of large wooden folding doors which separated two rooms, and in this position he got excellent results, better than when the speaker was in the middle of the room. I expect this was due to some kind of resonance set up by the wooden door which acted as a sort of sounding board.

Try Different Positions.

Other readers, as I say, described effects which are in general similar to the above, and it seems pretty clear from experiences of those who have written to me that a great deal depends on the position of the speaker in relation to the wall and even to other objects in the room.

This is a point you are rather apt to forget in the ordinary way, but it is best to try a few different positions and find one which, whilst being convenient, also gives you good reproduction. I have actually come across cases where a speaker was tried in different positions and the results were so different that you would have hardly recognised it as the same instrument.

Sound Patterns.

Those of you who read an article of mine in "P.W." about two months back on

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

"Loudspeaker Sound Patterns" no doubt wondered whether the arrangement could be used for "percussion" notes, such as those of a piano. A "percussion" note, I should explain, is one produced by a vibrating object, such as a string, which is struck and then left to vibrate freely.

The note from a piano string is a good example of a percussion note, the vibrations dying gradually away. A violin string, on the other hand, gives out a note whilst the bow is moving across it, and it is kept in what is called "maintained" vibration, which is quite a different thing.

Damped Wave Train.

In the arrangement which I described in the article the sound waves were impressed upon a cinema film, and several correspondents have pointed out that whilst this would give the reproduction of *maintained* notes, such as those of the organ, violin and various other instruments, it would not give *percussion* notes, such as those of the piano.

On the face of it this would seem to be so, but I understand from the inventor that he has some special arrangement by which the individual notes are recorded and the film moves forward at the necessary speed, so that actually, if you depress a key when a piano film is being played, you get precisely the same effect as if a pianoforte note were struck.

Can You Improve It?

But, as I said in the article and as I hasten to repeat, the "Film Piano" is not *my* invention, and I described it because I thought it embodied many very interesting possibilities. I should be pleased to hear from other readers who may see ways in which it could be used or improved.

Transformer Surge.

I wonder if you have ever noticed when using a small transformer—or any other similar inductive component for that matter—that if you frequently "make and break" the current you will sometimes, at the "make," get a current which is much greater than the normal current.

This is quite different from the ordinary step-up kick which you get in the secondary, and, in fact, the effect I am referring to occurs in the primary because, of course, that is where you make and break the current.

Safeguard the Winding.

I remember noticing this effect particularly once when experimenting with some small transformers for rectifying purposes. To safeguard the whole outfit I had a small flashlamp bulb in series with the primary as a fuse, and I knew that when things were working normally the current was so small that the filament in this little lamp was scarcely visible.

After switching on a number of times, however, I would suddenly see a bright flash in the lamp and the filament would fizzle out. On putting in another pea-lamp the same thing would perhaps occur right away at the first shot, or sometimes the lamp would last for a number of times and then would suddenly go the same way.

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

Excess Current.

It appears to be due to surges of current which depend upon the precise point of the alternating current wave which you strike, as it were, when switching on. You might switch on a dozen times and never get this effect, whilst on the other hand you might get it the first time and blow a fuse which is designed to carry a far greater current than the normal for the conditions in which you are working.

Loose Connections.

The burning out of a fuse is not in itself a very serious matter, but what is much more important is the effect on the transformer winding if you do *not* use a fuse. You will see from this how important it is to use a transformer which is generously proportioned for the work and capable of standing up to a sudden surge like this.

One very important point to note is that if you get a vibrating loose connection in the primary of the transformer, which is giving you a make-and-break effect, you will be very liable to damage the windings sooner or later, so that it is better to have such a break repaired without delay.

S.G. Valves and Selectivity.

The selectivity of a set when using a screened-grid high-frequency stage can often be improved by trying out different values of the bias in the control-grid circuit. As a matter of fact, this method is used in a number of commercial sets.

The value of the bias to be used cannot be stated generally, because it varies a little in different conditions, and it is worth while to try different values for yourself. The usual value of 0·9 volts sometimes does not give you anything like the best results as regards selectivity. You will quite possibly find that if you vary this a little—it may be a little more or a little less, I can't tell you—you will get greatly improved results.

Adjusting the S.G. Bias.

If you are putting in a new screened-grid valve you should certainly try slight variations of the value of this bias, and not just assume that it is the conventional 0·9 or, indeed, any other prescribed value. I have known more than one case where ever such a slight adjustment of this grid-bias value has made a remarkable difference to the selectivity and, for the matter of that, to the sensitivity of the set as well.

S.T.500 CORRECTIONS.

Although all drawings, photographs and the blue print of the "S.T.500" are correct, wire (67) mentioned on page 293 of the Rapid Construction Guide ("Popular Wireless," dated October 21st, 1933), should read:

(67) No. 5 terminal (tighten) on anode coil to anode reaction condenser fixed vanes upper terminal (tighten) F1.

The instructions given for correcting the connections to certain differentials (other than those used) were given in the issue of "Popular Wireless" dated October 28th. On page 339 near the bottom of the middle column, the wire 74 should read 65. At the top of the left-hand column on page 340 wire 74 should also read wire 65.

J. S.-T.

Presentation Book Token 5

Printed and published every Wednesday by the Proprietors, THE AMALGAMATED PRESS, LTD., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices: Messrs. John H. Lile, Ltd., Ludgate Circus, London, E.C.4 (Telephone: Central 5352). Registered for transmission by Canadian Magazine Post. Subscription Rates: Inland and Canada, 17/4 per annum. Abroad (except Canada), 19/6 per annum. Sole Agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd.; and for South Africa: Central News Agency, Ltd. Saturday, November 18th, 1933. S.S.

POPULAR WIRELESS, November 25th, 1933. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THIS WEEK: THE A.T.B. ECONOMY THREE

ECKERSLEY EXPLAINS RECTIFIERS

Popular Wireless

HOW TO BUILD A BAND-PACK FOUR

No. 599. Vol. XXIV. November 25th, 1933.

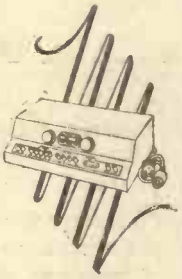
EVERY WEDNESDAY PRICE 3D.

The S.T.500 AS A RADIOGRAM

FINEST VALUE AND THE BIGGEST OUTPUTS

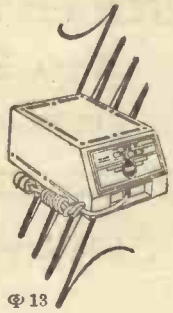
MAINS RADIO POWER at its BEST!

When you decide to convert your battery set to mains operation and cut your running costs to less than one shilling a year, be sure to insist on the only Mains Units to win the Olympia Ballots for two years in succession—the only Units to give such a high-reserve of power—and the units that experts invariably choose.



ATLAS MAINS UNITS

CLARKE'S "ATLAS"



The new models have been entirely re-designed and give by far the highest voltages, biggest outputs and finest smoothing—for any set, even "Class B" and "Q.P.P." And because prices are unaltered they are the finest value in the world. Models from 39/6 cash or 10/- down. Insist on "ATLAS." H. Clarke & Co. (M/cr). Ltd., Patricroft, Manchester. London: Bush House, W.C.2. Glasgow: G.E.S. Co. Ltd., 28, Oswald St.

★ POST COUPON NOW ★

℗ 13

H. CLARKE & CO. (M/CR.) LTD.,
Atlas Works, Patricroft, Manchester.

Please send me Booklet No. 87, telling me how to run my set from the mains with the wonderful new "ATLAS" Units.

Name.....

Address.....

30/13.

ASK YOUR DEALER — HE KNOWS

Purveyors of Electric Lamps By Appointment

Manufacturers and Purveyors of Electric Lamps By Appointment

EDISWAN

The name that means 'EXCELLENCE'

"EXTRA LIFE"

Ediswan "Extra-life" accumulators are designed so that the positive and negative plates are in perfect electrical balance. This means quicker charging, longer discharging and extra life. And they have other special features, too—metal carriers, non-corrodible terminals, a host of minor refinements. Better, from every point of view, than ordinary cells, and no more expensive. Get your Ediswan to-day.

E.L.M.2.	20 *a/h* - 4/3	*E.L.S.5.*	40 *a/h* - 11/-	*E.L.7.*	60 *a/h* - 10/3
E.L.M.4.	45 *a/h* - 8/-	*E.L.S.7.*	60 *a/h* - 12/6	*E.L.9.*	80 *a/h* - 12/3
		E.L.S.9.	80 *a/h* - 15/6		

EDISWAN EXTRA LIFE ACCUMULATORS

THE EDISON SWAN ELECTRIC CO. LTD.
PONDERS END, MIDDLESEX

TUNGAR - the Better Service Chargers

B.275

Not so simple
as it looks

38 SEPARATE PARTS IN A COSSOR VALVE

An ounce and a half of metal and glass—an elaborate little structure, patiently assembled stage by stage with meticulous care — accurate to one thousandth of an inch — the modern Aladdin's Lamp on which millions of discriminating listeners rely for their nightly radio entertainment — a Cossor Valve.

Year by year Radio technique advances with giant strides. Month by month new discoveries are made—new circuits are evolved. And always in the forefront are Cossor research engineers developing new valves to take advantage of these ever-changing conditions.

Whatever your valve requirements—whether it be a replacement valve for a simple Battery Receiver or one for an elaborate All-Electric Super Het you will find it in the Cossor range. More than 80 different types available —and every one manufactured to the same exacting standards of accuracy and efficiency.

COSSOR VALVES

Send for a copy of the new Cossor Wireless Book — 72 pages of interesting and useful information—latest circuits—definitions of radio terms—list of broadcasting stations, etc., etc. From cover to cover this publication is packed full of interest for expert and novice alike. Please use the coupon.

FREE

To A. C. COSSOR LTD., Melody Department, Highbury Grove, London, N.5.

Please send me free of charge, a copy of the 72-page Cossor Wireless Book B.V.33.

Name .....

Address .....

P.W. 25/11/33

4040.

POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
Technical Editor: C. V. DOWDING, Associate I.E.E.
Assistant Editor: P. ROBERT BIRD.

Managing Editor: N. F. EDWARDS.

Chief Radio Consultant: P. P. ECKERSLEY.
Assistant Editor: A. JOHNSON-RANDALL.
Chief of Research Dept.: K. D. ROGERS.

WIRELESS EXPORTS
G.P.O. RESEARCH
A NOVEL AERIAL
U.S.A. AMATEURS

RADIO NOTES & NEWS

MODERN MUSIC
ANTARCTIC RADIO
OUT OF PLACE
ADDING EFFECT

Where Britain Stands.

BY way of a cocktail, swallow this: A review of the world's radio trade by Dr. G. Lehmann, of the German "Wireless Industry Union," shows that in radio exports Holland has ousted the mighty U.S.A. from the premier place and now has 33 per cent of the world's trade. The U.S.A. is second with 28 per cent and Germany third with 22 per cent. Great Britain, the nation of traders, with half the earth under its flag, has *eight* per cent.

Correspondence Cleared.

BEFORE turning to this week's agenda permit me to wipe out a small arrears of correspondence, thus:

B. R. T. (Clapham).—I say the crystal is obsolete because it is—out of date. If you are going to use L.F. amplifiers with it you might just as well use a detector valve, too, and have done with it.

R. L. (Edinburgh).—I refuse to be drawn into a controversy about Scottish programmes. I like all the Scots I have ever met and don't wish to make a Scottish enemy.

L. S. F. (Andover).—Yes, at a pinch nitric acid would "do" for your accumulator. I should say it would "do" for it in about seven and a half minutes.

T. G. (Rye).—No, I cannot recommend any special make of valve. Not cricket!

Agate for Needles.

MY dream of the everlasting needle made of agate has been dispelled by a very workmanlike letter from J. L. C. (Forest Hill), who evidently knows his subject from A to ampersand.

It seems to be clear from his remarks that agate, whilst possessing the requisite hardness, has not, in all probability, the necessary compliance and is inferior to steel.

Well, what about steel with an admixture of some hardening metal? I forget the name for the moment. Uranium? Beryllium? Now, then, inventors, a really *permanent* metallic gramophone needle, please!

Transmissions on "Ultra-Short."

I UNDERSTAND that Messrs. Stratton & Co., Ltd., of Birmingham, are constructing a transmitter with which they propose to conduct experimental radiation on ultra-short waves, with the object of ascertaining their range and penetrability in congested industrial areas. The transmissions will be made once or twice a week.

Not much in this for the ordinary listener, but for those who steer about in what I might call the underworld of ether they may furnish a pleasant surprise.

The New P.O. Research Station.

THE new research centre of the Post Office at Dollis Hill has rightly attracted much favourable comment; it is beautifully equipped with both apparatus and the right kind of men. The Post Office is tired of being regarded as the Cinderella of the Civil Service and is gradually emerging from its obscurity.

I should be grateful if the researchers would give attention to (a) Post Office nibs; (b) automatic stamp machines which won't; (c) reduction of telephone rental; and (d) the reduction of the licence fee.

Trade Snippets.

THE Radio Manufacturers' Association has decided to apply to the Board of Trade for a marking order for radio sets, electrical reproducers and radio accessories.

Pye's have delivered a consignment of their sets to the Orkney Islands by aeroplane.

The Marconiphone Co.'s sales during September were the largest made during a month in the company's history. Then this record was beaten in October. Their superhet sales have increased by over 1,000 *per cent!*

"Originality in Wireless."

THAT is the title of a lecture which was delivered by Lieut. W. Jackson before the Portsmouth and District Wireless and Television Society last month. As a fine example of what may be done by skill and ingenuity I refer you to his full-rigged model of the Cutty Sark, which stands on a loudspeaker.

Forty feet of almost invisible wire—the rigging—acts as an aerial, and may be incorporated with the copperfoil of which the sails are made. This aerial system is designed to be directional, so that, as the ship is swung round, various stations may be tuned in.

Fine Amateur Work.

AS I have remarked before, and now, in their own language, "you gotter hand it to" those U.S.A. radio amateurs, for they certainly "saw wood."

The chairman of the Chicago Fair Radio Amateur Council states that over 10,000 messages to all parts of the world have been sent by W9USA and W9USB, the short-wave stations in the show's travel and transport building. Since June, too, 13,800 licensed amateur operators have registered in the short-wave exhibit.

"P.W." and a Lady of Spain.

THE British Blue Spot Co. have received, and kindly passed to us, the following letter from a Spanish lady in Huelva:

"I am Popular Wireless's subscriber, and also very fan to make sets. I beg you, if you please, send me a catalogue (P.W. 83S). I beg you, said me, how much, is the price of the Pick-Up 33; but I don't like nor arm neither volume control, because I have its.

"Thus I don't like but the pick-up and it

(*Continued on next page.*)

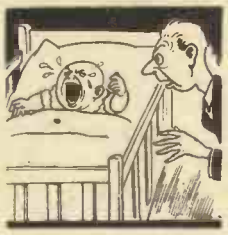
ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

wire. Excuse me the faults of this letter, and the troublesomes. I said, Pick-Up, 'New Blue Spot 33', that you advertment in Popular Wireless, Oct. 7th, 1993."

No trouble at all, dear lady. Charmed and honoured.

The Blow Falls!

SO it has come at last!—to me, who has boasted that I never was incommoded by other people's radio noises. Over my peaceful home the loudspeaker fiend has cast the dire shadow of his wing. Shadow, I say! *Puh!* More like massed bands. His speaker is operated at a volume which caused the vases on our mantelpiece to vibrate at their natural frequencies.



There is, however, a ray of hope, for we have observed that on six evenings a week the goof wakes his own baby, and *her* broadcasting is too much even for *his* cast-iron ears. I suppose that in about a year he will be cured, and then we shall be able to put our vases back again.

A Dictator on Music Modernists.

I HAVE read recently that Herr Hitler told some students that his choice in music was a good old German military march and that all the "modernists" ought to be in an asylum. No doubt the word "military" was a slip of the tongue. However, it is pleasant to be able to find something resembling common ground on which to stand with Germany's ruler.

Personally, though, I should be well content if the modernist music were kept in the concert halls and remote from the microphone. The composers might then go free, so little is the ill-will I bear them.

Pity the Poor B.B.C.!

AN acquaintance of mine, by profession an income-tax inspector, or assessor, or something, but by nature a clown and wit, has devised a ghastly scheme (so his daughter describes it) for baiting the B.B.C.

It seems that an indulgent uncle presented my friend's young son with quite a good model printing press. Result: young hopeful always pestering pa for "copy." Suddenly the imp of the perverse inspired pa to pen a series of searing criticisms of certain B.B.C. programmes, beautifully written in his best official style.

These he intends to be printed, stored and eventually placed in envelopes (4s. per 1,000), and finally delivered by hand at Broadcasting House. He proposes to keep up this jape for twelve months!

More About Byrd Broadcasts.

THE glamour of the proposed broadcasts from the Antarctic by Admiral Byrd is largely spoiled for me by the news that they, or the first three, are to be "sponsored" by something called "Postum." Whatever this may be, I feel sure that it is tasty, highly nutritive—and perfectly, horridly unromantic.

I learn further that "Postum" has the option of deserting the ship after the first broadcast, when, if that option is exercised, Jacob Ruppert, New York brewer, carries on. I think I like Jacob a little better, because he is partly financing the Byrd Expedition.

Weymouth for Ever!

ACCORDING to Mr. A. G. Smith, of Weymouth, the first radio transmission and reception in Britain was performed by Samuel Hunt, a bootmaker, in 1897. He says that Mr. Hunt devised a receiver, "afterwards called a cohera"!

Oh, dear! The principle of the coherer was known in 1870 by S. A. Varley. Calzecchi-Onesti developed it in 1884–5, and Branly produced a working coherer in 1891. Marconi patented his improved coherer in 1896, and demonstrated his wireless system to the Post Office in the same year, at the G.P.O. and on Salisbury Plain.

A Single-Knob Superhet.

"MODERN WIRELESS" for November provides a nice bit of construction in the shape of a one-knob, five-valve superhet, with band-pass input, on-off switch, combined with volume control, all the business being run from a separate power pack, selectivity with sensitivity being the aim.

Sacrilege.

TO-NIGHT, having to dine in town, I deserted my club in favour of Ye Olde Cheshire Cheese, in Fleet Street as ever was, there to try my luck once more with the famous steak, kidney and oyster pudding, and to gaze with reverence upon the favourite seat of that mighty journalist, Dr. Samuel Johnson.

I was an early diner, the only other company being two Amurrcan ladies who ate twice as much each as I did. Arrived at *cawfee*, one of them said: "Say, Mister Waiter, don't you have any raddio?" The heroic Johnny Bull steadied his voice and replied: "No, madam; only very old Cheshire cheese." Good! I tipped him double.

SHORT WAVES

TO-NIGHT'S WIRELESS.

8.30.—How the Wind Works in the Child—I. By the Hon. Medical Director of the East London Child Guidance Clinic.—Yorkshire paper.

Our Nanny could have told them.—"Punch."

* * *

Actions speak louder than words—but not when the loudspeaker next door is turned on at full strength.

* * *

UNRELIABLE.

Small Girl: "She's dead."
Friend: "No, she ain't."
Small Girl: "She is. Jessie heard it on the wireless."
Friend: "Oh, their wireless ain't no good. Her brother made it."—"Daily Mirror."

* * *

At the pre-Christmas meeting of carol singers it was unanimously agreed that wireless has completely spoilt their business.

A kind word for the B.B.C. at last.

* * *

A man living in a London suburb claims that he owns twelve different wireless sets.

We understand that the people who lived next door to him don't now.

* * *

FREEDOM OF SPEECH.

Let all pronunciations
By every man be mixed,
Save those that by dictations
The B.B.C. has fixed;
But every word those bouncers
Have sworn is wrong and vain
I call on free pronouncers
To use and use again!—"Punch."

* * *

"Saucepan used as a loudspeaker," runs a headline in the Daily Mirror.

But the daily supply of "hash" still guaranteed.

Society Note.

AS a sample of the kind of fare which is offered by good radio societies to their members let me instance a recent meeting of the Smethwick Wireless Society, at which Mr. F. Inchley, of the G.E.C., lectured on the Osram Catkin valves.

Mr. Inchley traced the development of valves, and thus led up to his description of the Catkin and the advantages of a metal container.

Lantern slides of the manufacturing processes were shown, and one is certain that the members received valuable information which is "not in the books." Hon. Sec.: Mr. E. Fisher, M.A., 33, Freeth Street, Oldbury, near Birmingham.

When Zeal Outruns Discretion.

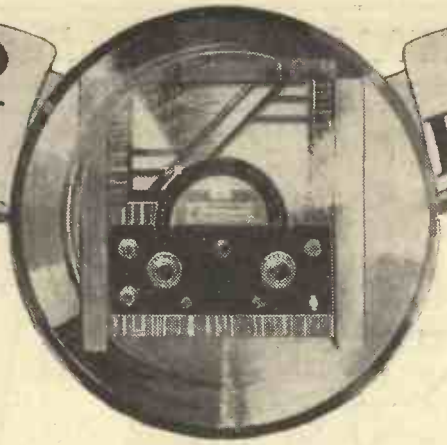
DURING September there was a fine old row in progress between the Columbia Broadcasting Company and the Indiana State Police because the former had broadcast a bullet-punctured programme purporting to describe a running fight between the police and some escaped convicts.

The police said that no shots were fired by them, and the Columbia B. Co. said that their O.B. man had had shots fired over the microphone (in order to inject a little 100-per-cent Americanism into the job?), and that, for their part they had fired *him*.

To my mind, the sole matter for astonishment in the affair is that a U.S.A. cop should deny with indignation that he had fired a shot!

ARIEL

USE YOUR S.T. 500 AS A RADIOGRAM



The "S.T.500" with its great output power and excellent quality makes an ideal set for the electrical reproduction of gramophone records.

Full details for converting the "S.T.500" into a highly efficient radiogram receiver are given below By JOHN SCOTT - TAGGART, F.Inst.P., A.M.I.E.E.

ALTHOUGH most constructors prefer a design to be for radio alone, there is a growing public for the joys of electrically reproduced records.

Only by electrical reproduction can one obtain the full quality from a modern record; but one essential is required: the set must be able to give a really large volume output, otherwise the ordinary mechanical gramophone will be preferred.

Here it is that the "S.T.500," with its magnificent output power, makes an ideal set—in fact, the best possible with battery sets. Its perfected Class B arrangement will give an output of 1.500 milliwatts or thereabouts, while with 150 volts on the anodes as much as 2,300 milliwatts can be "punched out"—and with excellent quality.

Only Four Extra Components.

