

S.T.500—A GIGANTIC SUCCESS

New Cones for Old

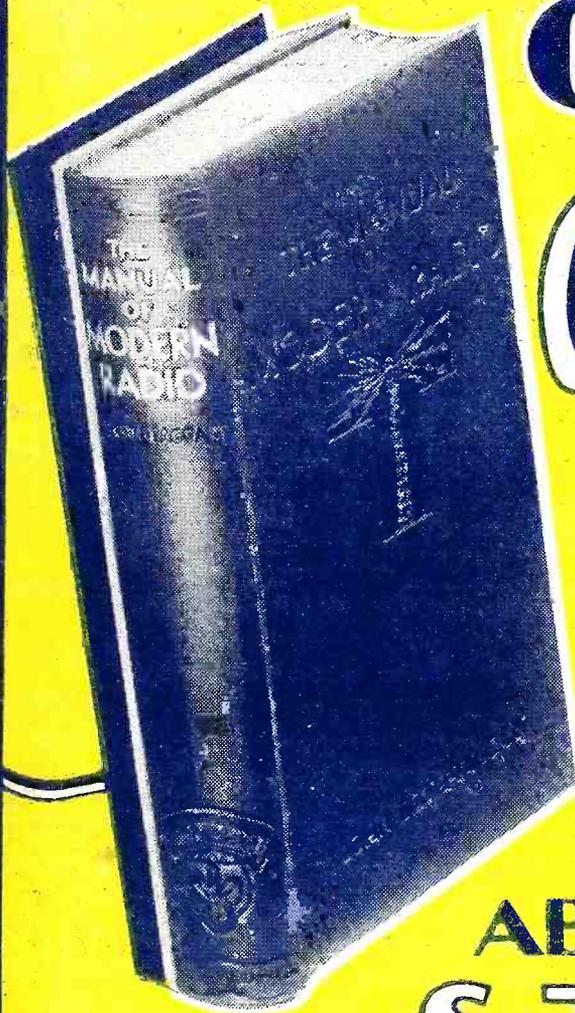
Popular Wireless

No. 595.
Vol. XXIV.
October 28 h.
1933.

**RADIO
STEP-BY-
STEP**

OUR SPECIAL
SUPPLEMENT
FOR
BEGINNERS
In This Issue

EVERY DAY
WEDNESDAY PRICE 3^D

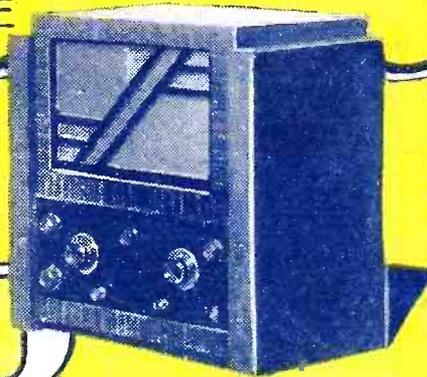


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SEE INSIDE

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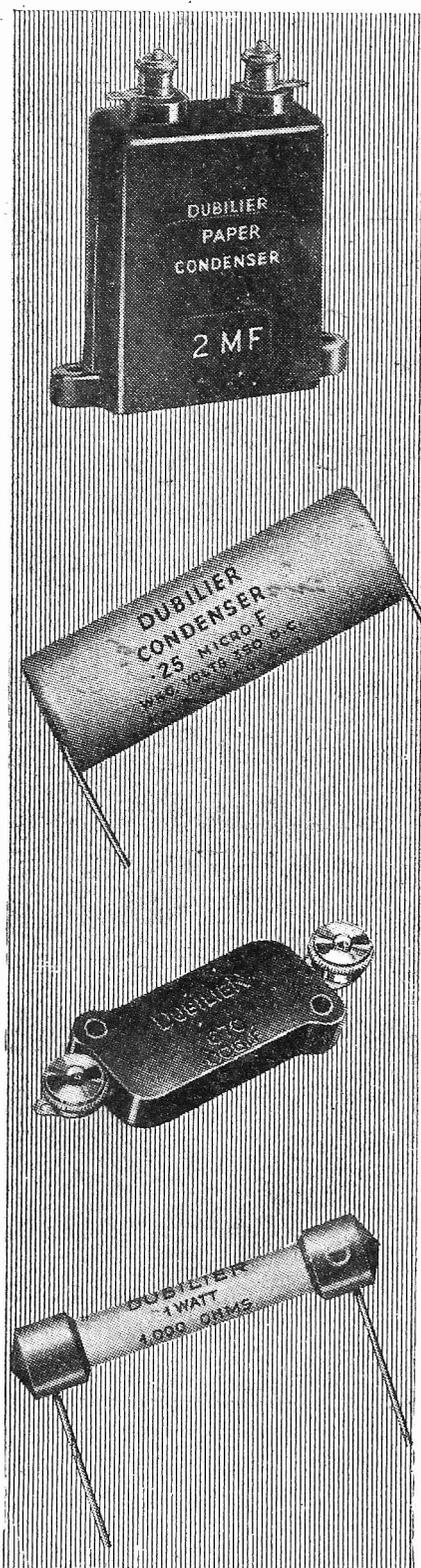
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Three Type B.B. non-inductive type fitted into moulded bakelite cases. 250 volts D.C. peak.
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One 250 ohms, 1/- each.