The S.G. of the "S.T.500" is switched off automatically when the radiogram switch is turned to "gram," and the purely wireless circuits are also completely out of action. The grid of the detector valve is switched over from the grid condenser to the source of pick-up E.M.F.'s.

I shall now tell you how to alter your "S.T.500," which I have assumed has been built in accordance with the Rapid Construction Guide.

The parts required are:

(a) A radiogram switch, Wearite type I.23.
(b) A 50,000-ohm potentiometer, preferably of log-law type.
(c) A pick-up.
(d) A small single-cell battery, giving 1½ volts, or a tapping on a *separate* grid-bias battery.

It is essential, by the way, that the —1½ volts which is applied to the detector grid should come from a separate battery and not the grid-bias battery used for the other grids. (You *could* do so if you thoroughly decoupled the bias, but this complication and cost is avoided by a separate battery.)

Step-by-Step Connections.

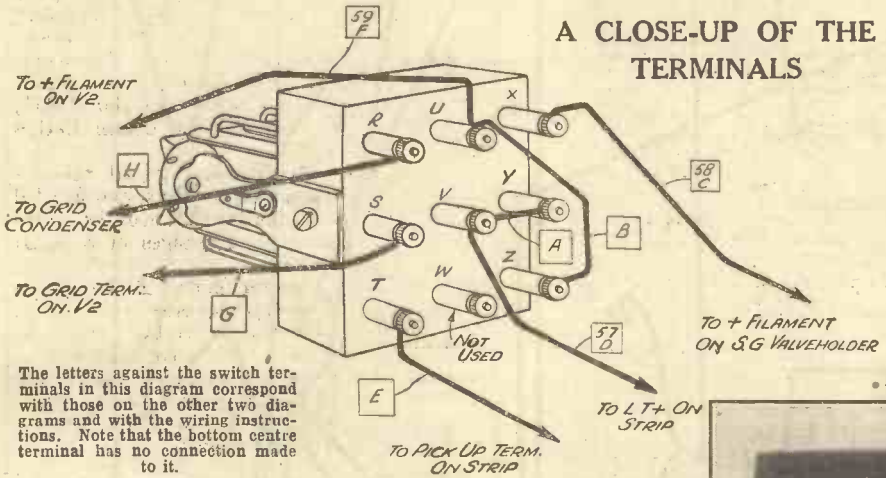
The external connections are given at the end of the following Rapid Guide. All the numbers are those in the drawings accompanying this article. Similar markings (except in the case of new or altered wires) appeared in the drawings appearing in the "S.T.500" main article (POPULAR WIRELESS, dated October 21st, 1933).

(a) Remove all wires from the two terminals of the anode tuning condenser—i.e. the wires (75), (74), (56), (55), (69), (68).
(b) Remove knob and dial from anode tuning condenser; remove anode tuning condenser from panel and lay aside temporarily.
(c) Remove wire (59) and discard.
(d) Disconnect ends of (58) and (57) from toggle switch (or radiogram switch if already fitted in accordance with suggestion made in the "S.T.500" Rapid Guide).
(e) Remove toggle switch. (If radiogram switch is fitted, take it off.)
(f) Fit wire (A) between V terminal and Y terminal (tighten) on Wearite I.23 radiogram switch. (See switch sketch.)
(g) Fit wire (B) between U terminal and Z terminal (tighten) on Wearite switch. (See sketch.)
(h) Hold switch temporarily in the position it will ultimately occupy. Mark the lengths to which wires (57) and (58) will be shortened, if necessary.

N.B.—Wire (58), after shortening, is called (58C). Wire (57), after shortening, is called (57D). In the sketches all

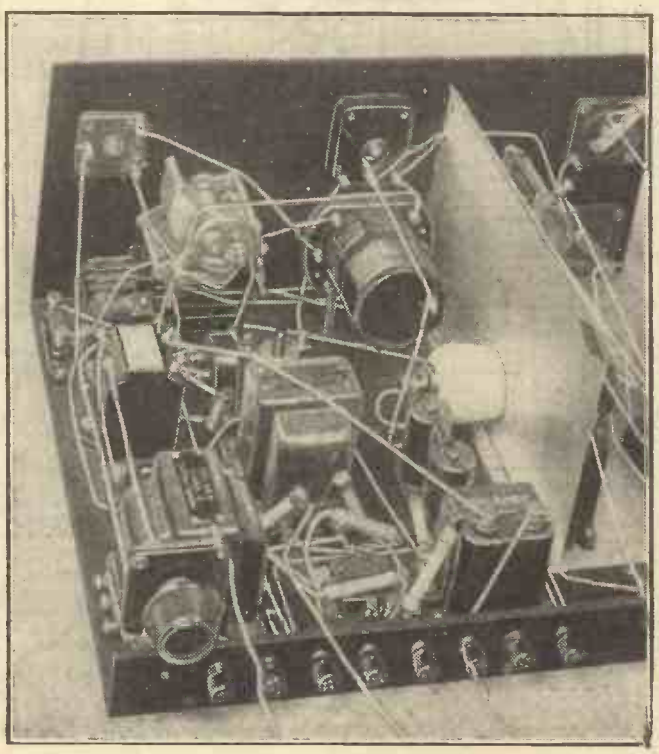
(*Continued on next page.*)

A CLOSE-UP OF THE TERMINALS



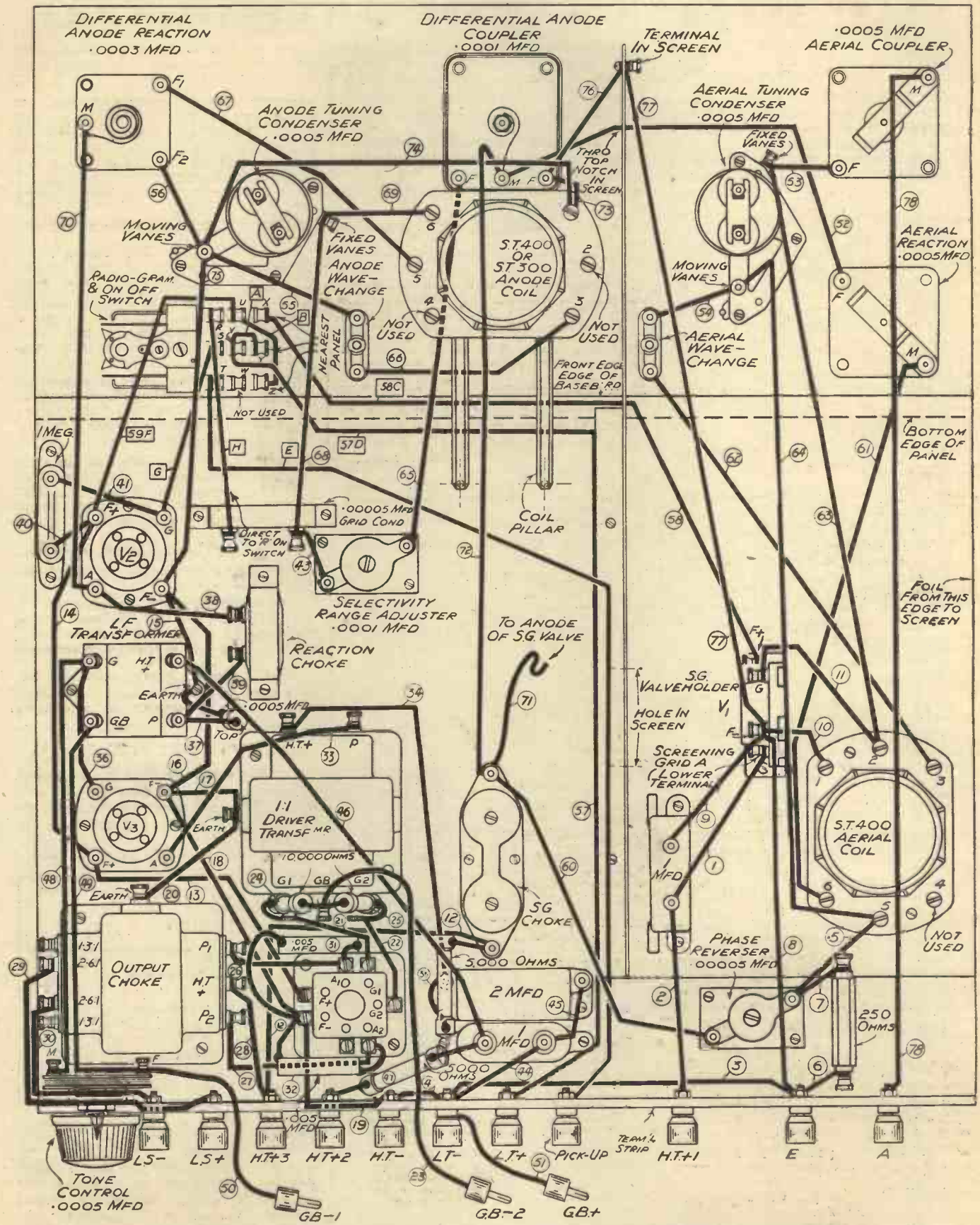
The letters against the switch terminals in this diagram correspond with those on the other two diagrams and with the wiring instructions. Note that the bottom centre terminal has no connection made to it.

AFTER CONVERSION



In this view of the modified receiver the radiogram switch can be seen below and slightly to the left of the anode tuning condenser. When the switch knob is turned to the "gram" position the S.G. valve is automatically cut out of circuit.

Use Your "S.T.500" as a Radiogram—continued



The wiring shown in the above diagram is identical with that of the "S.T.500" blue print, except for the connections to the radiogram and on-off switch. All new or altered leads are indicated by letters, which link up with the point-to-point instructions given in the article.

Perfected Class B does justice to Modern Records

numbers of new or modified connections are shown in squares to facilitate their location.

(j) Slip switch spindle through its hole in panel. Place indicating bracket on protruding switch spindle, and tighten down with fixing nut. Fit switch knob, noting that it indicates "off" when switch is in middle position.

(k) Connect (58C) to X terminal (tighten) on switch.

(l) Connect (57D) to V terminal (tighten) on switch.

(m) Drill hole for pick-up terminal on terminal strip (see drawing for position). Fit terminal loosely.

(n) Connect wire (E) from T terminal (tighten) on switch to pick-up terminal (tighten) on strip.

(o) Connect wire (59F) from U terminal (tighten) on switch to V2 filament terminal (tighten) F+ nearer baseboard edge.

(p) Remove wire (42) and discard.

(q) Connect wire (G) from S terminal (tighten) on switch to grid terminal (tighten) G on valve holder V2.

(r) Connect wire (H) from R terminal (tighten) on switch to grid condenser terminal (tighten) nearer valve holder V2.

(s) Fit anode tuning condenser on panel, refitting dial and knob.

(t) Reconnect (68) and (69) to anode tuning condenser fixed vanes terminal (on side in case of Ormond), tightening terminal.

(u) Reconnect (55), (56), (74) and (75) to the anode tuning condenser *moving* vanes terminal (tighten), at end in case of Ormond.

This concludes the conversion to radiogram. If the toggle switch fits too snugly in one corner it may be necessary to modify slightly this corner of the cabinet vignette to accommodate the radiogram switch.

Connecting the Pick-Up.

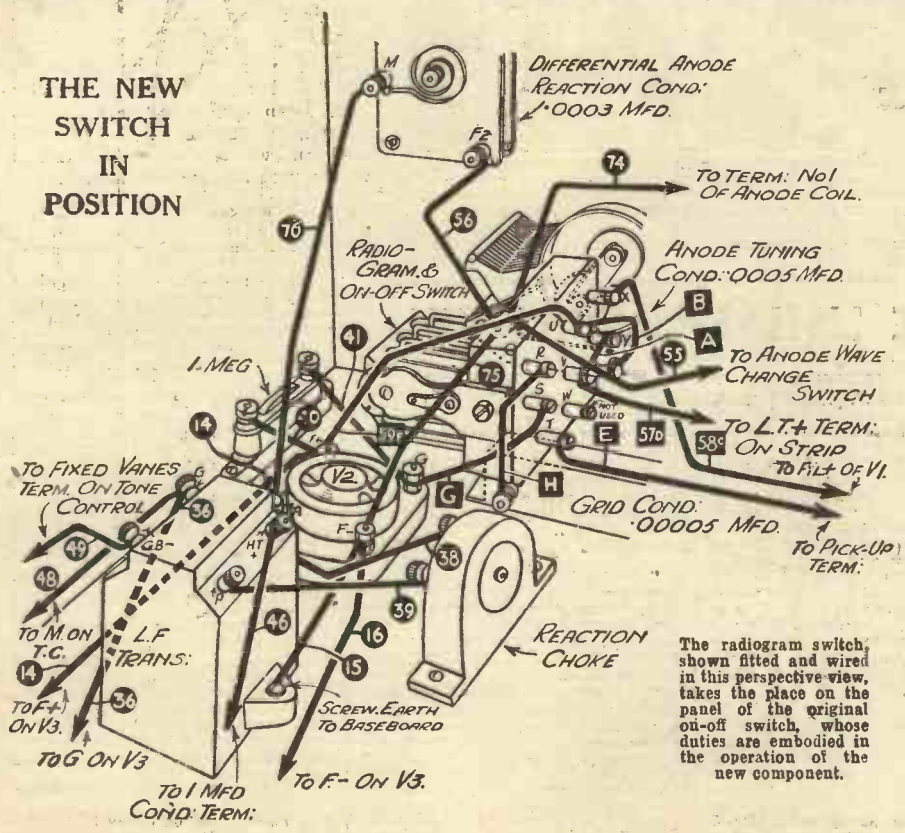
The external connection instructions are: Connect pick-up leads across the potentiometer (which will usually be fitted on the motor-board). Connect the end of the potentiometer (the end where the "law" is "open"—i.e. spread out, in the case of a log-law potentiometer) to —1½ volts on a separate battery. Connect this grid-bias battery's positive to L.T. — on strip. Connect sliding contact on potentiometer to pick-up terminal on strip. If there is an earthing shield on the pick-up leads, earth it to L.T. —.

You are now ready to enjoy the really fine gramophone music obtainable from the "S.T.500." J. S.-T.

THERE ARE NO EXTRA CONTROLS

The words "Off," "Rad" and "Gram" appear when the radiogram switch knob is rotated through its three positions. The knob is clearly visible in the bottom right-hand corner of this photograph.

THE NEW SWITCH IN POSITION



The radiogram switch, shown fitted and wired in this perspective view, takes the place on the panel of the original on-off switch, whose duties are embodied in the operation of the new component.

FROM S.T.500 BUILDERS

"EXCELLENT SET."

From J. T. Cathcart, "Muckross," Orwell Park, Rathgar, Dublin.

"On receipt of your issue of October 21st, giving details of the 'S.T.500,' I built same and have nothing but praise for it.

"Since then I have been patiently waiting for the details of how to add the radiogram switch (Wearite I23) which were promised very shortly.

"I feel sure that there are hundreds of other constructors who, like myself, are most anxious to play records through this excellent set."

"MORE THAN DELIGHTED."

From Walter A. Cross, 170, Wallace Road, Sheffield 3.

"Just a word of praise to your paper and S.T.

"I have built the 'S.T.500,' and working same from H.T. eliminator not a special model, and I am more than delighted with wonderful results from it ('S.T.500').

"For stability, quality, selectivity and volume there is no set to touch it, it is really a remarkable set. Thanking you again for a real enjoyment."

"EVERYTHING YOU CLAIM."

From W. Bayliss, 96, Vine St., Liverpool.

"I have recently completed the building of the 'S.T.500,' and would say that I am delighted with the results. It is everything that you claim for it."

FOR YOUR ACCUMULATOR

IT is not always possible to arrange the accumulator in such a position that it is out of sight; nor is it possible to place the accumulator so that there is no possible fear of acid creeping over the surrounding woodwork on which the accumulator is stood. Even the very best of accumulators have a nasty habit of occasionally spraying acid-laden fumes on the surrounding material on which it stands.

It is suggested, therefore, that the accumulator be placed inside a large glass or earthenware jar, and then the outside of the jar painted or treated in such a manner as to harmonise with the local surroundings. J. R. W.

THE MIRROR OF THE B.B.C. By O. H. M.

A NEW ORCHESTRA FOR THE B.B.C.?

The Bells of Bethlehem—Some Cheery Programmes—Sir Thomas Beecham Again—The Story of King Arthur.

THERE is a good deal of talk in musical circles about a report that the B.B.C. may form a new symphony orchestra of about fifty players. The idea as suggested is that the present main orchestra is having much too much to do and is tired before it gets well started on its public symphony season.

The advantage of a new orchestra would be to relieve the main orchestra of all the routine studio performance which its sections have now to undertake. Of course, if the B.B.C. were to take action of this kind the main orchestra would be able to concentrate on public performance in a way likely to challenge the new competition of the Philharmonic Orchestra.

More Bother About Bells

The Christmas relay of the bells of Bethlehem has involved more crises and difficulties than any other programme event of which I have heard. Last week I gave an account of the early difficulties as between the N.B.C. and the B.B.C., and of how these were settled by the separation of the bells transmission from the main B.B.C. Empire programme.

Since then I hear that further political and religious difficulties in Palestine have ruled out the possibility of the relay of the bells on Christmas Day itself. The authorities there say that they will provide the bells only at eight o'clock on Christmas Eve: so the arrangements both in this country and in America have to be recast. Anyway, it is now fairly certain that the bells will be heard at the time offered.

An Attack Stifled.

On the day Parliament reassembled the Wireless Telegraphy Act of 1904, under which broadcast receiving licences can be collected, had to be formally renewed under the Expiring Laws Continuance Bill. This apparently was to have been made the occasion for a large-scale attack on the B.B.C.

Plans of the attack had been kept so secret that it was hoped to spring a complete surprise both on the P.M.G. and on the B.B.C. As usual, however, the intelligence resources of Broadcasting House were equal to the occasion, with the result that the attack did not develop. So the enemies of broadcasting are awaiting another occasion.

For Possible Emergencies.

Ever since the General Strike in 1926, when the B.B.C. was taken over by the Government for the national emergency, there have been in existence standing orders containing regulations for possible future emergencies. These, of course, include international war as well as civil troubles at home.

With the declaration of a state of war between His Majesty's Government and any foreign Power or Powers the Board of Governors of the B.B.C. would be as much under the direction of the Government as the War Office or the Admiralty. It would be necessary, first of all, to attempt to safeguard the transmissions both from ether interference and from hostile bombing.

It is anticipated that an enemy would make the maximum effort to destroy Broadcasting House. But in the unlikely event of this succeeding the broadcasting service would continue unaffected, at least so far as essential work was concerned.

RECEIVING A BROADCAST LESSON

The school broadcasts sent out by the B.B.C. have proved very popular in many localities. In the photograph above you see children at the Aldersbrook School, Wanstead Park, listening to a lesson on a receiver which was constructed in the school workshops.

Bright Spots.

Ella Retford, Jay Laurier, Sandy Rowan, the Western Brothers, Dora Gregory, Harold Clemence and W. E. C. Jenkins are among the artistes who will take part in a performance of "Fill Up Here," a garage concern scenario by Tom H. Townson, which Charles Brewer is producing on Wednesday, November 29th. With such a brilliant cast it has the makings of a good show. Put the date in your radio diary.

And while you are at it don't forget Saturday, December 2nd, when Leonard Henry, Ernie Mayne, Bertha Willmott, Marriott Edgar, Tommy Handley, Dan Leno (jun.), and the Eight Step Sisters are taking part in a programme called "What Next?"

John Sharman is the producer, and the book has been written by Dan Leno (jun.), whose previous diverting programme, "The Fire Station," was one of the best things in the programmes last month.

(*Continued on page 572.*)

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes and on microphone personalities of the moment.

I HAVE no authority whatever for passing judgment on such a great composer and pianist as Bela Bartok, unless being a keen student of Sir Walford Davies confers on me some sort of qualification. I have certainly taken Sir Walford seriously and endeavoured to obtain a better understanding of the vast quantities of good music that the B.B.C. provides.

And in most cases I have succeeded in discovering (at any rate, to my own satisfaction) what the composer has intended to express in his composition and the player in his interpretation.

* * *

But when I hear a performer like Bela Bartok I am thrown into a state of confusion. He seems so different from everyone else. I know he is reputed to be a law unto himself as far as music is concerned.

After listening to his interpretation of Bach's Suite in G minor (which was for all the world like Bach gone wrong to me) I was so bewildered and moved that I couldn't resist protesting with the remark, "We are being fooled!" If this is the real stuff, then all I can say is that, as far as my powers of musical appreciation are concerned, I am still as undeveloped as ever I was.

* * *

I could see, however, what was behind Arthur Bliss' Choral Symphony, "Morning Heroes," although I can't say I enjoyed more than bits of it here and there. By the way, one of the movements reminded me strangely of Chopin's Funeral March. But the orator part of it was, in my opinion, a mistake. It was unique, but one had either to listen to him or to the music. It was obvious one couldn't listen to both. In fact, I don't think it was possible to listen to them both at the same time, because listening to music and listening to oratory are by no means the same thing.

* * *

In these duets the orator dominated the scene. He seemed to monopolise the microphone, and what was heard of the musical accompaniment was too ill-defined to be appreciated. Yet the work was well constructed, and the majestic climax at the end was a triumph for the chorus and orchestra. Ion Swinley's oratory was superb, but it was too preponderant to be considered the complement of a harmonious whole.

* * *

"Good Evening" was variety masquerading as something I can't quite define. It was variety plus patter plus surprises intentional and unintentional. Naturally, the unintentional surprises evoked the greatest interest and discussion.

The party spirit was well sustained throughout, but like the critic who, in a criticism of a certain performance of Macbeth, asked, "What is the piano doing on the blasted heath, anyhow?" I, too, wondered what Gray's Elegy was doing bringing a party of this sort to a close. This was the surprise of the evening!

The other variety show compered by Dave Burnaby also lacked lustre, and gave further signs of the fearful strain put on our purveyors of humour. The sentimental song, too, was in evidence; its source never seems to run dry.

Anything less like Harry Tate than Harry Tate in that extraordinary fantasy, "Fortifying a House," couldn't be imagined. He obviously doesn't believe that stage and broadcast performances call for the same treatment. In fact, Harry Tate was hardly recognisable through the loudspeaker. Yet he wasn't a failure by any means.

* * *

I think the B.B.C. is right in pinning its faith on musical comedy. It doesn't seem to matter how old a musical comedy is; it is always well received. Why is this? I wonder. Is it because the sparkling, lilting tunes and the orchestral arrangements are sufficient in themselves to attract? I think so. I have long felt that the road to musical comedy stardom is infinitely smoother than, say, that of the variety stage, just because it is musical comedy and not variety.

"A Waltz Dream" needed no Gertie

(*Continued on page 571.*)

ECKERSLEY EXPLAINS-

The rectification of alternating current is the subject dealt with by our Radio Consultant-in-Chief this week. He explains in a most understandable and interesting manner how rectification is obtained, and gives details of the various systems in common use.

EVERYONE seems to want to know more about mains units. The problems of smoothing are not easy to solve by making calculations. The principle of smoothing and rectifying alternating voltages to produce a steady, direct current supply is illustrated in Fig. 1.

First of all, we can illustrate what comes out of the rectifier as "gulches" of water fed out from a tank where it says "load." These "gulches" are unidirectional. If there was no rectifier the tank T would never get filled, because one impulse of the pump would push water into the tank and the other impulse would suck it out again.

Compared with a Tank.

The rectifier is a "valve" which opens for one pulse and shuts for the other, and so lets the water into the tank in gulches. The tank, of course, corresponds to the condenser.

It will be obvious that the smoothness of the flow out of the tank will, for a given amount of water forced in per pump push, depend upon the size of the tank and the rate at which the water is allowed to flow past the "load."

If the load passes the water very easily the tank will empty as fast as it fills, as it were, and the outflow will be uneven. On the other hand, if scarcely any water flows out of the tank the pressure in the tank will rise until the rectifier (or valve) will scarcely open at each gulch and the outflow will be much more even.

Thus we see that a mains unit smoothes better as the condenser is bigger and as the load current is less. Many a mains unit gives apparently bad smoothing because the set used with it takes more current than the unit was designed to supply.

Secondly, because the more frequent the pump impulses the more smooth the outflow. In effect, the faster the pulses supplied to the condenser the more easily are these pulses smoothed.

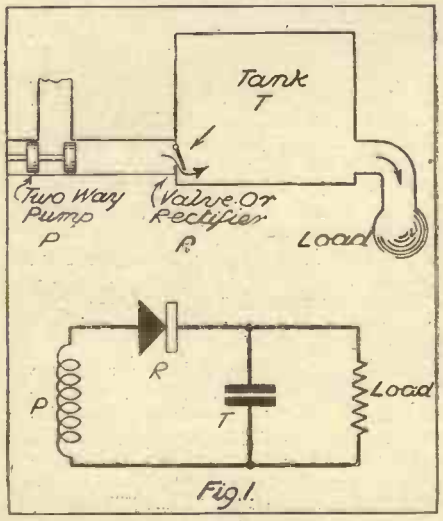
Thus in Fig. 2 we show a way to get double-wave rectification, and this has the advantage that the smoothing condenser can be smaller.

Improving the Smoothing.

Another way of making the smoothing system efficient is to put a choke and condenser after the smoothing condenser so that the choke resists the pulses and the condenser accepts them. It is cheaper to use chokes like this than to increase the size of condensers.

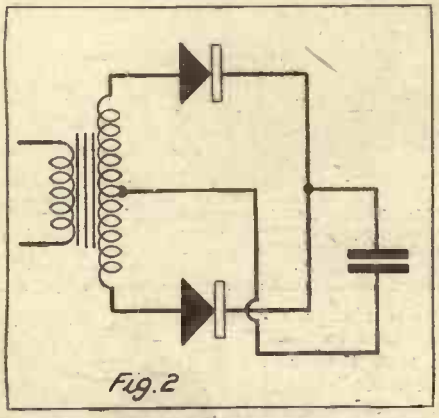
There is yet another way to get double wave—or, as it is also called, "full wave"—rectification which has the advantage of doubling the voltage given by the transformer. If you work it out slowly, taking pulse by pulse, you will see how it works. (Fig. 3.)

THE PUMP ANALOGY



"The rectifier is a 'valve' which opens for one pulse and shuts for the other, and so lets water into the tank in gulches. The tank, of course, corresponds to the condenser."

A FULL-WAVE RECTIFIER



With the aid of a centre-tapped transformer and two rectifiers, full-wave rectification can be obtained. It is necessary, however, that the *total* voltage given by the transformer be approximately double that of the rectified output.

People often wonder whether it is better to use valve rectifiers or gas (mercury vapour) rectifiers or metal (dry) rectifiers. The answer depends upon the purpose of the design of the set.

Every rectifier has a resistance. The current has to pass through the rectifier. Therefore volts are lost in the rectifier, and the more current is taken out of the system the more volts are lost in the rectifier. A rectifier is, in this respect, and between certain limits, very different from a battery.

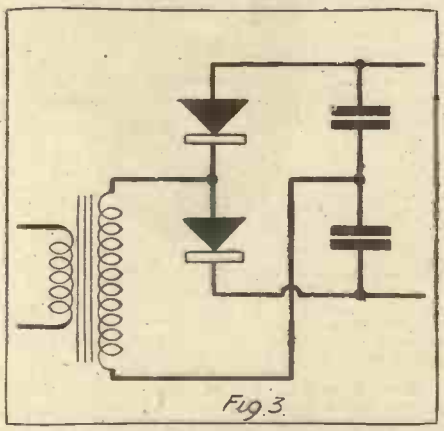
A battery, between certain limits of current discharge, gives almost the same voltage for a small as for a big current. But the voltage coming out of a mains unit falls, more or less rapidly, as more current is taken from it.

Internal Resistance.

Metal rectifiers have a high internal resistance. Mercury-gas rectifiers are almost constant current devices and have a very small internal impedance. Mercury rectifiers behave almost like batteries. The valve rectifier has a smaller internal resistance than a metal rectifier, but a higher resistance than a mercury rectifier.

(*Continued on page* 573.)

FOR VOLTAGE DOUBLING



In the diagram above you see a circuit which is capable of full-wave rectification using a transformer giving only *half* the voltage of the rectified output. It is called a voltage-doubling system, and is employed in most metal rectifier circuits.

A NEW R. & A. SPEAKER

As I have so often said before, we must not let the present great moving-coil boom blind us to the fact that there are other types of speakers deserving the closest consideration.

The balanced armature principle has not stood still; great improvements in its application have been made. And prices, too, have fallen just as much as with the M.c.

For instance, there is a new R. & A. improved "differential armature] reproducer" at only 21s. which is probably equivalent to the highest standards of achievement reached in this particular branch of the art.

The constructor may well ask himself whether or not it may be better to buy the very best of an alternative type of speaker which costs at the very least half-a-guinea less than the cheapest representatives of another class.

I was very favourably impressed indeed with this R. & A. type 60, as it is styled. In my view, its performance is definitely superior to many moving coils, some costing three times as much.

But if I get really started on the subject of fetishes and fashions (for a few M/c.'s owe their success to that and not their intrinsic merits), I shall overrun my space.

The R. & A. type 60 is a sound instrument, well designed and well built, and I urge readers to give it a hearing. They could spend so much more and receive so much less satisfaction, especially with sets of modest power output; and that is what the average battery set is after all.

INTERFERENCE ELIMINATOR

I have seen devices advertised as being certain cures of every form of interference, natural and otherwise. You connect one of these little boxes of magic to the aerial and at once both atmospheric and artificial electrical interference are eliminated. Anyway, that is the kind of claim made.

Actually, of course, there is no such easy solution to the problem. If there were, all those dozens of experts on the I.E.E. Interference Committee would be wasting their time.

Yes, I have tested some of these wonderful gadgets. One did reduce interference considerably, but the broadcasting programmes were rubbed out, too!

It is refreshing to turn from these ineffective articles to a properly engineered method of dealing with the trouble, such as the Belling-Lee Disturbance Suppressor, which has been designed in accordance with Post Office recommendations for cutting out electrical interference.

The R. & A. balanced armature loudspeaker is an inexpensive, well-made instrument, capable of a particularly fine performance.

No exaggerated claims are made for it; there is no need for that, for it does not attempt the impossible, but is a perfectly sound up-to-the-minute version of a well-tried and tested scheme which achieves its mission by dealing with the interference *at the source*.

It comprises two heavy duty 2-mfd. fixed condensers, with the centre point connected to a shrouded earthing terminal and the other connections taken via a pair of safety fuses to terminals for connection to the mains.

The whole is converted into a neat little unit the lid of which forms the carrier for the fuses. When this lid is removed the fuses are, of course, completely disconnected from the circuit and can be safely handled.

The presence of these fuses is, in itself, evidence of the careful engineering underlying this Belling-Lee Suppressor. You see, however carefully a condenser is made, it cannot be guaranteed to last indefinitely, and after carrying a mains voltage for years it is almost bound to break down in the end. The suppressor fuses guard against such a breakdown causing damage.

The device is used in either of two ways. It can be inserted between the set and the mains if the interference reaches the set in that way.

If it comes into the aerial or earth, then it must be dealt with at its starting point, which may be some domestic electrical appliance in the listener's or a neighbour's house.

This Belling-Lee interference eliminator deals very effectively with most forms of "man-made static."

Belling-Lee claim that their Disturbance Suppressor can be "expected to do its job in 80 to 90% cases of disturbance by man-made static."

Obviously, that is a very fair assumption, because its application is scientifically sound. As for the article itself, it is very well made indeed, and when we tried it on a battered old fan that was creating terrible interference it did its job perfectly.

The price is 9s. 6d., and most complete instructions are supplied with it.

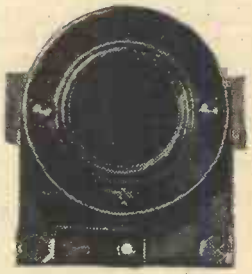
A USEFUL FITTING

There are times when a radio set does its work too quietly. I mean at the end of the programme when, if there is a silent background (as there should be at least from the locals), there is nothing at all to remind one to switch the set off.

I know ladies sometimes forget to switch off electric irons, but a screaming vacuum cleaner is not often forgotten!

Well, I am not advocating sets which do make humming and other noises, but there is always the visual alternative.

Most mains sets have illuminated tuning scales and these answer the purpose admirably. On the other hand, the majority of battery sets are bleakly undemonstrative. And to leave a battery set running all night is a terribly wasteful procedure.



Warning that a battery-driven set is switched on is provided by the Ready Radio indicator illustrated here.

Ready Radio have an excellent little gadget for removing the danger, one which forms a clear reminder for the forgetful.

It takes the form of a neat little panel light which shows the word "On" when the set is switched on. The criticism might be raised that this light itself consumes current. But it consumes only L.T. and a mere ·06 ampere at that.

This is an almost negligible increase on the normal L.T. consumption of a set.

The light is easy enough to fit, too, and makes a handsome refinement for any set. It costs 1s. 6d. complete, and there is both a battery and a mains model.

And this reasonable price for a decidedly useful gadget reminds me that practically all the Ready Radio components are reduced in price this season. There are some very excellent values for money to be found in the "R.R." range.

Weekly jottings of interest to buyers

I AM always inclined to think that the word "portable" as applied to wireless receivers is a particularly loose, even almost a misleading, term.

Ask a number of people what they think of portable receivers, and nine out of ten of them—assuming that you mean one of those "fifty - shilling - complete - with - valves - built-in-a-suitcase" affairs (semi-colon!)—will denounce them.

If that represented a true picture I'm afraid I should be with them. But it doesn't. The technique of "portable" reception has developed almost as rapidly as that of straightforward receivers, and the outdoor application of a modern portable is very much a secondary consideration.

Portability, in the modern sense, is really another way of describing a completely self-contained instrument requiring neither aerial nor earth and enabling reception to be effected in any part of the house without the need for loudspeaker extension leads.

Happier for the explanation, I can now pass on to the real purpose of this note, which is to introduce the very latest addition to H.M.V.'s famous range of receivers. They have called it the "Superhet A.V.C. Portable Grand." Hence my remarks above concerning the word "portable"!

As a matter of fact, this new H.M.V. effort—typical of the name that it bears—is a remarkable instrument: six valves, an 8-stage superheterodyne circuit, automatic volume control, moving-coil speaker, Q.P.P. pentode output and so on. The most amazing thing about it to me is that in the quiescent state it takes a total H.T. consumption of only 9 milliamps.

I am glad to say that arrangements have been made for a complete test report to appear in "P.W." at an early date. Meanwhile, full details are available through our postcard literature scheme. This "red-hot" opportunity (it has only just been released) is definitely one that should not be missed. **(No. 65.)**

Ferranti's Do It Again!

For the second year in succession, as a result of the ballot organised by the Wireless Retailers' Association in conjunction with Allied Newspapers, a Ferranti receiver has been awarded first place for the best value-for-money set shown at the recent Northern National Radio Exhibition.

The set to gain this distinction (and, incidentally, the cup that goes with it) was the Ferranti "Lancastria Parva"

(*Continued on page* 571.)

A BAND-PACK FOUR

A superb four-valve battery receiver combining simplicity in construction with exceptional efficiency. Outstanding range and selectivity, single-knob tuning, automatic volume control and a special H.T. economiser are features which must appeal to all who desire a really up-to-the-minute design.

Designed and Described by THE "P.W." RESEARCH DEPARTMENT.

WHILE there are undoubtedly many constructors who are prepared to regard their sets as pieces of apparatus to be constantly altered and experimented with, there must be as many again who desire to make permanent sets for either themselves or friends.

And obviously they want them to be as compact and of as good appearance as high-quality commercial receivers.

You must all agree that in both these respects the "Band-pack Four" is an outstanding design. Indeed, it is as good as or better than *any* set from even the purely æsthetic point of view.

Also, as you can see, there are only three controls. It is a set that anyone can handle with complete success.

Constancy of Performance

Judged as an example of modern radio engineering, it is quite an exceptional design.

For providing colossal power, an all but uncanny command of the ether, it has two variable-mu screen-grid valves.

Absolute constancy of performance is guaranteed by the inclusion of an up-to-the-minute automatic volume control system.

Fading and wide variations in programme strength due to the varying strength of the scores of different stations are reduced to an astounding degree.

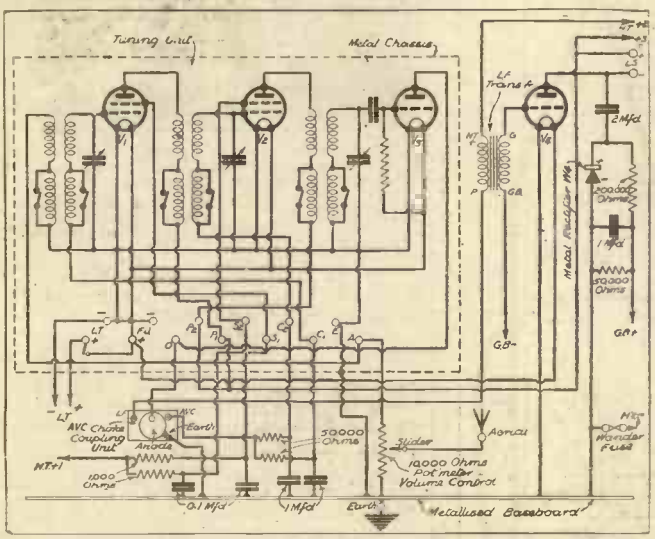
But it should be noted that this A.V.C. does not necessitate a double-diode pentode or other such complication and expense.

That inexpensive, ingenious, versatile, and efficient little "Westector" accomplishes the task in conjunction with the variable-mu S.G. valves.

A second Westector is used in order to economise H.T. The A.V.C. Westector is incorporated in a complete A.V.C. unit. This is a very convenient method of applying the system and adds nothing to the

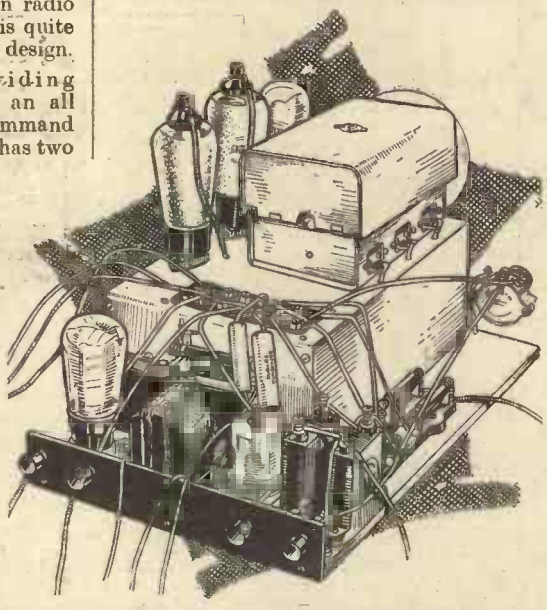
(*Continued on next page.*)

DUAL VOLUME CONTROL



An ingenious A.V.C. unit overcomes fading and keeps the volume constant. Manual volume control is also provided for setting the actual "level" at the required degree. An H.T. economiser is another feature of the set.

THREE TUNED CIRCUITS



The artist's sketch shows very clearly how simple is the wiring for a set of this description. Advantage has been taken of the compact units which are available to achieve this end.

THE COMPONENTS YOU REQUIRE ARE INCLUDED IN THIS COMPREHENSIVE LIST

Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.	Component.	Make used by Designer.	Alternative makes of suitable specification recommended by designer.
1 Metaplex baseboard, 9 in. x 14 in.	Peto-Scott	—	2 1-mfd. do.	Lissen, type L.N.133	T.C.C., Igranic, Dubilier, Telsen
1 Igranipak	Igranic (Battery Model)	—	1 1-mfd. do.	Telsen, type W.227	Igranic, Lissen, T.C.C.
1 L.F. transformer	Lissen "Hypernik"	—	2 1-mfd. tubular do.	Dubilier, type 4404	T.C.C.
1 Four-pin valve holder	Benjamin "Vibrolder"	W.B.	1 A.V.C. unit	Varley	—
1 10,000-ohm wire-wound potentiometer	Bulgin, type V.C.32	Igranic	1 Westector	Westinghouse, type W.4	—
1 200,000-ohm resistance with terminals or wire ends	Graham Farish "Ohmite" 1½ watt	Dubilier	1 Terminal strip, 9 in. x 1½ in.	Goltone	Peto-Scott
			4 Terminals	Bulgin	Belling-Lee
			5 Wander-plugs	Clix	Belling-Lee, Eelex
1 50,000-ohm do.	Dubilier, 1 watt type	Graham Farish	1 Wander-fuse	Belling-Lee	—
2 50,000-ohm resistances with horizontal holders	Dubilier ("Dumetohm holder")	Graham Farish	2 L.T. Sockets	Clix	Belling-Lee, Goltone, Bulgin
			6 yards 18-gauge T.C. wire	Goltone	—
2 1,000-ohm resistances with horizontal holders	Graham Farish "Ohmite" 1½ watt	Dubilier	4 yards insulating sleeving	Goltone	—
			Screws, flex, etc.	Peto-Scott	—
1 2-mfd. fixed condenser	Telsen, type W.226	Lissen, Igranic, T.C.C.	Cabinet to suit above	Peto-Scott	—

A BAND-PACK FOUR

(Continued from previous page.)

cost of the set, for the separate items would probably cost more.

The economiser Westector is in the anode circuit of the power valve. It alters the grid bias of this in proportion to the volume. The saving in H.T. current is considerable. In fact, the total H.T. consumption of the set is hardly that of many three-valvers!

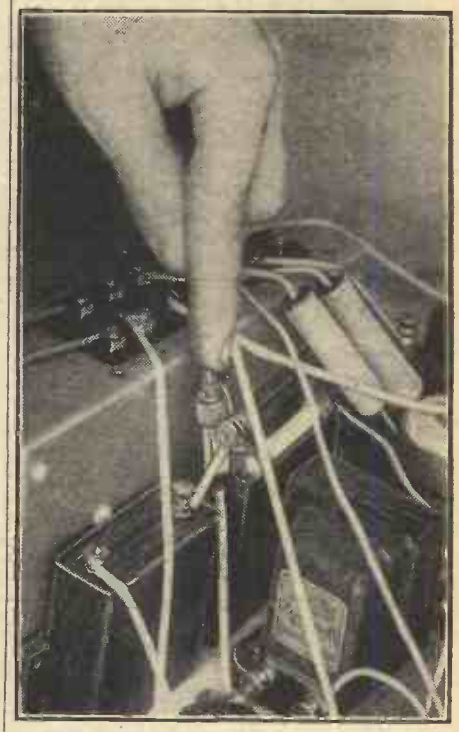
There are three tuned circuits, and so a very high degree of selectivity is achieved. But all three circuits are tuned by the operation of one control.

In addition to A.V.C., there is a manual volume control for setting the level from which it is desired that the A.V.C. shall work.

This manual control is right at the front door of the set, i.e. in the aerial circuit. By this means overloading of the H.F. and detector is avoided.

But this does not impose any special duty on the operator. The control is

FOR H.T. SAVING



An important feature is the economy effected in H.T. consumption by a clever adaptation of the Westector shown in the photograph above.

adjusted so that the volume is satisfactory on one of the less powerful stations, and then the automatic volume control will maintain all the other programmes at approximately the same level.

It might be thought from all the foregoing that the "Band-pack Four" would at least be a difficult set to build. But it isn't. Quite the contrary. It is wonderfully easy to construct. Certainly much easier than the average home-constructor design.

Labour-Saved, Efficiency Gained.

The reason is that advantage has been taken of certain units that are available. We have mentioned the A.V.C. unit. Using that has helped to simplify the design; but of even greater assistance is the Igranipak, comprising the coils, the ganged condenser, the valve holders and other items.

This saves an enormous amount of component fixing and wiring. It constitutes a good half of the set. Actually there are other advantages in the use of this pack even beyond those of time and trouble saving. Solid technical advantages.

The coils and the condenser are scientifically matched to work together properly, and the screening is expertly applied and efficient.