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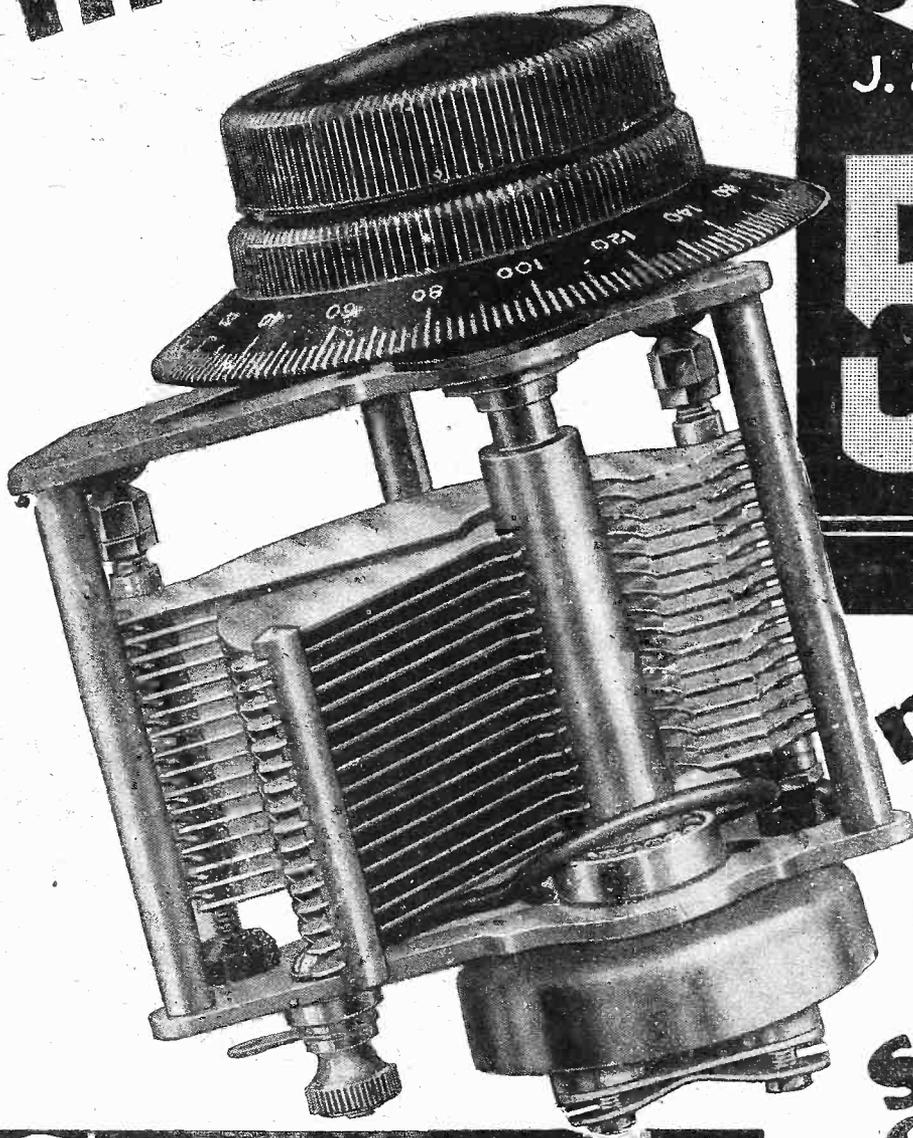
Dubilier Condensers and Resistances have been consistently specified over a number of years in connection with the famous circuits designed by Mr. Scott-Taggart.

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,
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THE BIG SUCCESS!