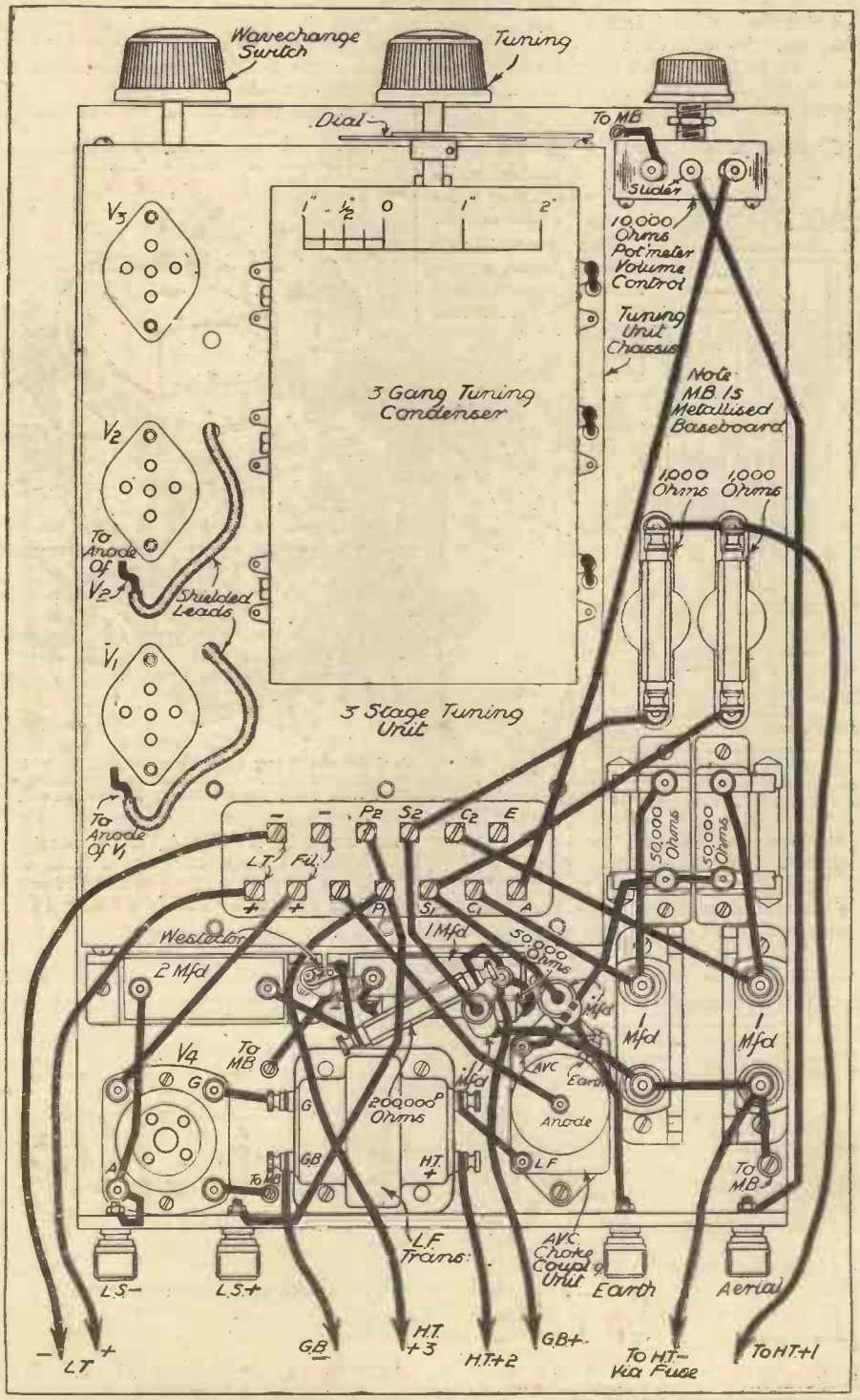
The set almost lays itself out. Having gathered together all the components, you will find no difficulty in arranging them in the manner illustrated in our photos and diagrams.

You could, if you so wished, have a conventional ebonite panel. It is easy enough to fit. But we expect the majority of constructors will prefer to employ an artistic cabinet similar to the one used by us.

In such a case the controls protrude through the wood and the volume control is actually mounted on it.

(Continued on page 551.)

QUITE SIMPLE TO BUILD



This diagram will enable you to complete the set, and, as can be seen, wiring will present no difficulties.

A BAND-PACK FOUR

(*Continued from page 548.*)

The loudspeaker is fitted into the same cabinet, and there will be ample space left for all the batteries.

Alternatively, a smaller cabinet to accommodate the set only can be employed and the loudspeaker and batteries arranged externally.

THE VALVES WE RECOMMEND

Make	1st and 2nd H.F. stages	Detector.	Power Output
Mullard	P.M.12M.	P.M.1H.L.	P.M.202
Cossor	220V.S.	P.M.1H.F.	230X.P.
Mazda	S.215V.M.	H.L.210	P.220A.
Marconi	V.S.24	H.L.2	P.2
Osram	V.S.24	H.L.2	P.2

The metallised baseboard is quite essential, but this again is a trouble saver as well as an aid to efficiency, for it enables the wiring to be shortened and reduced.

Connections are made to it merely by making a loop in the bared end of a lead and screwing this down to the Metaplex with a small wood screw.

One or two of the smaller components are of the suspended type and are not fixed to the baseboard in any way. Alternative makes, or even different types of the same make, should be avoided, because you won't find room on the baseboard for them if they happened, as would be likely, to require baseboard fixing.

Lists of recommended valves and accessories are given; the "Band-pack" is not irritatingly particular with regard to these. It is a stable set designed to give real service with standard valves and accessories.

Nevertheless, it is necessary that you should choose the *types* recommended. Obviously, the A.V.C. and battery economiser part values are subject to restriction, and neither can work properly unless the valves, particularly, are suited to their requirements.

An Important Point

Or, rather, unless the values are suitable for the valves used.

This is an extremely important point. Probably the set would still work fairly well if totally unsuitable valves were employed: sufficiently well, in fact, to mislead the constructor into thinking all was as it should be — until some untoward circumstance was encountered!

It is quite likely that you will not find it necessary to make any trimming adjustments, because the "packs" are sent out pretty closely adjusted. At least, that is our experience.

Grid-Bias Value

But, in any case, trimming is very simple so long as you remember that each trimmer is a vernier tuning adjustment for the circuit which its condenser section tunes.

Get a station tuned in as closely as you can with the main tuning control, and then apply fine tuning with the trimmers until the best results are obtained. But adjust only one trimmer at a time or you won't know where you are.

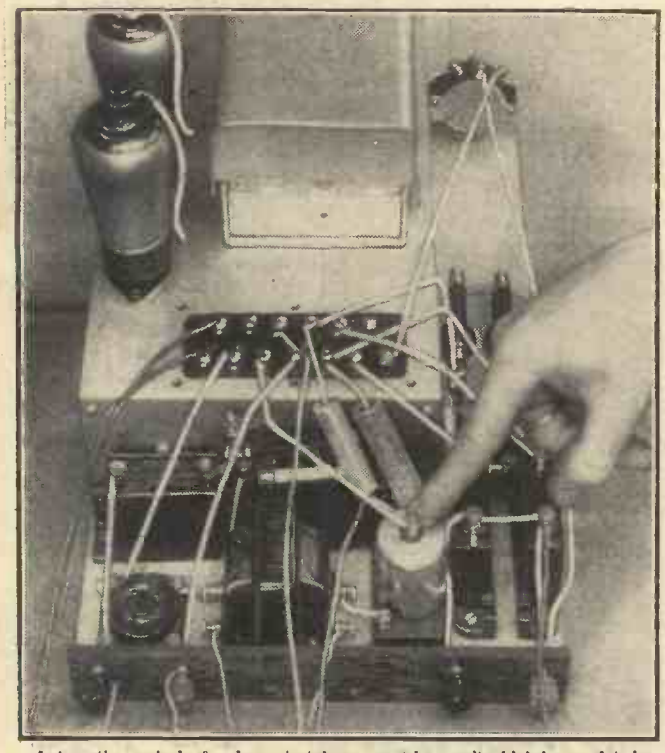
The grid bias for the output valve needs to be about twice the normal. The exact amount needed will vary with the valve, but the object is to reduce the anode current to approximately one-tenth of the normal. The grid-volts anode-current curve of the valve will indicate the voltage needed, and if you are in doubt your local radio store ought to be able to make this point clear to you.

Anyone who knows how to read a valve curve can figure out a little problem like that in two or three seconds. We shall be showing you how to do it in our Beginners' Supplement in due course.

There is a manual volume control on this set in addition to automatic volume control. The object of the manual control is to enable initial settings to be obtained. However *automatic* A.V.C. may be, it cannot know your own individual volume tastes!

But it can take a given degree of volume and keep all the stations pretty close to it.

COMPACT A.V.C. UNIT



Automatic control of volume is taken care of by a unit which is complete in itself and only has to be wired into the position indicated.

SINGLE-KNOB TUNING

Only one knob is used for tuning the three circuits, and this, of course, is the centre control. The left-hand knob is the manual volume adjuster. Wave-changing is by the right-hand switch knob.

SUGGESTED ACCESSORIES

LOUDSPEAKER.—Blue Spot, type 29P.M., R. & A., Rola, W.B., Marconiphone, Magnavox, Blue Spot, H.M.V., Celestion, G.E.C., Amplion, Ormond, Atlas, Ferranti, Epoch.

BATTERIES.—H.T. 120 volts: Lissen, G.E.C., Ever Ready, Siemens, Marconiphone, Pertrix, Hellesens, Drydex, Ediswan, Block.
G.B. 9 volts: Pertrix, Marconiphone, Lissen, Ever Ready, Siemens, Hellesens, Ediswan, Drydex.
L.T. 2 volts: Block, Edlswan, G.E.C., Oldham, Exide, Lissen, Pertrix.

AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," Radiophone "Receptru" downlead, Bulgin lightning switch, Graham Farish "Filt" earthing device.

Short-Wave Notes By W.L.S

READERS sometimes write to me decrying the "programme value" of short-wave reception. "Very thrilling," they say, "but you can't sit down and enjoy a string of items as if you were listening to a medium-wave station."

I don't agree with that at all, having had some very enjoyable times during the last week listening to American programmes. I am quite sure that the best of the short-wave broadcast stations furnish us with better "programme value" than a good many of the European medium-wave stations. Naturally, no one can compare them with the local station in this respect; but they really are very good on the whole.

Real news, right-up-to-the-minute, and of vital importance to those interested in short-wave reception, is offered by our popular contributor in these notes. They will appeal to all listeners who are attracted by any aspect of reception on the higher frequencies.

Quite a Good Average.

Anyone who says that he derives no "programme value" from his short-wave set is merely confessing the presence of an inefficient or defective receiver.

By the time you read these notes the "fade-out" on the 19-metre stations will be becoming quite an early business. At the time of writing, however, W 8 X K and W 2 X A D, both in the 19-metre band, are *excellent* between 5 and 7 p.m. on three days out of four, which isn't a bad average for 1933.

I don't believe in harping too much on one subject, but this "programme-value" business wants a little clearing up. It isn't obvious to some people, for instance, that it depends just as much on the receiver as it does on reception conditions or transmissions. The "P.V." (for short) of a receiver that suffers from hand-capacity troubles is practically *nil*. How can one enjoy a programme when one has to keep one's hands on the knobs all the time?

The highest "P.V." is undoubtedly given by a superhet. You may not appear to have as many stations to choose from as you would expect from a big set, but those that you *do* get well will probably be a hundred per cent more reliable than they would be on a smaller set.

Americans Like the Local.

As I write these words I am listening to London Regional on the speaker of a cheap little two-valve A.C. set, and he is undoubtedly coming over with better reproduction and greater reliability than anything that one is likely to hear on a two-valve short-wave set. But I have heard Americans on my "Empire Super" that would compare very well with him.

I have often expatiated on the different types of short-wave listener—the D X hound, the novice who is thrilled by everything, and the blasé "old hand" who wants Mars, and the rest of them. You simply *can't* make one set to suit them all. But they all settle down, sooner or later, with their ideal type of set, and they all agree that short waves are worth the trouble.

"T. C." (Wakefield) has been in the news rather a lot lately; his present flair is for amateur signals on the 40- and 20-metre bands, and a very good job he seems to be making of it. His latest log, for just over a fortnight, includes well over a score each of Australians and New Zealanders, together with Costa Rica, Java, South Africa, Cuba, Argentina, and all the rest. *He* finds short waves worth while!

"J. B. M." (Glasgow), whose postcards arrive with great regularity, generally has some tit-bit of news for me about a "mystery station," or a new station on the air, or an old station that has suddenly appeared again. His taste is entirely different from "T. C.'s," but I don't doubt that he enjoys his short waves just as much.

Those Impromptu Thrills.

Then listen to the tale of "C. L." (Birkenhead), who cashed some of his hard-earned savings just to see what all this short-wave fuss was about. Now he knows! And he wants any other "fans" in Birkenhead to get into touch with him. His address is Charles V. Lord, 33, Kingsland Road, Birkenhead.

As an example of the impromptu thrills that short waves bring you I can't do better than quote from "R. W." (Worksop), who unexpectedly heard "D E N N E," the Graf Zeppelin, trying to get in touch with Bound Brook, W 3 X L, who could not get them. Did anyone else hear this? The Graf Zeppelin works, I believe, on 36 metres approximately.

The Hold of S.W. Listening.

I quote these various letters as representative of those that I receive day by day. No one reading them could possibly doubt the hold that short waves take on one who has had the patience to start them properly.

Now for some definite news. A new station to listen for is H C 2 R L, at Guayaquil, Ecuador, on 45 metres. At present they may be heard in the small hours of Wednesday mornings and from 11 p.m. till midnight on Sundays.

Ecuador would probably be a new country for a good many listeners. Another is the Dominican Republic, represented by Santo Domingo, H I X, on 50·4 metres. I mentioned the particular circumstances controlling Y V 2 A M last week, although I am not sure that the real times were not meant to be midnight to 3 a.m. instead of midday till 3 p.m.

Nairobi Again.

Another Venezuelan station, the better-known Y V 3 B C, now works on 48·8 metres, and should be heard between 10 p.m. and midnight.

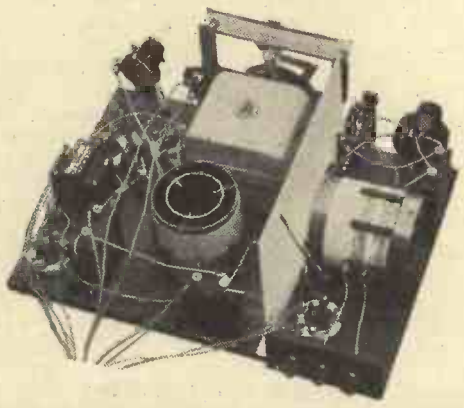
After all this feast of Central and South America it is perhaps worth while to mention that Nairobi, V Q 7 L O, is now on 49·5 metres between 4 and 7 p.m. most days. Last winter he was very good and quite consistent. Perhaps he will repeat the performance this year.

TINY ULTRA-SHORT-WAVE VALVES

An American firm has recently developed special miniature valves for use in ultra-short-wave apparatus. They are no larger than marbles, and above you see one being fitted to a diminutive receiver.

E.M.PLUS 4

The only kit incorporating coils based on the famous "EVERYMAN FOUR"



Build the set that is more efficient than any commercial receiver.

The E.M.Plus Four is straightforward in design and very easy to build. It is the receiver which every constructor will be proud to own and operate because it will respond to his skill. In the hands of a constructor who knows how to operate a set its range and selectivity are practically unlimited. Ask your radio dealer for a demonstration. Compare the E.M.Plus Four with any other Kit or commercial set—you will prefer the E.M.Plus Four.

COILS OBTAINABLE SEPARATELY.

For the benefit of constructors wishing to modernise their existing sets, the E.M.Plus Four coils can be supplied separately with complete wiring instructions. E.M.Plus Four coils will remain the most efficient for many years to come, because they are wound to the specification which is accepted by scientists as being the most efficient.

E.M.Plus Four coils are unscreened and are wound on 3-in. diameter formers with 27/42 Litz wire, with the primary windings air spaced and supported over the Litz wires on insulated ribs. Every reader who has studied coil design will know that this specification must give vastly superior results to those obtainable with small diameter fine wire coils enclosed in screening cans.

Price 27/6 Per Pair

Get your copy to-day of the FULL-size constructional chart with wiring diagram and complete building instructions, together with full details of the E.M.Plus Four and many interesting facts about this amazing receiver. Kit supplies available immediately; in case of difficulty write to Ready Radio.

You remember the "Everyman Four"—one of the most famous receivers ever designed. Its amazing performance was obtained by using the most efficient coils that could possibly be designed, and the ***formula for coil efficiency is just the same to-day as it was then.***

In order to keep down the price of commercial receivers, deliberate sacrifices have to be made in efficiency. E.M. Plus Four coils cost ***eight times as much to make*** as the coils used in commercial sets; but so great is their efficiency that the rest of the circuit can be much simpler in design, so that the complete E.M. Plus Four Kit, including coils, costs only £4 17s..6d.

The E.M. Plus Four is definitely superior to any other 4-valver or battery-operated superhet. It is the only receiver in which no sacrifices of efficiency have been made. ***The E.M. Plus Four is the only 100% efficient receiver.***

E.M. PLUS 4 KITS

KIT.—Less Valves (including everything you need, and full instructions)

£4-17-6

OR 9/6 DOWN

and **11** monthly payments of **9/6**

E.M.Plus 4 Oak Consolette Cabinet with Moving-Coil Speaker **£2-0-0**

In Walnut, with M.-C. Speaker as illustrated - - - - **£2-10-0**

Recommended Mullard Valves:
P.M.12V., P.M.2DX, P.M.1H.L., P.M.202 (or P.M.2)

READY RADIO

EASTNOR HOUSE, BLACKHEATH, S.E.3

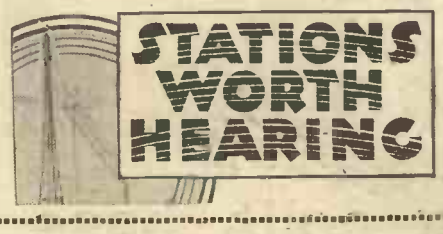
To READY RADIO LTD.,
EASTNOR HOUSE, BLACKHEATH, LONDON, S.E.3 (Book Dept.)

Name.....

Address.....

.....P.W.25/11/33

(Please enclose 1½d. stamp to cover postage).



A review of recent conditions on the "broadcast" bands, including details of stations that are coming in well, and other information that will enable you to get the best results when searching for foreigners.

By R. W. HALLOWS, M.A.

THE Lucerne Plan, or what is left of it, will apparently come into force on January 15th. The long-wave part of it will have to be recast entirely, since both Holland and Luxembourg have refused to budge so much as a centimetre from the wavelengths that they regard as theirs by right of possession.

The Cause of the Trouble.

As Kootwijk boasts 50 kilowatts and Luxembourg 200 kilowatts, both stations are capable of shouting down opposition, and all that can be done is to rearrange the wavelengths of the other long-wave transmitters.

Something can be done, since a good many of the channels were assigned with an eye to the future, to stations not yet in existence. What will happen, though, as such stations are completed and come into operation, goodness only knows!

It was announced shortly after the emergency meeting of the U.I.R. at Amsterdam that, though the long-wave portion of the Plan had been wrecked, the medium-wave section was safe and sound. But on that point I confess that I have my doubts, for very little prominence was given to one particularly important piece of news.

At the Amsterdam meeting the Russians apparently withdrew their assent to the Lucerne Plan, their representative stating that since then they had evolved an entirely new wavelength distribution of their own.

As Russia has more than forty medium-wave transmitters of high power built or building, this is not too good.

What, then, is likely to happen in the end? Working under the new order of things will take a little time to settle down; a good many adjustments of channels will be necessary; and by the time that everyone is more or less happy we shall be neither very much worse nor very much better off in the matter of heterodynes and jamming than we are at present!

Plenty of Alternatives.

Anyone with a good set nowadays can obtain as many alternative programmes from abroad as he can reasonably want. That is the position in November, 1933, and I don't think that matters will be very different in six months' time.

There is a possibility that seems to me an even greater menace than the actual jamming or heterodyning of stations by their next-door neighbours. This is the trouble that may be caused by the harmonics of long-wave stations, when numbers of them increase their power to 100, 150, or 200 kilowatts.

Suppose, for instance, that a station has a wavelength of 1,500 metres: then its third harmonic on 500 metres, its fifth on 300 metres and its seventh on 214·3 metres all fall within the limits of the medium waveband and may cause interference. One powerful long-wave station may therefore cause as much havoc as three medium-wave stations.

We are now enjoying the very cream of the wireless season, and there is no question that it is one of the best seasons that we have had for many a year. The field strength of stations as a whole is considerably greater than it was a year ago. When you switch on the set and begin to move the tuning controls you have at once a pleasant feeling that the apparatus is as "lively" as you could wish. Stations are to be found everywhere, and the number that come in at good loudspeaker strength should satisfy even the most confirmed of knob-twiddlers.

A PORTABLE SET FOR SAILORS

A photograph of portable transmitting and receiving apparatus, for use by landing parties, being tested on board H.M.S. Challenger. The object of the gear is to enable those ashore to keep in close contact with their ship.

For Long-Wave Listeners.

On the long waves Huizen suffers intermittently from bad interference of Russian or Roumanian origin, but on nights when heterodyning or jamming is absent the transmissions are steadily received, since the programmes are sent out after 3.40 p.m. by the 50-kilowatt Kootwijk station. Radio-Paris is always good, and Zeesen has now settled down, providing good quality and fine volume night after night.

Warsaw seldom disappoints. Motala, though not quite so reliable as some of the other long-wavers, is generally good. Luxembourg is occasionally heterodyned, but the field strength of the station is so great that it is receivable on the smallest of valve sets.

Kalundborg is now clear of Monte Ceneri. With a highly selective set either station can be heard at will. Make a note, though, that the Swiss transmitter generally closes down not much after 9 p.m.

Oslo is also free from the interference by which it was troubled for so long, and is receivable with good volume at any time when it is working.

On the Medium Waves.

There have been a few changes of importance on the medium waveband amongst the German stations. Both Munich and Stuttgart have closed down their big transmitters, the service being undertaken temporarily by their old 1·5 kilowatt plants. Meantime, the new 100-kilowatt Witzleben station is ready to begin work, and will probably be testing by the time that these notes appear in print. It will transmit on 360·5 metres, becoming the London Regional's next-door neighbour in place of Stuttgart.

As soon as the tests begin the new Mühlacker station, if it is ready, or the old one if it is not, will move to Munich's present wavelength of 533 metres and Munich will descend to 419 metres, the channel vacated by Witzleben.

Budapest is now a good and reliable transmission from about 6 p.m. onwards. Vienna is greatly improved, and will be better still when the second mast is complete and in regular use. The two Brussels stations are providing wonderful reception, the former being very good in daylight.

Florence has had an occasional heterodyne, but nothing very serious. Prague and Langenberg both come in with immense volume; Lyons (La Doua) is always worth attention.

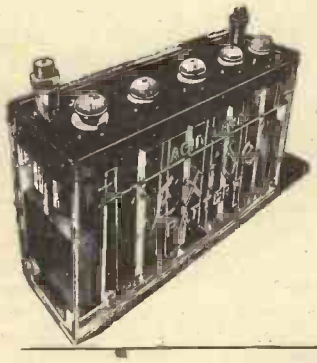
Beromünster has had some return of the heterodyne troubles which were such a nuisance a while ago; but as a compensation for this Paris Ecole Supérieure, a station not heard for months, is occasionally clear and good.