J. SCOTT-TAGGART'S
S.T.

500

make sure
you use
the only
specified
Condenser
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The ORMOND No 6

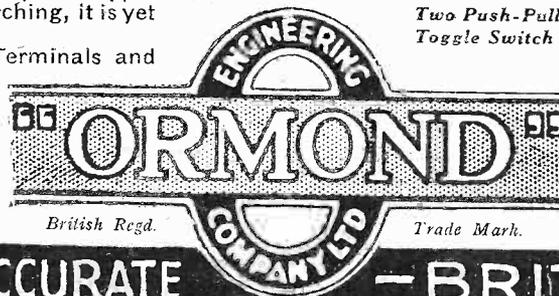
The S.T. 500 deservedly won great popular acclaim when recently introduced. When you build yours, use the **only** condenser Mr. Scott-Taggart considered worthy of a place in his masterpiece. Thus you will be sure of getting the performance and dependability **he** approved, and furthermore, a fine value 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 55 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.

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



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Ormond Components recommended include:—

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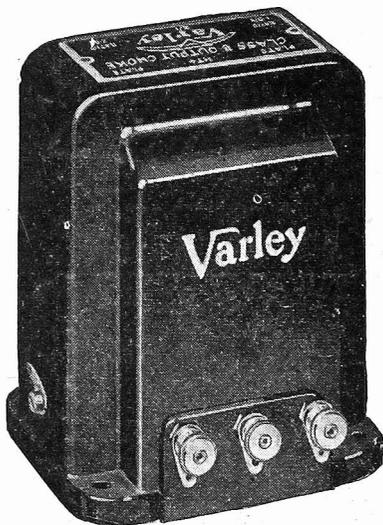
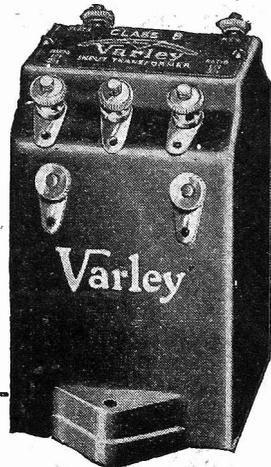
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CLASS B DRIVER TRANSFORMER

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1 : 1

Price: D.P. 40 11/6



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Ratios:

1.5 : 1 2 : 1

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JOHN SCOTT-TAGGART

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Ratio: 1 : 3.5
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*It's much easier to stock all Varley
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Advertisement of Oliver Pell Control Ltd., Kingsway House, 103, Kingsway,
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—charming men and women—at night living in a world of make believe, but in the morning ordinary folk interested in real life . . . They are regular readers of Daily Sketch. It stimulates them . . . "Besides, dear thing," confided Cochlot's latest discovery, "it's D'Alroy who gives me that amazing poise you're always raving about—D'Alroy each morning, that's all." . . . "And then, there's no need to *disinter* the facts," she added, "they cut out unnecessary detail and give you the news in a glimpse. Daily Sketch certainly has made news reading a pleasure for me."

● Finally in Daily Sketch they enjoy expert advice on making the most of their health and their looks and how to keep youthful and to dress well at a minimum of expense.

Make it
a habit...
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NOW

And above all they enjoy those magnificently produced exclusive newspictures that almost talk as they show them the world at a glance.

DAILY SKETCH

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**FOLLOW
MR. SCOTT-TAGGART'S
LEAD . .**

**CHOOSE A
CELESTION**

The Very Soul of Music

LOUDSPEAKER
(for "Class B" Output)

**FOR YOUR
S.T. 500**

Mr. Scott-Taggart chose CELESTION for his S.T.500, and every constructor who values outstanding performance combined with efficiency will follow his lead.

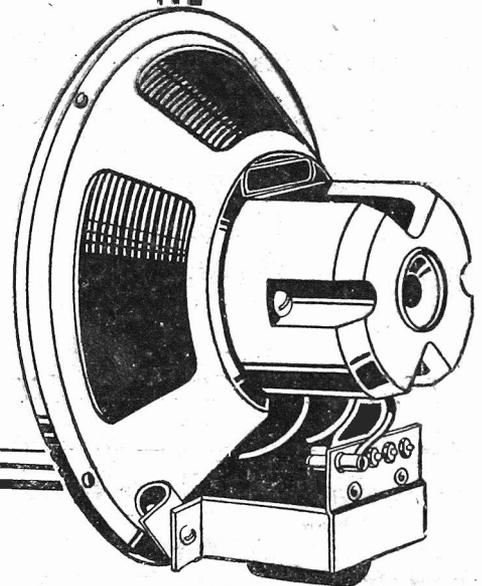
It is **attention to detail** in construction and design that puts Celestion in the **forefront** of modern loudspeaker design. Celestion speakers can be supplied to match any set or type of output.

Ask your dealer to demonstrate Celestion either in chassis or cabinet form.

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Fingerprints!