Rome is completely reliable, and Stockholm is nearly as good. Katowice, though varying somewhat, very seldom disappoints. Toulouse Midi is generally good, but I have noticed a fair amount of fading on certain evenings.

The Milan Experimental station is not one of the long-distance man's "regulars," but it is always worth trying for, since on some nights it comes in strongly and quite clear of interference.

The Battery they depend on,

when the wireless may be the last hope, is the same in 9 out of 10 British ships! It is the Exide —the battery that will bring to you, clearly and consistently, the programmes of the Radio world.



Exide

BATTERIES

H.T. ACCUMULATORS

Prices per 10-volt unit

WJ	2,500 milliamp. hrs.	5/-
WH	5,000 milliamp. hrs.	6/3
WT	10,000 milliamp. hrs.	12/-

These prices do not apply in the Irish Free State

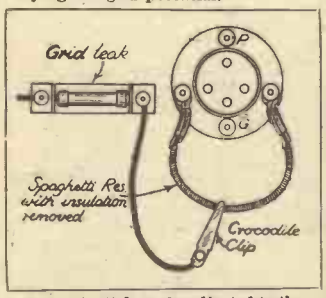
For the finest dry battery ask for Drydex

Obtainable from Exide Service Stations and all reputable dealers. Exide Batteries, Exide Works, Clifton Junction, near Manchester
Branches: London, Manchester, Birmingham, Bristol, Glasgow, Dublin and Belfast

R 27

A SHORT-WAVE HINT.

MANY a listener on short waves has missed a DX station because of "ploppy" reaction. This can be cured by using a potentiometer for varying the grid potential.



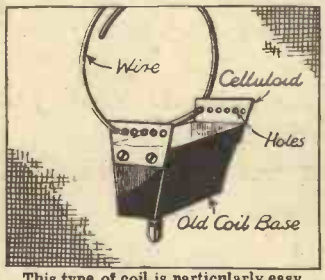
Grid potential can be adjusted to the optimum value with the clip.

If, however, you haven't got one in your junk box, then here's a way to do it. Buy a 600-ohm spaghetti and carefully remove the sleeving, then wire across the detector filament terminals and take the leak to a crocodile clip, as shown. Thus you can vary the grid potential by sliding the clip along (carefully).

INEXPENSIVE S.W. COILS.

MATERIALS required: 6 in. of No. 16-gauge wire; small quantity of celluloid; 4 coil bases off old plug-in coils.

Cut the celluloid to fit coil bases, as shown; drill holes in the celluloid to correspond with the holes in the coil bases. Next with a piece of 18-gauge wire burn 7 holes (in the case of 7-turn coil), all slightly slanting inwards to take the curve of the wire. Also make two thin spacers with 6 holes drilled in them.



This type of coil is particularly easy to make.

Procure a round cylindrical object, 2½ in. diameter, and wind 8½ turns of 16-gauge wire on it and allow it to spring off, leaving 6½ turns at 2¾ in. diameter. Next hold coil of wire and thread one side plate for 1 turn only, taking care that the 7 holes as threaded slant down from left to right when held on left side of coil, as shown in sketch.

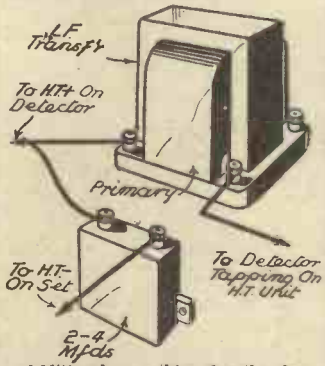
Next thread on the spacers and finally the other side plate, this time with the line of holes sloping the other way. Thread all the pieces round the wire until all the wire is taken up, and it will be seen here that the 7th hole is necessary to hold the final turn of wire, which is fastened to the terminals at the side of the coil base.

It will be found that they are easier to make than to describe, and that 2-turn, 4-turn, 6-turn and 8-turn coils will be ample for ordinary needs.

REMEDYING HUM.

WITH sets supplied with H.T. by a mains unit a slight hum, which increases in intensity as reaction is advanced, is evident.

This form of hum is usually due to the detector H.T. supply being insufficiently smoothed. An old L.F. transformer, used in conjunction with a 2- or 4-mfds. condenser, will frequently remedy this fault.



Additional smoothing for the detector H.T. can be provided in the above manner.

It is only necessary to connect the transformer primary between the detector H.T. + terminal on the set and the corresponding tapping on the H.T. unit. The condenser terminals are connected to the detector H.T. + terminal and the H.T. — terminal respectively on the set.

CUTTING OUT A VALVE.

FOR the sake of economy it is often useful to cut out a valve. The best valve to cut out in the case of a Det., 2 L.F. set is the centre one. This can be done by wiring a switch between the grid circuit of the second valve and the last one.

With the switch open the set works as usual. When the switch is closed and the middle valve is taken from the holder the set works as a two-valve. The economy consists in saving H.T. and L.T. The grid bias to the middle valve should also be removed.

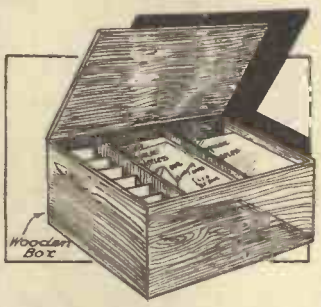
FILING YOUR "P.W.'s."

HERE is a suggestion, which although not strictly of a technical nature, will no doubt appeal to many readers of "P.W." With the usual perversity of fate, it often happens that the time when you most require some particular information, is exactly the time when you can't remember where you saw it.

To avoid this inconvenience, construct, from an old wooden box, a small "bookcase" to hold all your "P.W.'s." As "P.W.'s" are better stored flat, divide the box into partitions, each capable of holding from 20 to 30 "P.W.'s" piled on top of each other.

Before making these partitions, erect one about 6 in. from the end of the box, as in sketch. Cut a number of cardboard or stiff paper slips to fit into this pocket.

When the case is ready for the first magazine, read your "P.W." carefully, make a note of any information you



Enables reference to be easily made to P.W. "back numbers."

may think useful, on the cardboard slip, on the right-hand corner of which write plain the figure 1, which is also written on the right-hand corner of the "P.W." Similarly the second "P.W." and slip are marked 2.

The slips are arranged in the pocket for reference. You will find this a tidy and handy method of keeping your "P.W.'s."

ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others will be paid for at our usual rates.

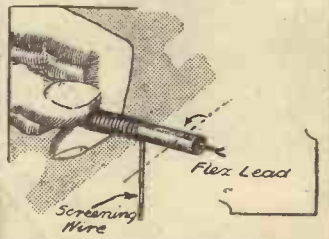
Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear?

The best Wrinkle last week was sent by Mr. R. Shaw, 4, Berwick Street, Victoria, London, S.W., to whom a guinea is being awarded.

SCREENED LEADS.

READERS using screened leads to S.G. valves may sometimes experience difficulty in obtaining the metal covering. I hit on the idea of using a length of cotton or enamelled coil wire twisted neatly around the lead and earthing it. It is quite easy to do. Twisting the piece of flex between finger and thumb, the coil wire will wind itself evenly and neatly round the lead. The accompanying sketch illustrates my idea.



An effective means of screening rubber-covered leads.

I have also used quite long lengths of this for screening long gramophone pick-up leads running from the turntable to the gramo-radio switch on the panel.

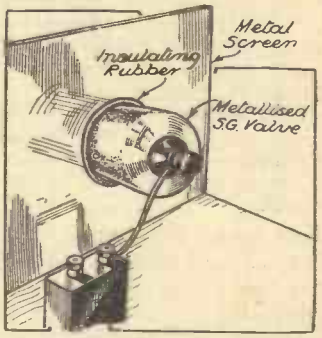
AN IMPROVISED COIL FORMER.

WHEN a low-loss coil former is wanted in a hurry by the experimenter it can be made by gluing some corrugated paper to an ordinary cardboard former of the cylindrical type.

This method will be found useful when making up short-wave coils, as it has a cushioning effect and prevents shake, which is usually noticed when using short-wave coils.

METALLISED VALVES.

WITH regard to metallised valves, with some receivers, it is important to take great care that the coating does not come into contact with any part of the metal screening in the set, as, should this happen with a battery valve, the low tension battery will be short-circuited if the filament circuit is not wired correctly.



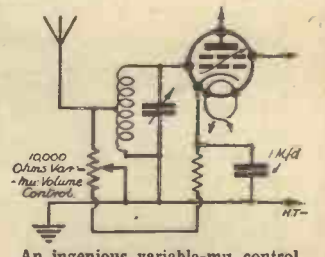
The rubber prevents shorts between the metallised valve and the screen.

With all-mains valves the grid-bias resistance would be shorted out if the bias resistance is in the cathode, and the valve would consume more current and distortion would take place.

Measure the circumference of the metallised screen-grid valve where the screen intersects it. Obtain a slightly longer piece of ordinary car H.T. cable, split it lengthwise, then pull out the wire from the rubber casing. The rubber casing can then be inserted into the screen hole, and it will act as an insulator and also as a cushion for the valve to rest on, thus preventing shorts and microphonic noises.

A DUAL VOLUME CONTROL.

WHEN a sensitive A.C. mains receiver is used in close proximity to a local station difficulty is frequently experienced in obtaining a sufficiently wide range of volume control.



An ingenious variable-mu control which also reduces the input to the set from the aerial.

If the set uses one or more variable-mu S.G. valves the variable resistance in the cathode circuits can be arranged as shown to reduce the signal input at the same time as the variable-mu grid bias is increased.

It should be mentioned that this arrangement cannot be used if a band-pass circuit employing capacity coupling is employed in the set.

It is seldom that so many desirable features are included in a single design as in the A.T.B. Economy 3. There is no doubt about the economy, for this set consumes less current than most two-valvers. Also it incorporates such valuable refinements as pre-detector volume control and automatic tone balance, which ensure the highest standard of reproduction from both near and distant stations.

Designed and described by H. A. R. BAXTER.

THERE are not many sets on which at least some foreign stations cannot be heard these days, but the entertainment value of the average foreign programme is in practice very slight indeed.

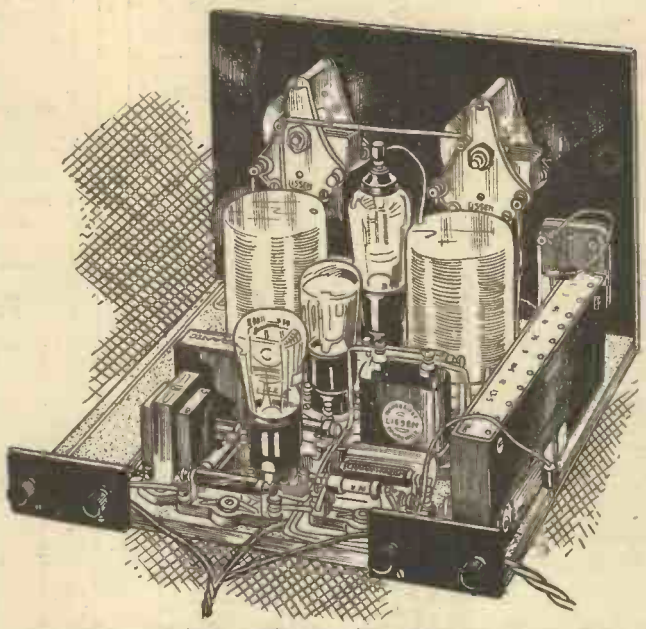
This is because of the terrible distortion accompanying normal long-distance reception, mainly due to the use of reaction. On nine out of ten, or even perhaps ninety-nine out of a hundred, receivers, there is a clear-cut quality line of demarcation between "local" and "distant" results.

Foreigners Like the Local.

The local station may come in quite well, comparatively speaking, but the moment reaction is employed for "reaching out" the reproduction becomes fuzzy, muffled and boomy.

Reaction distortion cannot be overcome by ordinary tone-control methods. By "ordinary" we mean those methods which start with a moderately good tonal balance and then work downwards towards boominess by means of treble-paring resistances and capacities.

SIMPLIFIED EFFICIENCY



From the above sketch you will get an idea of the clean layout of the receiver. The S.G. valve, with its associated tuning circuits, is located nearest the panel, the detector in the middle and the pentode output valve at the rear of the set.

However, there is, as regular "P.W." readers now know, as simple a system which really is perfectly satisfactory. We refer to automatic tone balance in conjunction with a compensating transformer—the inventions of "P.W.'s" Technical Editor.

Automatic tone balance is applied to this present set and endows it with almost uncanny powers. By introducing tonal balance in all conditions it renders the set capable of bringing in foreign stations with the fidelity of good local stations.

Range With Quality.

There may be other sets able to tune as many or even more programmes, but how many of them are likely to be really pleasant to listen to by the hour? Every station comfortably audible on the A.T.B. Economy 3 (and that will be a hefty bunch) *will be* pleasant to listen to.

It is, in fact, the true multi-station instrument, not a local-station receiver, which can command a chorus of distant

(*Continued on next page.*)

HERE ARE THE PARTS REQUIRED TO BUILD THIS INEXPENSIVE RECEIVER

Component	Make used by designer	Alternative makes of suitable specification recommended by designer
2 ·0005-mfd. tuning condensers	Lissen L.N.5058	Graham Farish, Polar, Ormond, J.B., Utility
2 Vernier tuning dials	Lissen L.N.264	Telsen, Igranic, Ormond
1 Pair Matched screened coils	Telsen W287	—
1 Coil switch coupling assembly	Telsen W217	—
2 4-pin valve holders	Telsen W224	W.B., Benjamin, Lissen, Ferranti, Wearite
1 5-pin valve holder	Telsen W225	W.B., Benjamin, Lissen, Ferranti, Wearite
1 2-mfd. fixed condenser	Lissen L.N.134	Telsen, Graham Farish, Igranic, T.C.C., Dubilier, Ferranti
1 2-mfd. fixed condenser	Igranic	T.C.C., Dubilier, Ferranti, Lissen, Telsen, Graham Farish
1 ·1-mfd. fixed condenser	Lissen L.N.110	T.C.C., Dubilier, Ferranti, Telsen
1 ·01-mfd. fixed condenser	Dubilier 670	—
1 ·0003-mfd. fixed condenser	T.C.C., type S	Dubilier, Telsen, Lissen, Ferranti, Graham Farish
1 ·0003-mfd. series aerial condenser with switch	Telsen W350	—
1 2-megohm grid leak with wire ends or terminals	Lissen	Igranic, Dubilier, Telsen, Graham Farish
1 50,000 ohms resistance	Dubilier 1 watt	Graham Farish, Ferranti
1 Holder for above	Dubilier Dumetohm	Graham Farish, Ferranti
1 5,000 ohms resistance with terminals or wire ends	Graham Farish	Dubilier [Varley
1 20,000-ohms potentiometer	Graham Farish, Megite	Lewcos, Igranic, Telsen,
1 Screened H.F. choke	Graham Farish, H.M.S.	Bulgin, Telsen
1 ·5-mfd. fixed condenser with wire ends	Dubilier, type 4406	T.C.C.

Component	Make used by designer	Alternative makes of suitable specification recommended by designer
1 ·1-mfd. fixed condenser with wire ends	T.C.C. type 250	Dubilier
1 200,000-ohms resistance with horizontal holder	Graham Farish Ohmite	Ferranti
1 100,000-ohms resistance with horizontal holder	Graham Farish Ohmite	Ferranti
1 100,000 ohms resistance with wire ends or terminals	Dubilier	Graham Farish
1 50,000-ohms resistance with horizontal holder	Graham Farish Ohmite	Ferranti
1 Metal rectifier	Westinghouse W4	—
1 Compensating L.F. transformer	R.I. Varitone	Telsen, Varley
1 2-pt. push-pull switch	Lissen L.N.5070	Telsen, Ready Radio, W.B., Bulgin
4 Indicating terminals	Bulgin	Igranic, Eelex, Belling & Lee, Clix
1 Ebonite panel, 12 in. x 8 in. x ¼ in.	Peto-Scott	Permcol, Becol, Goltone,
1 Metaplex baseboard, 12 in. x 12 in.	Peto-Scott	—
1 Cabinet to suit above	Peto-Scott	—
2 Terminal strips, 3 in. x 1½ in. x ⅛ in.	Peto-Scott	Permcol, Becol, Goltone,
6 yds. 18 S.W.G. T.C. wire	Lewcos	Wearite, Goltone
4 yds. insulating sleeving	Lewcos	Wearite, Goltone
1 Grid-bias battery clip	Bulgin No. 2	—
2 Spade terminals	Belling & Lee	Clix, Bulgin, Eelex
1 Wander-plug type fuse	Belling & Lee	Bulgin Clix Eelex,
1 Anode connector	Belling & Lee	
4 Wander-plugs	Clix	Bulgin, Belling & Lee, Eelex
Flex, screws, etc.	Peto-Scott	—

THE A.T.B. ECONOMY 3.

(Continued from previous page.)

distortion, as are, we fear, only too many outfits.

The A.T.B. has appeared in other "P.W." designs, but it is still new for all that. Probably it won't reach the commercial sets until the next show, for it is only a month or two since the A.T.B patent was purchased from our Technical Editor for the use of the British Licensing Pool.

In the meantime, home constructors can enjoy its full benefits, and those who do not try it are missing one of the most important developments of the decade.

Where this A.T.B. Economy 3 is entirely new is in its combination of this great automatic tone-balance invention with another wonderful feature—the Westector Economiser.

Really Worth-while Economy.

This is, as its title suggests, an economy measure; it cuts down the H.T. current of the output valve to an extraordinary extent. And that without in any way interfering with quality or volume.

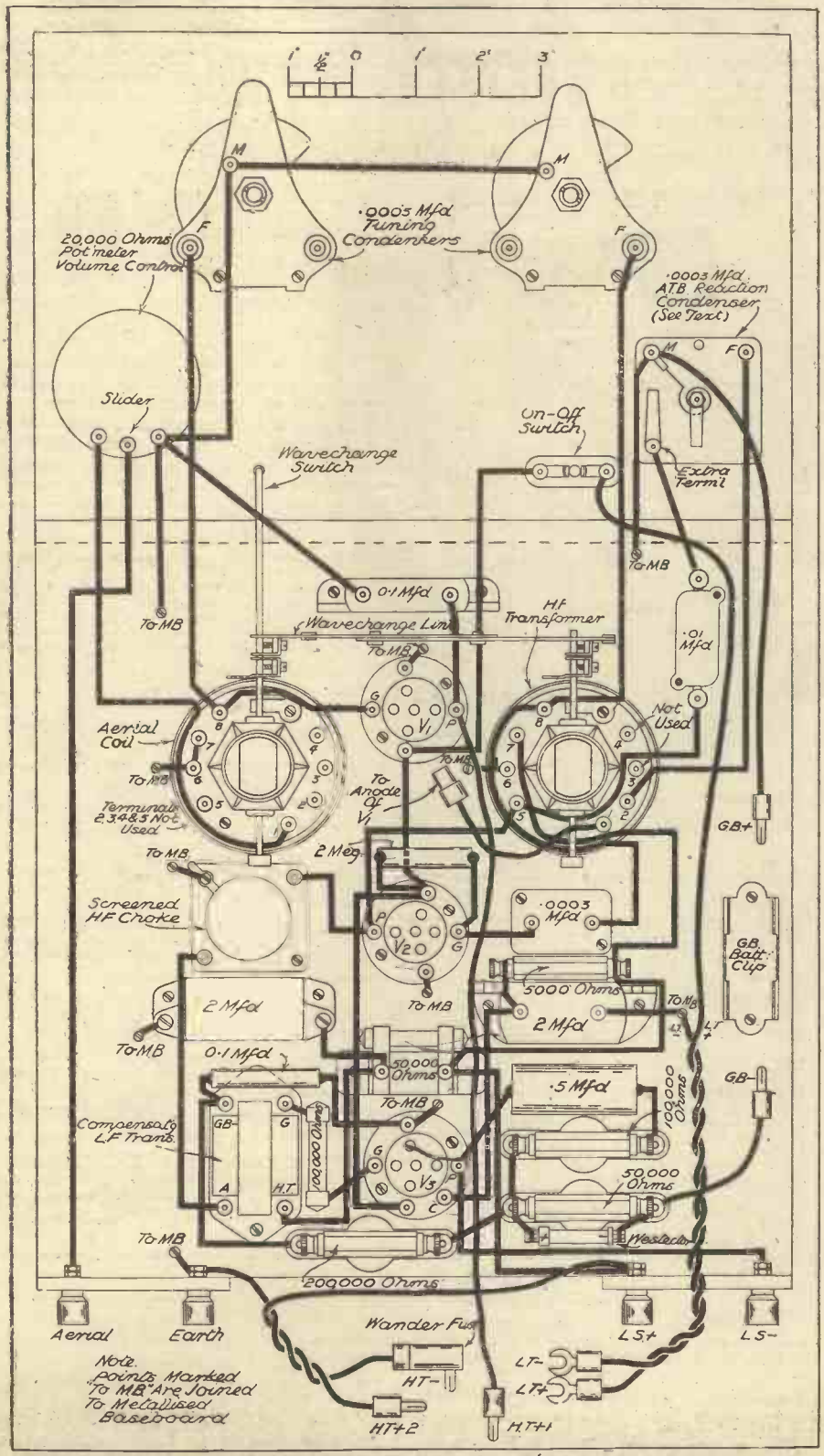
So great is the economy achieved that this powerful three-valver actually takes less H.T. current than most two-valve sets! Its average consumption for normal loud reception is a mere 7 or 8 milliamperes.

You are probably familiar with the manner of working the Economiser now, for several articles on the subject have appeared in "P.W."

In short, by the employment of a metal rectifier the anode current of the pentode is made proportional to the volume.

Well, there have been many three-valvers, but it is hard to conceive of one having so many outstanding points of genuine worthwhile appeal as this one.

MODEL YOUR SET ACCORDING TO THIS PLAN



When you have laid out the components and screwed them down in their correct positions, you are ready to start the wiring. This should be carried through in a systematic manner, and each wire ticked off as it is completed. You will then have a useful check as to whether or not you have missed any connections.

RECOMMENDED ACCESSORIES

BATTERIES.—H.T. 120 volts: Lissen, Ever Ready, Ediswan, G.E.C. Siemens, Pertrix, Hellesens, Drydex, Marconiphone or Block accumulators.
L.T. 2 volts: Lissen, Block, Oldham Exide, Ediswan, Pertrix.
G.B. 16½ volts: Ever Ready, Hellesen, Siemens, Ediswan, Pertrix, Marconiphone Drydex.

LOUDSPEAKERS.—R. & A., Blue Spot, W.B., Rola, Amplion, Magnavox, Ormond, Epoch, Atlas, Marconiphone, Ferranti, H.M.V.

AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," Bulgin Lightning Switch, Radiophone "Receptru" downlead, Graham Farish "Filt" earthing device.

We have mentioned two; here is a third. Aerial-circuit volume control enables the volume to be regulated to a nicety without the overloading of individual stages.

Reaction Condenser Modifications.

That the set will be easy to build will be plain to see from the diagram, and you can take our word for it that it is simply delightful to handle.

There are no components which are not freely obtainable; all are of a quite standard character.

A Telsen Aerial Series Condenser is used for reaction control; the ordinary kinds of reaction condenser are not suitable for this set.

On inspection it will be seen that this Telsen condenser has a shorting bar fixed to its one terminal with which a short arm on the spindle makes contact.

This shorting bar should be removed by unscrewing the terminal head and the nuts which lie under it.

Now get a 1-in. 6B.A. bolt and nut, and with this fix the shorting bar to the diagonally opposite hollow split rivet that is mounted through the case of the condenser.

This hollow rivet is not in electrical contact with the reaction condenser, and

(Continued on page 560.)

"No Tears with a PILOT AUTHOR KIT"

S.T.500

PILOT AUTHOR KIT
EXACT TO SPECIFICATION

The Pilot Kit SERVICE was founded in 1919.

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

For detailed list of Parts SEE OUR PREVIOUS S.T.500 ANNOUNCEMENTS Oct. 21st and Oct. 28th issues or sent upon request by return of post.

CASH — C.O.D.

£5-5-0

OR YOURS FOR 9/6

Balance in 11 monthly payments of 9/6.

CONVERT YOUR S.T.400 to S.T.500

Peto-Scott S.T.500 Conversion Kit comprises all FIRST SPECIFIED parts required to convert your S.T.400 to the new S.T.500. Complete Kit, including output choke but less valves, with a copy of "POPULAR WIRELESS," 21/10/33, and BLUE PRINT, CASH or C.O.D., Carriage Paid, 42/-. Or 5/- deposit and 8 monthly payments of 5/3.

YOURS FOR 5/-

H.P. TERMS: Complete Kit with Valve, 12 monthly payments of 5/3.

PILOT S.T.500 STRUCTAKIT

Comprising Peto-Scott Baseboard with Metaplexed Section; Ready Drilled Panel and Terminal Strip; S.T.500 Screen; B.R.G. Mounting Bracket with Free copy of "Popular Wireless," and OFFICIAL BLUE PRINT. "CASH or C.O.D. Post Free, 7/6.

7/6 CASH OR C.O.D

EXCLUSIVELY SPECIFIED PETO-SCOTT S.T.500 WALNUT CONSOLETTE

25/-

Regd. Design No. 787.010

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.*

Specified PETO-SCOTT TABLE CABINET. CASH or C.O.D., 19/6. Or 6/- Deposit and 3 monthly payments of 6/- (including carriage and packing).

Send for 1934 Cabinet Catalogue.

KIT "A" Comprising Mr. John Scott-Taggart's Kit of FIRST SPECIFIED Components, including Telsen "Class B" Output Choke, Peto-Scott "Metaplex" Baseboard and Ready-drilled Panel and Terminal Strip. Less Valves and Cabinet. With FULL-SIZE Blue Print and copy "Popular Wireless," Oct. 21st. Cash or C.O.D. Carriage Paid **£5-5-0**

or 12 monthly payments of 9/6.

KIT "B" As Kit "A" but including 4 Specified Valves. Cash or C.O.D. Carriage Paid. **£7-10-3**

or 12 monthly payments of 13/9.

KIT "CT" As Kit "B" but including Peto-Scott Specified Walnut Table Cabinet. Cash or C.O.D. Carriage Paid **£8-9-9**

or 12 monthly payments of 15/6.

KIT "CC" As Kit "B," including Peto-Scott Specified Walnut Consolette Cabinet. Complete with Baffle Baseboard Assembly, but less Speaker. Cash or C.O.D. Carriage Paid **£8-18-9**

Or 12 monthly payments of 16/3.

If Peto-Scott Permanent Magnet Speaker required add 15/- to Cash Price or add 1/3 to each monthly payment.

IMPORTANT

Order from PETO-SCOTT any separate items for the S.T.500. We specialise in, and carry the largest stocks in the country of all FIRST SPECIFIED PARTS. Delivery from stock. Therefore, you KNOW that you are certain of receiving the parts Mr. John Scott-Taggart chose. WE DO NOT SUBSTITUTE. Send Cash or C.O.D. Orders over 10/- all Post Charges Paid. Easy Terms on orders over £2.

S.T.500 FINISHED INSTRUMENTS

"S.T.500," complete in Peto-Scott Walnut Table Cabinet, exact to Mr. John Scott-Taggart's FIRST Specification. Aerial Tested. Complete with Valves. Cash or C.O.D. Carriage Paid. **£10-0-0**

or 12 monthly payments of 18/3.

"S.T.500," complete in Peto-Scott Walnut Consolette Cabinet, exact to specification. With Peto-Scott Moving-Coil Speaker. Complete with Valves. Ready to Play. Aerial Tested. Cash or C.O.D. Carriage Paid. **£11-5-0**

or 12 monthly payments of 21/-.

DETAILED LIST OF PARTS SENT ON REQUEST

A.T.B. ECONOMY 3

KIT "A" Author's Kit of first specified parts, including ready-drilled panel with "Metaplex" Baseboard and "Westector." Less Valves and Cabinet. Cash or C.O.D. Carriage Paid. **£4-16-6** or 12 *monthly payments of* 8/9

KIT "B" As Kit "A," but with Valves. Cash or C.O.D. **£6-15-6** Carriage Paid. or 12 monthly payments of 12/6.

KIT "C" As Kit "A," but with Valves and Cabinet. Cash or C.O.D. **£7-18-0** Carriage Paid. or 12 monthly payments of 14/6

KIT-BITS Orders over 10/- C.O.D. Charges Paid. Set of 3 specified Valves, £1.19.0. Specified Peto-Scott Cabinet, 22/6. 1 pair Telsen W.287 matched Screened Coils, 14/6. 1 R.I. "Varizone" compensating L.F. Transformer, 11/6. "Metaplex" Baseboard, 12" × 12", 1/9.

BAND-PACK 4

KIT "A" Author's Kit of first specified parts, including "Metaplex" Baseboard and "Westector." Less, Valves and Cabinet. Cash or C.O.D Carriage Paid. **£6-7-6** *or 12 monthly payments of* 11/9

KIT "B" As Kit "A," but with Valves. Cash or C.O.D. **£8-17-6** Carriage Paid. or 12 monthly payments of 16/3.

KIT "C" As Kit "A," but with Valves, and Cabinet. Cash or C.O.D. **£10-0-0** or 12 monthly payments of 18/3.

KIT-BITS Orders over 10/- C.O.D. Charges Paid. Set of 4 specified Valves, £2.10.0. Specified Peto-Scott Cabinet, 22/6. 1 "Igranipak," £2.17.6. 1 Varley A.V.C. Unit, 15/6. 1 "Metaplex" Baseboard, 9" × 14", 1/9.

PETO-SCOTT CO. LTD. 77 CITY ROAD, LONDON, E.C.1. Telephone: Clerkenwell 9406/7. Tel.: Holborn 3248.

West End Showrooms: 62 High Holborn W.C.1.

Dear Sirs,—Please send me, CASH/C.O.D./H.P. .....

for which I enclose £.....s.....d. CASH/ H.P. Deposit.

NAME.....

ADDRESS.....P.W., 25/11/33.

ANY ITEM SUPPLIED SEPARATELY—ORDERS OVER 10/- SENT C.O.D. CARRIAGE AND POST CHARGES PAID

THE A.T.B. ECONOMY 3

(Continued from page 558.)

so is a most convenient point of attachment. This 6B.A. bolt and nut that holds the shorting strip in its new position becomes the extra terminal needed.

The shorting strip now lies along that side of the condenser on which the moving-vane terminal is—an exact opposite to its original place.

Previously the spindle arm made contact with it when the condenser knob was turned to full capacity, but now this happens at minimum capacity and a third terminal point is provided.

The wiring diagram clearly shows the new position for this arm. It is a simple modification.

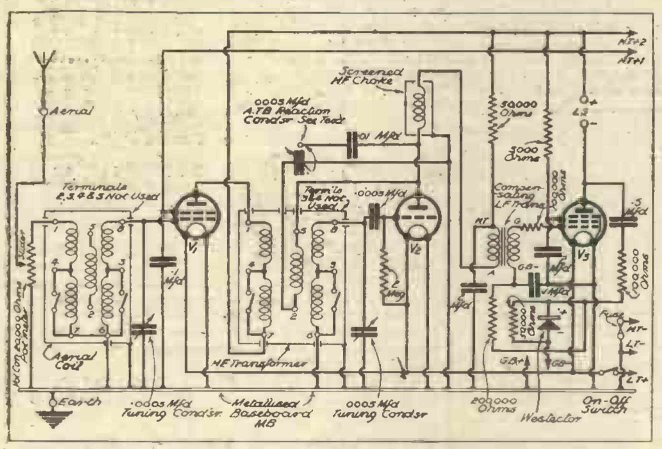
Economiser Components.

You see the reason for it? At the minimum reaction adjustment the ·01-mfd. condenser is brought into circuit, and the effect of this is to remove the high-note compensation that is needed and is present when the reaction is employed.

SUITABLE VALVES FOR THE SET

	S.G.	Det.	Output
Cossor	220S.G.	210H.F.	220P.T.
Mullard	P.M.12A	P.M.1H.L.	P.M.22
Mazda	S.G.215	H.L.2	Pen.220A
Marconi	S.22	H.L.2	—
Osram	S.22	H.L.2	—
Eta	B.Y.6	B.Y.1814	—
Hivac	S.G.210	H.210	Z.220

LOW H.T. CONSUMPTION IS ASSURED



There are several outstanding features in the circuit arrangement of this economical three-valver. These include a pre-detector volume control, automatic tone balance and special circuit arrangement which renders the set particularly economical in its H.T. current requirements.

The components concerned with the Economiser are grouped together on the baseboard near the loudspeaker terminals. There is the Westector, a ·5-mfd. condenser and 50,000-ohms, 100,000-ohms and 200,000-ohms resistances.

Now, these resistances suit only the types of pentode valves recommended for this set. If different types of output valves are used different resistance values are needed.

No output choke or transformer is included in the A.T.B. Economy 3 because the majority of modern loudspeakers themselves incorporate transformers and render the inclusion of them in sets unnecessary.

Bias Values.

A Metaplex baseboard is employed, and this is a convenient alternative to the clumsier method of covering a baseboard with copperfoil.

Leads are connected to the Metaplex merely by holding their looped, bared ends down on it with screws. Firm-pressure contacts made in this way are perfectly satisfactory.

The wavechange actions of the coils are controlled by the one knob, a coupling link being introduced for the purpose. This is sold as a separate item, but costs only a few pence.

The grid bias needs to be considerably greater than is normally employed for the pentode valve. It is increased until only about a tenth of the normal H.T. current flows in the anode circuit of this valve.

In practice this works out that nearly double the grid bias is applied. Usually about 9 volts is used for the Mullard P.M.22 or Mazda Pen. 220A, but with the Economiser you apply 15 or 16½ volts.

Reaction Adjustments.

But, as we have indicated, the volume is not affected. For a relatively absurdly low H.T. consumption you get a marvellous output.

Give H.T.+2 the full 120 volts H.T. and H.T.+1 about 90 volts.

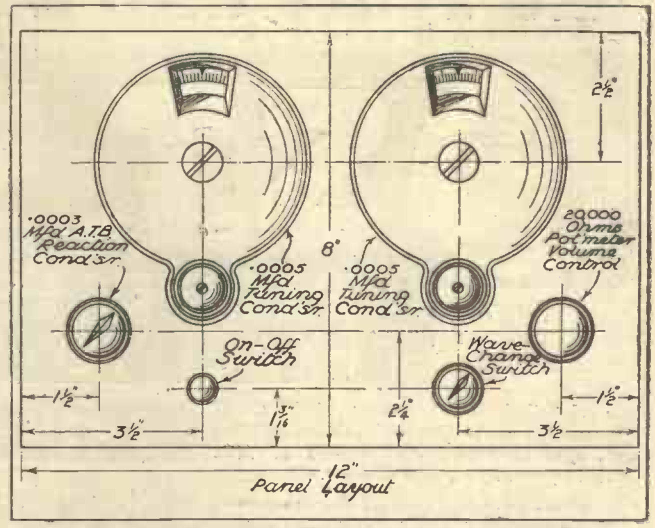
The operation of the set is perfectly straightforward. The two tuning dials and the reaction control are handled as in an ordinary receiver.

Set the reaction control hard over to minimum (anti-clockwise) when receiving the local station or any other programme for which the boosting powers of reaction are not needed.

The high-note lift which compensates for reaction distortion automatically comes into action the moment the reaction control is advanced from this minimum position.

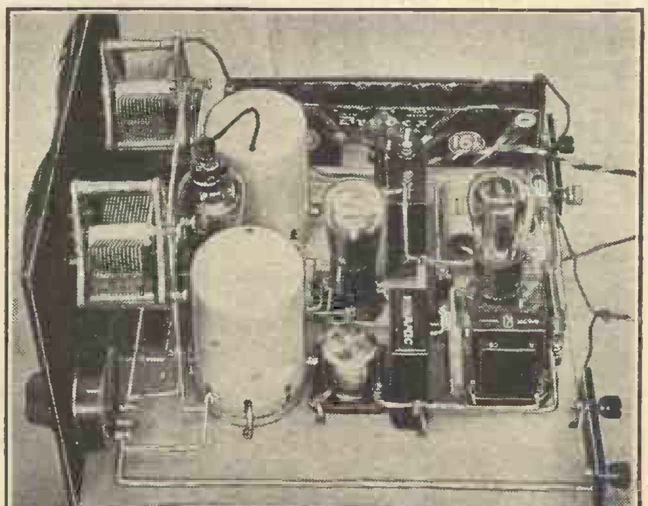
Should you desire this high-note emphasis to overcome the deficiencies of a boomy loudspeaker, or to brighten particular musical or other items from the local, you can introduce it by just sufficient advancement of the reaction control to switch away from the ·01-mfd. condenser connection.

THERE ARE NO COMPLICATED CONTROLS



The positioning of the controls is a most important part of the design of any receiver. From this front-of-panel diagram you will notice that in the A.T.B. Economy 3 they fall particularly well to hand.

READY FOR THE CABINET



The appearance of a radio receiver is enhanced greatly by neat wiring. And provided you take reasonable care there is no reason why your set should not look as neat as the original model shown in the above photograph. While on the subject of wiring, don't forget to make sure that the connections to the baseboard are really effective.

Yours for Better Radio this Year

Peto-Scott

READ THIS SATISFIED CUSTOMER'S LETTER

Gentlemen,

Your letter of the 30th Oct. to hand. I think your "**Extended Credit System**" a good idea and makes the public dealings with you a real pleasure; in fact, there is a personal contact observed between "firm and customer."

One way and another during the past 10/12 years I have obtained goods on the H.P. system from various firms, but never before have I had such a pleasure in dealing with a firm such as yours. For instance, the forms of agreement and pertaining letters I have received from other firms have been outlined in a stiff and (if I may call it) an unfriendly manner and one got the idea that these firms were conferring a blessing and privilege upon a customer in granting H.P. terms, which to customers does not go down very well

I observed in your agreement with me it was stated that although the name of one's employer was given the same would not be approached, now that is a sound idea.

I took up with you—an absolute stranger—received my form of agreement and a nice letter—I sent my first instalment, and almost by return received the goods (that is another good point in your favour—despatching the goods quicky).

Yours faithfully, J. A.

ORDER NOW—ONLY 27 WORKING DAYS TO XMAS

NEW LISSEN SKYSCRAPER FOUR ALL-WAVE CHASSIS MODEL, complete kit comprising all components, including set of Lissen Valves. Cash or C.O.D. Carriage Paid, £5/12/6. Balance in 11 monthly payments of 10/3. Send **10/3** only

NEW LISSEN SKYSCRAPER FOUR ALL-WAVE CONSOLETTE CABINET MODEL, complete kit comprising all components, including set of Lissen Valves, Cabinet and Moving-Coil Speaker. Cash or C.O.D. Carriage Paid, £8/2/6. Balance in 11 monthly payments of 15/-. Send **15/-** only

NEW LISSEN 7-VALVE SUPER-HET CHASSIS MODEL, complete with Lissen Valves in Sealed Carton. Cash or C.O.D. Carriage Paid, £8/17/6. Balance in 11 monthly payments of 16/6. Send **15/-** only

NEW COSSOR MODEL 341. S.G. Detector and Pentode, and Balanced Armature Speaker, complete with Cabinet. Cash or C.O.D. Carriage Paid, £6/7/6. Balance in 11 monthly payments of 11/9. Send **10/-** only

LISSEN SKYSCRAPER THREE (Battery Model), complete with three Valves and constructional chart in sealed carton. Cash or C.O.D. Cash Price, £4/9/6. Balance in 11 monthly payments of 8/3. Send **8/3** only

TELSEN H.T. AND L.T. A.C. MAINS UNIT W.346. H.T. Portion:- Max. Det. and S.G. tappings, each adjustable for high, med. or low voltages. Maximum 28 m/A. at 150 volts. L.T. trickle charger, 2, 4, or 6 volts at ½ amp. Cash or C.O.D. Carriage Paid, £4/17/6. Balance in 11 monthly payments of 9/-. Send **9/-** only

ATLAS C.A.25 ELIMINATOR, for A.C. mains, Class "B" or Q.P.P., four tappings:- 60/80, 50/90, 120, 150 volt, 25 m.a. Cash or C.O.D. Carriage Paid, £2/19/6. Balance in 10 monthly payments of 6/-. Send **6/-** only

GARRARD AUTOMATIC RECORD CHANGER for A.C. mains. Mounted on unit plate complete, ready for fitting in position, including Garrard Pick-up and Tone-arm. Cash Price, £10/10/0. Carriage Paid. Balance in 11 monthly payments of 18/6. Send **18/6** only

NEW GARRARD MODEL 202A. 12-in. Turntable. Electric Motor for A.C. mains. Cash or C.O.D. Carriage Paid, £2/10/0. Balance in 8 monthly payments of 6/-. Send **6/-** only

NEW W.B. P.M.4.A. MICROLODE PERMANENT MAGNET SPEAKER complete with switch controlled multi-ratio input transformer. Cash or C.O.D. Carriage Paid, £2/2/0. Balance in 11 monthly payments of 5/9. Send **5/9** only

EPOCH MODEL 20C, 20CB and 20CQ PERMANENT MAGNET MOVING-COIL SPEAKER for ordinary power, Class "B" and Q.P.P. respectively, complete with input transformers. Cash or C.O.D. Carriage Paid, £1/15/0. Balance in 6 monthly payments of 5/6. Send **5/6** only

PETO-SCOTT CLASS "B" PERMANENT MAGNET MOVING-COIL SPEAKER. Complete with input transformer. Cash or C.O.D. £1/2/6. Balance in 5 monthly payments of 4/6. Send **2/6** only

R & A "CHALLENGER" PERMANENT-MAGNET MOVING-COIL SPEAKER With special Ferranti multi-ratio input transformer. Cash Price, £1/15/0, Carriage Paid. Balance in 5 monthly payments of 6/6. Send **6/6** only

NEW BLUE SPOT PERMANENT MAGNET MOVING-COIL SPEAKER 29P.M. With input transformer. Cash or C.O.D. Carriage Paid. £1/12/6. Balance in 6 monthly payments of 5/-. Send **5/-** only

NEW BLUE SPOT PERMANENT MAGNET MOVING-COIL SPEAKER 45P.M. With input transformer. Cash or C.O.D. Carriage Paid, £2/5/0. Balance in 7 monthly payments of 6/-. Send **6/-** only

ROLA F.6. PERMANENT MAGNET MOVING-COIL SPEAKER With Universal tapped input transformer. Cash Price £2/9/6. Carriage Paid. Balance in 11 monthly payments of 4/6. Send **4/6** only

BLUE SPOT 66R.B. CLASS "B" MOVING-COIL LOUDSPEAKER. With input transformer. Cash or C.O.D. Carriage Paid, £1/10/0. Balance in 5 monthly payments of 6/-. Send **6/-** only

B.T.H. MINOR PICK-UP AND TONE ARM. Cash or C.O.D Carriage Paid. £1/1/0. Balance in 3 monthly payments of 4/6. Send **4/6** only

PILOT CLASS "B" FOUR KIT

WITH COLVERN SCREENED COILS

Peto-Scott again triumphs with this up-to-the-minute CLASS "B" Battery 4 Kit at the right price. Provides super-selectivity and sensitivity with outstanding mains quality and seven times the volume of the ordinary battery set. Single-dial tuning; several coils; built on Metaplex. Comprises the latest S.G., detector, Class "B" power-driven and Class "B" output valves. Complete Kit (less valves) includes detailed "simple to build" instructions and Assembly Blueprint. A superlative Class "B" Kit with matched and tested components guaranteed for 12 months by Peto-Scott

KIT "A" Cash or C.O.D., Carriage Paid.

£3-10-0 or 5/- deposit, and 12 monthly payments of 6/-.

YOURS FOR **5/-**

KIT "B." As Kit "A" detailed above, but including 4 PETO-SCOTT matched and tested Valves. Cash or C.O.D., Carriage Paid, £5.5.6, or 12 monthly payments of 9/9.

KIT "C." As Kit "A," as detailed above, but including 4 PETO-SCOTT matched and tested Valves and Peto-Scott Consolette Cabinet, as illustrated. Cash or C.O.D., Carriage Paid, £5.18.0, or 12 monthly payments of 11/-.

Recommended PETO-SCOTT SPEAKER if required, add 22/6 to Cash Prices, or 2/- to each monthly payment.

NEW ROLA CLASS "B" PERM. MAG. MOVING-COIL SPEAKER AND AMPLIFIER. Complete with Valve and Input Transformer. Two models: A for PM2B. PD220 and 220B; B for 240B and HP2 (state which when ordering). Cash or C.O.D. Carriage Paid, £3/11/0. Balance in 11 monthly payments of 6/6. Send **6/6** only

NEW BLUE SPOT CLASS "B" OUTPUT STAGE. As advertised. Complete with Osram B21 Class "B" Valve. Cash or C.O.D. Carriage Paid, 43/6. Balance in 11 monthly payments of 4/-. Send **4/-** only

NEW FERRANTI CLASS "B" SUPER-POWER CONVERTER. Instantly converts your set to Class "B." Complete with Valves. Ready assembled. Cash or C.O.D. Carriage Paid, £3/3/0. Balance in 11 monthly payments of 5/9. Send **5/9** only

PILOT CLASS "B" CONVERSION KIT. Complete with all necessary components and Blue prints. Cash or C.O.D. 37/6 (Carriage Paid). Balance in 7 monthly payments of 5/6. Send **5/-** only

CELESTION CLASS "B" UNIT, "B" Stage 9. Combined Class "B" Unit and P.P.M.9 Moving-Coil Speaker. Cash or C.O.D. Carriage Paid, £3/7/6. Balance in 11 monthly payments of 6/3. Send **6/3** only

CELESTION CLASS "B" UNIT, "B" Stage 9. Combined Class "B" Unit and P.P.M. 9 Moving-Coil Speaker. Casb or C.O.D.Carriage Paid, £2/15/0. Balance in 11 monthly payments of 5/-. Send **5/-** only

PETO-SCOTT CO. LTD., 77, City Rd., London, E.C.1.
Telephone: Clerkenwell 9406/7.
West End Showrooms: 62, High Holborn, London, W.C.1.
Telephone: Holborn 3248.

Dear Sirs,—Please send me CASH/C.O.D./H.P.:

.....

for which I enclose £.....s.....d.
CASH/ H.P./DEPOSIT.

NAME.....

ADDRESS.....

..... P.W., 25/11/33.

SEND DIRECT to AVOID DELAY — CASH, C.O.D. or EASIWAY

RADIO STEP-BY-STEP

OUR SPECIAL SUPPLEMENT for BEGINNERS

SERIES AND PARALLEL CONNECTIONS

CELLS, batteries, resistances, etc., may be connected together in several ways. The two most common methods are known respectively as *Series* and *Parallel*.

The series method of connection in particular is one of great practical utility, although it should be mentioned that both schemes are widely used in electrical and radio work.

An Ideal Example.

The well-known dry-cell high-tension battery is one good example of the series method. An H.T. battery may consist of forty or more dry-cell units, each having a nominal voltage of 1·5.

But the voltage of a single cell is quite useless for the work which a battery of this type is called upon to perform. Many volts are necessary, and therefore a number of cells are joined together in series in order to supply the required voltage.

Every cell, no matter whether it is of the dry or wet type, has two terminals. One of these is positive and the other negative. In the case of a dry cell the centre terminal (connected internally to the carbon rod) is positive (or plus) and the terminal joined to the zinc outer case is negative (or minus).

Sometimes a Wire.

Sometimes the negative connection is not a terminal but a short length of wire soldered on to the cylindrical case surrounding the cell.

To connect two cells in series the positive terminal of one is joined to the negative terminal of the other, thus leaving two free connections, viz. a positive and a negative terminal for joining up to whatever arrangement the battery has to supply with volts.

This series method of joining cells can be carried on indefinitely, so that we can, if necessary, have a hundred small units connected in this manner: positive of one to negative of the next, positive of the next to negative of the following, and so on.

You will probably ask what is the effect of using this scheme. The answer is that the voltages of the various cells are added together. Thus, when two 1·5-volt units are connected in series the total voltage is 3. If twenty 1·5-volt cells are joined in series the total voltage is 30. So the obvious way of getting lots of volts is to join cells or batteries in series.

But suppose that, instead of volts, you want current capacity. Not lots of volts, but an increased capacity.

It is helpful to compare the capacity of a water tank with that of an electric battery. A big tank will hold more water than a small one. Although the smaller tank can supply the same number of gallons per second or minute as the bigger one, it will not be able to do it for so long. Obviously, the smaller tank will empty itself far sooner than the bigger one if it is called upon to supply the same amount of water.

Similarly, a small cell will not have the capacity of a big one. Its voltage may be the same, and in fact will be the same if it is the same type of cell, but it will run down more quickly if the same current is taken from it as from the larger. It is, however, quite easy to increase the capacity by connecting a number of cells in parallel. With the series method of connection the volts are increased but the current capacity (i.e. the period during which a certain current can be supplied) can never be greater than that of a single unit.

When two cells are joined in parallel the voltage remains equal to that of a single cell, but the current capacity is doubled.

The connections for paralleling cells are perfectly straightforward. All the positives are joined together, and likewise all the negatives. Thus you have what is, in effect, a single large cell.

Take, for example, six accumulator cells having ampere-hour capacities of 20. The voltage of each cell will be two (this applies to all such cells irrespective of their ampere-hour capacity).

If they are all joined in series the total voltage will be twelve and the capacity will remain that of one cell, viz. 20. If they are connected in parallel the total voltage will be two, but the ampere-hour capacity will now be 120.

There is a third method of connection which combines both the series and parallel schemes. It is, in fact, called *series-parallel*. We could take the six cells mentioned above and connect them in three pairs, each pair being in series to give a total of 4 volts.

Now, if we treat each of these pairs as one unit we can join them in parallel to give a capacity of 60 ampere-hours at 4 volts. This is one example of the series-parallel method.

Similar Treatment.

Resistances can be treated in exactly the same manner as electric cells. When two or more resistances are joined in series the total resistance of the combination is equal to the sum of the separate resistances. Say, for instance, that there are four resistances each having a value of 10,000 ohms. When joined in series the resultant value would be 40,000 ohms.

To connect resistances in series they are arranged so that the current flows first through one, then through the next and so on. They are, in other words, joined "end to end."

The parallel method is simple enough to apply in practice, in so far as the actual connections are concerned, but the arithmetic is a little more involved.

Finding the Value.

If three resistances having values of R_1, R_2 and R_3 are joined in parallel the equivalent resistance of the combination is given by the equation:

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

If there are only two resistances in parallel and each has the same value the answer is easy to find. It is half that of either one of the resistances. Thus, two 10-ohm resistances in parallel are equal to one 5-ohm resistance.

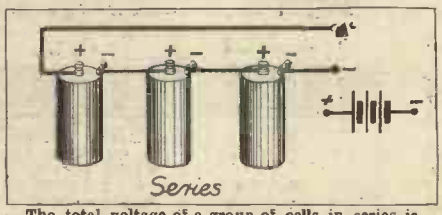
But suppose there are three resistances having values of 12 ohms, 4 ohms, and 6 ohms.

Then $\frac{1}{R} = \frac{1}{12} + \frac{1}{4} + \frac{1}{6}$

Therefore $\frac{1}{R} = \frac{6}{12} = \frac{1}{2}$ and

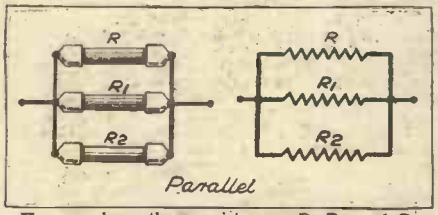
$R = 2$ ohms.

A POPULAR METHOD



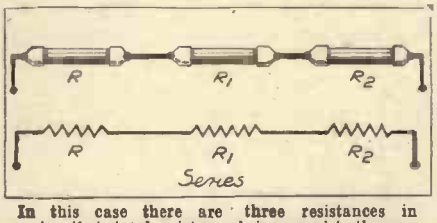
The total voltage of a group of cells in series is equal to the sum of the voltages of the individual cells. The smaller diagram illustrates the theoretical method of depicting cells in series.

FORMS A TRIPLE PATH



Here we have three resistances, R, R_1, and R_2 joined in parallel. The sketch on the left is a practical diagram and that on the right the theoretical representation. With this scheme the current flowing splits up, some going through one resistance, some through another, and so on.

THE VALUES ARE ADDED



In this case there are three resistances in series, their total resistance being equal to the sum of the separate resistances. In other words the values of R, R_1 and R_2 are simply added together.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos

Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so

QUESTIONS AND ANSWERS

USING A MOVING-COIL LOUDSPEAKER FOR THE "S.T.500."

S. M. (Eastbourne).—"I understand it is not advised to substitute an ordinary type of output, either power or pentode, in the 'S.T.500' instead of the Class B output used by Mr. Scott-Taggart, but I am not sure about using a moving-coil speaker with Class B. What is the position in regard to this?"

A moving-coil speaker is eminently suitable for use with the "S.T.500."

If the speaker is of a type specially intended for use with Class B the output choke in the set need not be used, the three leads in the set which connect to P.1, H.T. + and P.2 on the choke being connected directly to the corresponding terminals on the loudspeaker, in accordance with the makers' instructions.

If a moving-coil loudspeaker of the standard type, suitable for use with power or pentode valves, is available it may be used, the Class B output choke in the set being required in this case.

The lead from the L.S. terminals on the set should be connected to the "power" terminals on the speaker, and trial should be made to see which ratio of the output choke gives best results.

CHANGING FROM THE "S.T.300" TO THE "S.T.500."

F. A. L. (Chertsey, Surrey).—"I have decided to construct the 'S.T.500' exactly as described by Mr. Scott-Taggart, using as many of my 'S.T.300' components as possible.

"But how about the two three-point switches, the terminal strip and the screen? (I assume the panel is O.K. if redrilled?)"

The two three-point switches used in the "S.T.300" may be used as wavechange switches in the "S.T.500," any two of the three terminals on each switch being utilised.

The "S.T.300" terminal strip should have an additional hole drilled between the original H.T.+2 and H.T.+3 terminal positions. The terminals should then be arranged on the strip in accordance with the "S.T.500" blue print, the original L.S.— terminal hole not being used.

The original screen will be suitable, but an additional notch will be required. The position of this can be determined by reference to the diagram on page 262 of POPULAR WIRELESS for October 21st, 1933.

The "S.T.300" panel also may be used, but two additional holes should be drilled as shown in the diagram on page 270 of POPULAR WIRELESS for October 21st, 1933.

CURING HUM IN AN A.C. MAINS SET.

"TRANSFORMER" (Stalybridge).—"The power is wonderful and the quality almost perfect. The only fly in the ointment is a trace of hum, which is not noticeable on musical items, but not forgettable on speeches, announcements or intervals.

"I have heard that an exactly similar case to mine was cured by wiring a potentiometer of 30 ohms across the low-tension transformer,

(*Continued on next page.*)

"P.W." PANELS, No. 145.—PARIS, ECOLE SUPERIEURE.

Since the Poste Parisien station's arrival on 328·2 metres, the Ecole Superieure programmes have not received much attention from British listeners, though at one time this was a favourite station, especially in the South of England.

* * *

The wavelength is 447·1 metres. Reception is often surprisingly good, though the power is only ·77 kw., and four other stations share Ecole Superieure's wavelength.

* * *

The distance from London is about 214 miles, and outside relays are a feature of the programmes. Ecole Superieure is associated with many other P.T.T. stations, including Bordeaux Lafayette, Lille, Lyons, Strasbourg, and Toulouse.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

and I have got the potentiometer all ready. But I don't see how to wire it.

"My transformer (4-volt) is marked, on the L.T. wiring side, 2 : 0 : 2, and the heater leads go to the '2' terminals, the middle one going to earth (actually to a screen which is connected to earth).

"Do I put the two ends of the potentiometer on the outer (2) terminals and the earth return wire on the slider, or what?"

Yes, you have the idea exactly.

Simply connect the potentiometer across the outer (i.e. the "2") terminals, leaving these connected to the heater wiring. And disconnect the 0 terminal altogether.

The lead which formerly went to this goes to the slider on the potentiometer. And careful adjustment of this should find a setting at which the troublesome hum either disappears absolutely or else falls to such a low level that you have to listen very carefully indeed to hear it.

A QUESTION OF IMPROVED SELECTIVITY.

L. T. (Forest Hill, London, S.E.).—"My experience is more or less typical, I expect. Knowing nothing at all about wireless, at first I got interested in your paper, and soon began to try the effect of some of the dodges, etc., I read of, until I became keen on making my own set as near perfect as I could.

"I have made many improvements, one way or another, but this is the first time I have written, and I am sure you can help me out. It is in connection with improving selectivity.

"When I first tackled it the programmes used to overlap badly, and nearly every concert was mixed up with somebody's talk or music from another station. But now I have got perfect selection on medium waves and on long waves, the only trouble being that I have to do a wiring change-over every time I alter the waveband.

"What I have done finally is to put a ·00015 mfd. in the lead between aerial and aerial terminal, which gives beautifully sharp tuning on medium waves. (Bigger condenser not so good.)

"But I find this arrangement cuts down the strength of the long waves a lot. They are O.K. with a ·001 mfd., but best of all with no condenser in the aerial lead at all.

"So I have to disconnect every time I go from long to medium, and vice versa. And I want your advice on the best way to remedy this."

It's easy, L. T. All you require in the way of extra parts is an ordinary on-off switch that you can mount near your aerial terminal.

The idea is to connect this "across" the ·00015-mfd. condenser, enabling you to switch it in or out, according to whether you are tuning on medium or long waves, and, of course, without the need for alteration of the wiring each time.

For convenience the fixed condenser will now be placed inside the set instead of outside it. So first you must break the lead that goes from the aerial terminal to the tuned circuit, joining the aerial terminal to one of the condenser's terminals, the aerial terminal's connection (or connections) to the other condenser terminal.

This, you will see, puts the condenser permanently in the aerial-to-coil lead. Now for the method of cutting it out by means of the switch.

All you have to do is to mount the switch near the fixed condenser, joining one of the switch connections to one of this (fixed) condenser's terminals, and the other side of the switch to the other side of the same condenser.

When you place the switch in the "off" position it will obviously have no effect on the condenser, which will thus be inserted in the aerial lead to give you the necessary degree of selectivity for good medium-wave tuning.

On changing to long waves you place the switch in the "on" position. This joins the two condenser terminals together via the switch wiring, and so, in effect, cuts it right out until the switch is operated again.

The cutting out of the condenser is exactly what you want on long waves. So in future, instead of having to alter the condenser wiring, you get the same effect of condenser-in or condenser-out merely by means of the extra switch.

DO YOU KNOW—

the Answers to the following Questions?

There is no "catch" in them; they are just interesting points that crop up in discussions on radio topics. If you like to try to answer them, you can compare your own solutions with those that appear on a following page of this number of "P.W."

(1) Which is the most easterly station in Europe commonly received in this country?

* * *

(2) Which is the most crowded wavelength—i.e. the one on which the greatest number of stations are allowed to work—in Europe to-day?

* * *

(3) How many studios are there in Broadcasting House, London?

* * *

(4) When did the North Regional station at Moorside Edge begin to take over the regular programme service from the separate transmitters it was designed to replace?

"WHEN THE PROGRAMME DROPS SUDDENLY TO A WHISPER."

The query which appeared under the above heading in our November 4th issue has led to many interesting and helpful letters from readers anxious to assist our querist by giving their own experiences under similar circumstances.

We have to thank G. A. B., of Manor Park, for his specially detailed and clear letter, which is of such general interest that extracts are given below for the benefit of those who are still struggling with a puzzling fault of this kind. (Note how thorough the test had to be

(Continued on next page.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from previous page.*)

before the trouble was located by G. A. B. And remember that it can occur not only in a choke or other component, but in almost any part of the installation.) G. A. B. writes:

"In connection with R. V. M.'s (Billingshurst) query in the Radiotorial columns of 'P.W.,' dated November 4th, the following may be of interest:

"Early this year I built an 'S.T.300' and experienced the same trouble. Repeated efforts to trace the trouble were of no avail.

"Each of my investigations led me to conclude that the H.F. valve, which in this case is an S.G., was faulty.

"My dealer said the valve was quite O.K., so I took the complete receiver to him for test. The test confirmed my suspicions, so he changed the valve.

"After this the set behaved as an 'S.T.300' should do, but only for a time. The original trouble again asserted itself, and I had to start my investigations all over again.

"I tested everything there was to test and found nothing wrong. I rewired the set and the trouble disappeared, only to turn up again later. All efforts to trace the trouble had, for months, been fruitless, until in sheer desperation I stripped the whole set, wiring and components, and tested everything separately with a test meter.

"The trouble soon became evident. It was in the binocular choke.

"The two coils in this choke are connected in the base, the connection being effected by twisting together the ends of the wire from each coil. A blob of solder on this joint and my trouble was gone.

"If this information is of any use to R. V. M. I shall be happy to think I helped a fellow-sufferer who had a set which was minus an important blob of solder!

* * *

"P.S.—I might have mentioned that the underside of the base of my choke was covered with cardboard, which obscured the internal connections."

IS YOUR SET BEHAVING ITSELF?

Perhaps your switching doesn't work properly? Or some mysterious noise has appeared and is spoiling your radio reception? Or one of the batteries seems to run down much faster than formerly?

Whatever your radio problem may be remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers its unrivalled service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an Application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS, PLEASE NOTE: Inquiries should NOT be made by 'phone or in person at Fleetway House or Tallis House.

EFFECT OF USING UNMATCHED COILS WITH GANGED CONDENSERS.

T. N. Y. (Barnstaple, Devon).—"Purely for economy's sake I want to do something that I have never seen recommended, but which, I think, will save me money. And that is to use two different makes of dual-range coils in a two-gang condenser set.

"Originally a pair of matched coils were specified. But there is no 'local station' trouble here, so possibly different makes would do."

No, they wouldn't, T. N. Y. Far from being an economy, they would be sheer waste of time and trouble.

The only object of ganging condensers is to be able simultaneously to tune the two circuits. If you use *unmatched* coils, even of identical make, tuning may, and probably will, go out of step and defeat the whole object.

If, however, you use unmatched coils of *different* makes there is *certain* to be immediate trouble from mistuning.

What would happen would be that one circuit would be tuned in to, say, Western National, the other would bring in, say, Heilsberg, and you yourself would be in a sort of purgatory between the two.

Take our tip and don't attempt it.

HOWLS WHEN USING THREE L.F. STAGES.

C. M. (Church Stretton).—"Why do I always get a howl or whistle when putting a third L.F. amplifying stage on a det. and two L.F. circuit?

"All components, etc., O.K., and all work perfectly when in two-stage set. But nothing doing in combination as three L.F.'s. Why is that?"

Because you are trying the impossible, C. M. With ordinary apparatus and conditions three L.F. stages in combination are not three L.F.'s at all, but merely snares and delusions. They are not designed to work in this way—and they won't.

If you want enormous volume there are plenty of ways of getting it apart from three L.F.'s following a detector. So why try that impossible method?

THE ANSWERS

TO THE QUESTIONS ON PAGE 565 ARE GIVEN BELOW.

(1) Moscow.

* * *

(2) The common wavelength of 453·1 metres. There are no less than nine low-powered stations working on it.

* * *

(3) Broadcasting House has twenty-two studios.

* * *

(4) April 20th, 1931.

DID YOU KNOW THEM ALL?

DOPES AND DOPING

How to make and use special preparations for treating loudspeaker cones.

By W. WYMER.

ALTHOUGH the results of modern, commercially made loudspeakers would invariably be impaired by the application of a "cone dope," there are, nevertheless, many home-made and factory-built speakers of the older type which would benefit by a judicious treatment with one or other of the preparations given below.

Apart from altering the tone characteristics of a loudspeaker by the use of a dope, which the above may suggest, and which in itself affords a field of useful experiment, there are innumerable cases where a dope can be utilised with advantage: on an old fabric cone, for instance, whose fabric has sagged or become contorted owing to careless handling or storing.

Essential when Fabric is Used.

Or on a fabric cone whose threads have "laddered" and so left airspaces which defeat the object of the assembly. And, notwithstanding renovations, a dope of some kind is essential when fabric cones are being made at home, where various grades of cloth down to thin silk, and even the new "fish-net" material, may be tried either thickly or thinly doped. Before becoming chemically minded, however, just a few words on the most important subject of application.

In applying the dope to the material use a short-haired brush, preferably of the kind used by stencillers, and use this with dabbing movements so that the preparation is forced into the interstices of the cloth. Always begin at the outside edge of the material, and, irrespective of its shape, do the whole of this edge first, for, in doing so, when this begins to dry it will tend to shrink and pull the other portions of the fabric equally to it. Should any portion of the fabric being treated be missed, it is advisable not to touch this place up until the other part of the work is perfectly dry, so avoiding the tendency for the brush to pick up and blister the half-dried dope round the bare patch.

Probably the strongest dope to be manufactured at home consists of gum arabic and starch. This is prepared by soaking overnight a few small pieces of the gum in eight times its volume of water. When the gum has merged into something of a lumpy jelly it should be heated and well stirred, and finally filtered through a piece of fine-texture cloth to get rid of all foreign matter before stirring it into an equal quantity of starch, made to the consistency of cream.

Reinforcing Linen Cones.

Starch (or gum arabic) by itself is, of course, a dope suitable for reinforcing thin linen cones, and can be used thickly or thinly; and if thought fit, an inch or two of the material, left unstiffened round the edge of the cone, may be employed as a very efficient and supple suspension for the cone from the baffleboard or chassis.

A reliable damp-proof dope can easily be made by dissolving shreds of celluloid in a mixture of one part of amyl acetate and two parts of acetone. But remember, all these ingredients are highly inflammable. The liquids may be purchased ready mixed at almost any chemist's at a cost of about sixpence per ounce—enough to dope a square yard of material. The celluloid clippings may also be purchased at the same shop, or if you have on hand some old photographic negatives these can be utilised if the ultimate colour of the dope does not matter.

A USEFUL DIARY

THE 1934 edition of "The Wireless World Diary" is more interesting and useful than ever. It provides in a most compact form a mine of valuable information for listeners and constructors.

There are, for example—a summary of the regulations concerning receiving licences, details of the principal short-wave broadcasters, a list of the European broadcasting stations and those on the Mediterranean coast in the order of wavelength determined by the Lucerne Plan, which comes into effect on January 15th of next year.

The technical section is packed with useful tables and diagrams, and there are easy-to-read charts providing short cuts to innumerable calculations, many pages of hints and tips and a comprehensive survey of modern valves.

The Diary is bound in leather cloth, and costs only 1s. 6d., complete with pencil. It is obtainable at all booksellers and stationers, and in our view it should be in the hands of all radio enthusiasts.

AN AMAZING PENTODE

THE race for efficiency in valves is still proceeding with unabated vigour, and at frequent intervals we receive news of a fresh valve that is to put in the shade everything that has gone before it in the same line.

At the present time a great deal of attention is being focused on double-diode triodes and multu-mu screen pentodes, but that does not indicate that other varieties are being shelved. As a matter of fact, the L.F. side of the set is getting a very good share of attention, as can be seen from any list of recently developed L.F. and power valves.

The latest excitement in the ranks of power types comes from the Mazda factory in the form of a new indirectly-heated pentode with an amazing performance—the A.C.2/Pen.

Astonishing Characteristics.

It has been designed for use in the output stage of receivers where the utmost sensitivity is desired, and has most astonishing characteristics. The filament voltage is the usual 4, but the current is a little more than is usual with A.C. indirectly-heated valves, being 1·75 amp.

The anode and screen voltages are the same, 250 volts maximum, and at this figure the valve can deliver an undistorted A.C. output of something like 3,400 milliwatts. This, in itself, is not so surprising these days; but when we remember that this output is obtained from a *grid-voltage input of* 3 *volts peak* we begin to get some idea of the capabilities of the valve.

The mutual conductance is 9·0 ma/V., and the optimum anode load is only 6,500 ohms, a figure that is easily attainable in practice, and which undoubtedly accounts for a large proportion of the actual success obtainable with the valve.

Record Sensitivity Factor.

The anode current at maximum voltage is only 32 milliamps, which, with the screen current of about 6 milliamps, is easily obtainable from a good mains unit. The valve is one that should be kept well in the minds of mains-set constructors, for with a small receiver it is possible to get amazing power, as can be realised when we consider that the sensitivity factor of the valve (mW./Vg^2.) is 485.

On test in a three valver the A.C.2/Pen. provided such sensitivity that large numbers of distant stations were received not only at full loudspeaker strength, that is with the pentode fully loaded, and giving its 3,400 milliwatts output, but at sufficient power to require considerable volume controlling.

From this it can be realised that as regards sensitivity the valve brings the three valve mains set into the category previously enjoyed only by multi-valvers such as are associated with radiogram receivers, though as regards power output it considerably exceeds that available from many of the large radiograms on the market.

RADIO AS A CAREER

Details of a really practical system of home study specially suitable for those who wish to fit themselves for professional radio work.

IT is characteristic of any young and rapidly growing industry that it is unable to recruit from within its own borders all the new staff required by its continual expansion, and must seek men from other territories.

In radio this is especially true, for here there is always a rich vein of outside talent waiting to be tapped—namely, the great throng of knowledgeable amateurs. That, perhaps, is one of the sources of the remarkable fascination of radio as a hobby, for it offers its followers the definite chance of making it their livelihood when they have gained a sufficiently high standard of knowledge, as they often do by their own unaided efforts.

A Really Practical System.

The process, however, is not a very easy one for the man working entirely without help, and we are well aware that there is a considerable demand among amateurs for a really practical system of home study with expert guidance, such as would enable them to fit themselves for professional radio work without wasted effort and with the least expense.

We were therefore very much interested to learn that the Technical and Commercial Radio College, of Blackheath, is now offering just such a course of instruction by post. The matter seemed of sufficient importance to warrant investigation, and we accordingly sought an interview with Mr. R. H. Bradley, the Director of Studies at the College.

One of the first questions we put to him was this: "What standard of knowledge may the student expect to attain by the time he has completed your Course?"

"He is then a fully qualified technician, ready to take a professional appointment. He has had thorough instruction in all the basic principles, and special sections of the Course have dealt with servicing, maintenance, set design, factory testing methods, radio calculations, and in fact everything a fully trained man needs."

Types of Appointments.

"For what type of appointments do you particularly aim at fitting your students?"

"We believe that the main openings come under certain principal headings which I will jot down for you, and we keep these clearly in mind right through our Courses."

This is the list which Mr. Bradley then wrote down:

1. Laboratory staff in factories.
2. Test staff in factories.
3. Service work, whether in factories or the shops of radio dealers.
4. Technical correspondence staff.
5. Technically trained sales staff.
6. Spare-time work, servicing, maintenance, and so on.

All this seemed to indicate Courses planned expressly for the man definitely out to make radio his profession, so we asked Mr. Bradley whether the College did indeed confine itself to "vocational" training, to which he replied: "No, we particularly cater for the amateur who wants to get the greatest possible pleasure from his hobby. To do that he wants exact knowledge, concisely and interestingly presented, and that is just what we give him."

Two Principal Sections.

"How do you arrange your Courses to suit all these different requirements?"

"We divide our main Course into two principal sections, but more important is our arrangement to treat each student separately. By means of alternative supplementary lessons and personal tuition where necessary we manage to give him exactly what he requires."

In further discussion we learned that a special feature of the Course is that it is kept up to date by continual revision, in which it has a heavy advantage over the text-book method of study, and that it was specially compiled for the College by eminent authorities on each subject, chief among whom was Mr. G. P. Kendall, well known to the readers of "P.W." for his gift of lucid exposition and his wide knowledge.

Helping Students to Find Jobs.

Finally, we asked Mr. Bradley a very important question: "Do you make any arrangements to help your qualified students to get appointments?"

"Yes," he replied; "we place their names and details of past experience and training on our Employment Register, which we circulate among leading radio manufacturers, and arrange interviews between students and employers. A personal introduction of this nature is of the utmost value to a student and is a guarantee that his application will receive the most careful consideration."

We have since examined the syllabus of the Course, and also certain specimen sections, selected by ourselves, of the Course themselves, and we find that they can be fully endorsed as a really sound and conscientious piece of work. We believe that any student who will work through them with the will to learn cannot fail at the end to be in possession of knowledge of great practical value.

The fees are, in our opinion, decidedly moderate, and they can be paid in monthly instalments if the student so desires.

Readers requiring further details of this training are advised to write for a free copy of the Prospectus to: The Principal, Technical and Commercial Radio College, Lloyd's Place, Blackheath, S.E.3.

THE LISTENER'S NOTEBOOK

(Continued from page 544.)

Millar or a Lily Elsie to boom it. Adèle Dixon did all that was expected of her, and she received adequate support from Derek Oldham, Margery Hicklin and Margery Wyn.

As with musical comedies previously broadcast, so with "A Waltz Dream," the music was everything. Whereas tuneless rhythm may count its devotees in their hundreds, tuneful rhythm à la Oscar Straus claims its thousands.

* * *

I much enjoyed Thalben Ball on the B.B.C. organ in this week's "Foundations of Music." We don't get many opportunities of hearing this instrument, which is a pity, especially as the cathedral organs to which we've listened in the past aren't supposed to be great broadcasters. There shouldn't be any complaints now for some long time.

* * *

Mr. Oliver Baldwin is so good a broadcaster that he ought to have more than fifteen minutes a fortnight for his talk on "Films." He is no sooner under way than his time is up. And if he hands over half of his time to some big-wig of the films (as he did this week), then his job doesn't seem worth doing.

But this isn't all, for he devotes a large number of his precious moments to answering correspondents. All very entertaining, but, unfortunately, it means that he can give nothing more than a sketchy outline of "New Films Worth Seeing."

* * *

I think the B.B.C. is to be congratulated on the way it dealt with its programmes on Armistice Day. We know that the B.B.C. has made mistakes in the course of its career, as any live institution serving a large public is bound to do, but, generally speaking, we must allow that the B.B.C. does handle its big jobs well.

NEXT WEEK

Full constructional details and diagrams for building

THE "DOUBLE X"

and also

THE A.C. "DOUBLE X"

TWO MAGNIFICENT MODERN RECEIVERS!

THE LINK BETWEEN

(Continued from page 546.)

5-valve superhet, and I am tempted to remark that surely 50,000 Mancunians can't be wrong! Why not judge for yourself by learning all about it through the medium of our postcard service? **(No. 66)**

A New Tungsram Valve.

What I consider to be a particularly interesting addition has recently been made to the well-known Tungsram range of valves.

Styled the L.P.220, this new Tungsram valve is a high-efficiency low-consumption type of power valve which the makers claim to be very satisfactory for Q.P.P. operation.

According to the details that I have before me, the H.T. consumption, with correct biasing, is in the region of 4 to 5 milliamps, a remarkably low figure for the type of valve.

The price of these new valves is 7s. 3d., and they can be supplied in matched pairs for Q.P.P. use.

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way—just quote the number or numbers.

THE MIRROR OF THE B.B.C.

(*Continued from page 544.*)

Jack Hylton.

Jack Hylton and his Band are due to give an hour's broadcast for National listeners on Saturday, December 2nd. Scores of thousands of listeners will hope that he will have sufficiently recovered from his illness to fulfil the engagement.

The R.M.A. Banquet.

The Radio Manufacturers' Association annual banquet takes place at the Savoy Hotel on Monday, November 27th. London Regional listeners are to hear a relay of the cabaret show towards the end of the evening programme. The Prince of Wales is to be the guest of honour.

Sir Thomas Beecham and the Hallé Concerts.

Four of the five Hallé Concerts which Sir Thomas Beecham is to conduct this season are being relayed to North Regional listeners, a fact that will be pleasant news to his many admirers in Manchester and in Liverpool, near which latter city he was born.

On Thursday, December 7th, Sir Thomas is giving his second concert, when the programme will include Mozart's "Jupiter" Symphony and Sibelius' Violin Concerto, in which the soloist will be Henry Holst, who, like Arthur Catterall, has already played this difficult and intricate work in Manchester.

Delius' "Summer Night on the River" and "On Hearing the First Cuckoo in Spring," the compositions by which he is best known in this country, will also be heard. Sir Thomas Beecham is a great admirer of Delius, and he has been responsible for the first performances of several of his works. He is devoting the whole of one of the Hallé concerts in March to his works.

Welsh Singing.

Welsh choral singing, from the point of view of a famous adjudicator, will be the subject of a talk by Dr. T. Hopkin Evans in the West Regional programme on Friday, December 1st. Dr. Hopkin Evans has adjudicated at the National Eisteddfod almost continuously since 1917, from small children's choirs to the large chief choral.

He had judged at nearly all the important competitive festivals in the British Isles and in the Channel Islands, and in 1927 was engaged as the principal adjudicator at the American National Eisteddfod. His choral compositions have been chosen as test pieces at the chief choral contests at the National Eisteddfod on six occasions.

"In Quest of Arthur."

In these days of "debunking" (by the way, did you hear Charles Brewer's delightful song on the subject in a recent vaudeville programme from Broadcasting House ?) it is perhaps not surprising that the West of England, so full of folk-lore and legend, should begin an investigation into the accuracy of their long-cherished beliefs.

Science and modern archæology have a tendency to upset many of them, which brings us to the story of a visit paid by Mr. Nevile Watt to Cadbury Camp, which was anciently called Camelot, in Somerset,

(*Continued on next page.*)

MIRROR OF THE B.B.C.

(Continued from previous page.)

where King Arthur is said to have once dwelt.

Mr. Watt will tell the story in a talk entitled "In Quest of Arthur," on Tuesday evening, December 5th, and it is as well to warn listeners that he may raise such interesting queries as "Did King Arthur ever exist?"

Is there any background of fact in the legends that for a thousand years have hung round his name, his court, his knights and his Round Table? We hope there is, and quite frankly we don't want to be told there isn't.

ECKERSLEY EXPLAINS

(Continued from page 545.)

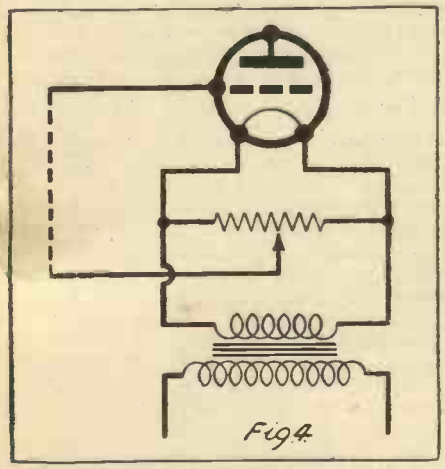
On the other hand, the metal rectifier lasts to all intents and purposes for ever—long after the set is obsolete, perhaps. So it costs you nothing in replacement. Its internal resistance may be a terrible nuisance where the load is not constant. When, however, the set demands the same power always, the metal rectifier behaves perfectly.

* * *

A lot of hum in mains designs may not be blameable upon the H.T. supply at all. If a filament is directly heated by A.C. it is important to bring the grid leads to an electrical centre, as shown in Fig. 4.

If low-frequency amplification is used the valves at the beginning, even if connected like this, may produce hum. In-

USING A CENTRE-POINT



When directly-heated valves are used on A.C. the grid leads should be joined to an electrical centre. This is easily done by connecting a potentiometer across the L.T. transformer secondary winding.

directly-heated filaments produce less hum, and of course in this case the grid leads can be connected to a cathode—no need for any centre point.

It is important to see that the mains transformers do not couple with intervalve transformers and/or loudspeaker transformers, magnetic circuits, etc. It is worth while, when the set is working, to have the mains transformer loose in the hand and twist it about and find the position for minimum hum *after* other obvious methods of getting rid of hum have been tried.

All these are principles and first-aid rules. The elimination of hum is, in certain cases, most difficult.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

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

Valve Impedance.

I SAID something the other day about the ratio between the impedance of an output valve and the load in the anode circuit of the valve. In the ordinary way, as you know, it is generally found that the anode impedance should be about twice the valve resistance for best results, although quite appreciable variations from this ratio are allowable without any very serious disadvantage.

The load usually consists of the windings of the loudspeaker or, if an output transformer is used, the primary winding of this transformer. If an output choke is used the load is a little more complicated and depends upon the output choke and the speaker winding.

Pentode Load.

The foregoing is pretty well known, but what I wanted to mention is the fact that if you use a *pentode* output this ratio does not hold so well. It has been found in actual practice that with a pentode output the load ratio which gives the best results is a much higher one—that is to say, a much higher ratio between the load and the valve impedance. Generally something about 8,000 ohms is a suitable load; but with some of the latest types of pentodes a much bigger load impedance, even twice as much, will be found most suitable.

High-Voltage Output Valves.

Another case where the 2-to-1 ratio must not be depended upon too much is when you use a larger output valve of the so-called "high-voltage" variety, where again, as in the case of the pentode, a relatively higher load gives the best results.

However, as a rule, you should have no difficulty on this point, because you will generally be guided by the specifications and recommendations of the manufacturers.

Study the Characteristics.

Incidentally, these specifications and data should be carefully studied before using a valve. I have often noticed that people take a new valve and just go by about two particulars, the filament voltage and the anode voltage, and are completely oblivious to the various other characteristics, which are just as important.

You might pick up a score of valves of the same filament and anode voltages and yet their characteristics would render them entirely different, and whereas one of them might be suitable for your particular purpose another might be quite unsuitable. The specification on the cartons or the specification sheet enclosed with the valve are not put there just for the fun of the thing, and if you want to get the best out of your valves you should study these very carefully.

Permeability Tuning.

One of the most interesting matters for speculation in radio just at present is the future of "permeability tuning." There are big developments being made in this just now, as you know, and there seem to be different opinions as to whether it represents a real advance or whether it is just a flash in the pan. Personally, I think it has come to stay; in fact, I have thought for a long time past that it ought to have been given more attention than it has received.

H.F. Resistance.

Permeability tuning has several important advantages, and one of them is that for tuning purposes coils can very easily be ganged, whilst, of course, the actual size of the coils can be made very small in comparison with the ordinary ones. A permeability coil may be made only a fraction of the size of an ordinary coil of the same high-frequency resistance.

Valves in Parallel.

When using power valves in parallel in the last stage for handling greater power output you should remember that the input voltage for loading the valves will be the same as if you were using a single valve, but the anode *current* will be increased.

At the same time the impedance will be *reduced*; assuming that the valves are more or less the same in characteristics—which they should be—the impedance of two will be half that of one. I do not suppose you will go to the length of using more than two valves in parallel, but if you use three similar valves the impedance will be about one-third.

Separate Biasing.

Referring to the anode current, it is desirable that this should be pretty well the same for each of the valves; and, as they will never be *quite* identical, it is better to arrange the biasing so that it is independent for each valve, as, in this way, you can adjust so as to get the anode currents the same.

Another point which I should mention is that, since your primary object in using output-power valves is to get increased volume, you will need to use a suitable output circuit, otherwise you will be disappointed with the results. If a transformer is used for the output, remember that in considering the ratio of the impedance of the loudspeaker to that of the output stage you must take the latter as the impedance of the valve combination and not of one valve alone.

Parallel Feed.

When you get a breakdown in transformer coupling—I mean a breakdown in the transformer itself—it is often thought to be due to burning-out of the winding owing to overloading. This, of course, may occur sometimes, but it does not happen nearly so often as people think. What *does* happen more often than you suspect is some sort of corrosion or disintegration taking place at some spot in the windings and a breakdown from that cause.

(*Continued on next page.*)

TECHNICAL NOTES

(*Continued from previous page.*)

If you use transformer coupling on the parallel-feed system, however, the direct current does not get into the primary winding, since the D.C. current in the anode circuit of the valve is kept out by means of a stopping condenser. This means that the likelihood of a breakdown from the causes mentioned above is greatly reduced.

In actual practice it has been found that if the D.C. is not allowed to get into the primary you get scarcely any breakdowns at all.

Motor-Boating.

I dare say you have noticed that sometimes a set which has been working quite well for a long time will gradually lose in sensitivity and volume, and may even, perhaps, develop a habit of motor-boating. If these troubles occur *gradually*, as I have just mentioned, it is obvious that the cause must be one which is itself gradual and progressive and in that case you will most likely find that it is due to the falling-off of the emission of one or more of the valves.

Examine the Valves.

If you find that this is so, it is time to treat yourself to a new valve, or maybe even a new set of valves if they have all been put in at about the same time. Even when you use a set of similar valves, however, you will often find that some will last much longer than others.

I remember starting a set of valves a few years ago which have been replaced one by one, but one valve in particular seems to have as many lives as the proverbial cat and is still going strong, although, as I say, its fellows have been replaced so that there is not one of the originals—except this one—remaining.

Lost Emission.

By the way, you know that if a valve has lost, or is losing, its emission you can often get a further period of useful life out of it by running it for a few hours with the filament operating, but without any high-tension connected to it.

This used to be a great dodge in the old days, though it doesn't seem to be so much practised nowadays. The theory is that the prolonged heating without any high-tension brings up the active material to the surface again. At any rate, if a valve is pretty well useless without this treatment you are not likely to lose anything by trying it, and on the other hand you may, as I say, get as much as two or three months' further service out of it.

Sudden Breakdown.

Talking about motor-boating, I came across a case recently in which motor-boating started in a set—this time rather suddenly, not the gradual change which is so characteristic of failing valves—and it turned out to be due to a decoupling resistance having gone west, so that the decoupling which in the ordinary way prevented motor-boating was no longer operating, or, at any rate, was not operating properly.

This is not the sort of thing that happens often but, as I mentioned in these notes a little time back, if you get a *sudden* change in the performance of the set you can

(*Continued on next page.*)

TECHNICAL NOTES

(*Continued from previous page.*)

generally look for what you might call an "accidental" cause like this—something gone wrong with one of the components—rather than the more gradual changes which one associates with valves and battery supplies.

Potentiometer Points.

Potentiometers are now used in all sorts of ways in a wireless receiving set for enabling a voltage to be adjusted more accurately and smoothly than can be done by merely taking different tappings.

You notice that it is the *voltage* which has to be adjusted and not the current, and this brings me to an important point which I think is often overlooked with regard to potentiometers. The word "potentiometer" itself means roughly a potential "meter," or potential "measure," the important point being that it is something to do with *potential*, not *current*.

Relative Resistances.

The essence of the potentiometer principle is that the resistance of the potentiometer itself should be so high that the current flowing through it is negligible, and, secondly, that any circuit connected to an intermediate point of the potentiometer should have such a resistance or should be of such a character that it draws away a current which is small compared to the current flowing in the potentiometer resistance itself.

In other words, you should tap off from the potentiometer what is virtually a *potential* and not a *current*. Of course, we all know that, inasmuch as we are not dealing with static electricity, we are bound to draw *some* current from the sliding contact on the potentiometer, but if this current is comparable with that in the potentiometer itself you will get an entire rearrangement of the electrical conditions, and the potentiometer will be acting more in the nature of a series resistance, that is, in series with the external circuit.

I have often seen people using a potentiometer in such a way that it was not really acting as a potentiometer at all, and, in fact, a series resistance would have been more efficient, because the bridged part of the potentiometer would have been removed.

Use the Right Value.

You will notice from what I have just said above that the potentiometer resistance should be high enough to keep the current reasonably small, but at the same time it won't do to go and make the potentiometer resistance enormously high, because if you do it is practically certain that the resistance of the external circuit connected to it will become by comparison too low.

So when you see a potentiometer of 400 ohms specified for a particular case, don't imagine that you can just as well use a potentiometer of 50,000 ohms in that position. It is wise always to use a component of the specified value if you possibly can, and, if this is not handy, use one which does not differ very greatly from the value stated.

Ganging.

The primary object of ganging is to reduce the number of controls on the set. Like many other advantageous arrangements, however, ganging and the reduction of controls is not without its drawbacks. The chief of these, I think, is that there is a great likelihood of the ganging not being perfect.

It is true that the trimmers provided with the ganging condensers are useful for matching up, but even then it is quite possible to get appreciable errors owing to different lengths of conductor used to connect up the condensers to other parts of the circuit.

Percentage Accuracy.

You may think that, inasmuch as most ganged condensers are reckoned to be accurate to one per cent, this should be sufficient for all ordinary purposes. But although an accuracy of one per cent may be pretty good for some things, it may represent far too much error for others, and if you make some very simple calculations with regard to the separation of wavelengths of different stations you will soon see that even with this accuracy of one per cent you can get stations overlapping quite a lot.

Effect of Leads.

The point of all this is that in connecting up ganged condensers—or ganged coils, for that matter—you want to try as far as possible to keep the leads and all other parts matched as well, so as to get the greatest accuracy you can in the ganging.

Some manufacturers, in view of the difficulty of really accurate ganging, have made the tuning coils and condensers altogether into one unit, and have adjusted the whole outfit before placing it on the market so that it is really accurately ganged; this is done by means of delicate tests with oscillators.

Points to Watch.

Personally, I regard ganging in the ordinary way as nothing more than what you might call a convenient compromise, and in the great majority of cases you pay for the convenience in manipulative control by a loss—greater or less—in selectivity.

At any rate, if you are making up a set according to a published design, it is very important to follow out the arrangement of leads and connections as set forth by the designer.

Presentation Book Token 6

Printed and published every Wednesday by the Proprietors, THE AMALGAMATED PRESS, LTD., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices: Messrs. John H. Lile, Ltd., Ludgate Circus, London, E.C.4 (Telephone: Central 5352). Registered for transmission by Canadian Magazine Post. Subscription Rates: Inland and Canada, 17/4 per annum. Abroad (except Canada), 19/6 per annum. Sole Agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd.; and for South Africa: Central News Agency, Ltd. Saturday, November 25th, 1933. S.S.