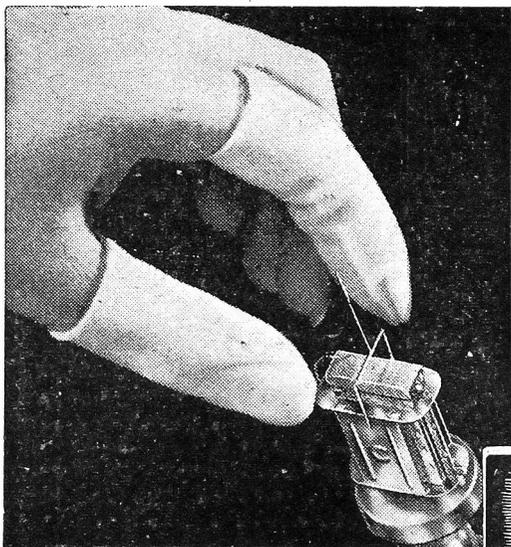
keep off!



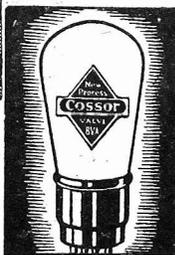
If you could watch Cossor Valves being made you would be surprised to see every one of the hundreds of girls engaged in assembly wearing thumb- and finger-stalls.

There's a special reason for this. Even in the driest atmosphere the skin exudes moisture. Pick up a tumbler and you'll leave finger-prints behind—an almost invisible film of grease. But finger-prints in valve assembly mean impurities deposited on the metal parts. And impurities mean trouble—poor quality of radio reception—distortion—fewer stations—and, maybe, a shorter life.

In the Cossor factory, you would find the most rigorous inspections—the most elaborate precautions—the universal use of finger-stalls is but one of them. Sometimes, perhaps, our engineers may be just a little *too* particular—but, after all, they are the men who are really responsible for safeguarding Cossor quality.



COSSOR VALVES



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POPULAR WIRELESS

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

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
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 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.

FACTS AND FIGURES
 "TOO BAD"
 THE RADIO TRAIN
 TWO-VALVE "SUPERS"

RADIO NOTES & NEWS

BATTERIES WANTED
 FOR THE MAIDS
 THE CRYSTAL AGAIN
 IN THE NORTH

Paderewski Likely to "Go Radio."

ONE of the few giants of art who have hitherto given the microphone a wide berth, Paderewski, the beloved pianist, has apparently realised that he has a duty to that part of humanity who cannot attend his concerts in person.

I understand that he may consent to broadcast in America this year, though he stipulates that he shall be "put on the air" only for the last half-hour of one-hour concerts given in public.

And We Let 'Em Do It!

DURING 1932 America sold to our very own Empire radio goods as per schedule which follows. In the words of Socrates, "How come?"

Transmitting sets and parts: To Canada, \$85,000. *Receiving valves:* To the United Kingdom, \$93,000; to Australia and New Zealand, \$551,000. *Receivers:* U.K., \$370,000; Canada, \$110,000; New Zealand, \$290,000; S. Africa, \$450,000. *Receiver components:* To Canada, \$770,000.

Every cent of that trade should have been booked by manufacturers in the British Commonwealth! What's wrong? After all, Americans don't produce goods at sweated wages or for nothing and a half per hour, like the Japs.

Short Waves.

IT is my colleague, W. L. S., who really merits the gratitude which Mr. Arthur E. Bear heaps upon us for our efforts to popularise work on the short waves.

I do a little now and then by dropping a word or two about the International Short-Wave Club (European representative, Mr. A. E. Bear, 10, St. Mary's Place, Rotherhithe, S.E.16), but W. L. S. does the real spade work. So to W. L. S. be the honour and glory.

Beyond doubt the short wave is the wave of the future; even now it is the wave of the radio explorer and adventurer. So build a "P.W." short-waver, and then write to Mr. Bear for small handbills of further particulars.

Light Interlude.

THERE is a news director of one of the American broadcasting chains who chafes under the restrictions of the Federal Radio Commission. They stand

OUR £1-1-0 BOOK YOUR LAST CHANCE TO SECURE S.-T.'s "MANUAL OF MODERN RADIO"

Spare a moment to read these words before you become absorbed in the further details given in this issue of the "S.T.500."

If Shakespeare had been Editor of "Popular Wireless" (fantastic thought!) he would doubtless have started this editorial with: "Friends, Romans, Countrymen, lend me your ears"; but I prefer to put it this way: "P.W. Readers, Pay Attention, lest you live to weep in vain regret."

**THIS ISSUE OFFERS YOU YOUR
 LAST CHANCE TO SECURE "THE
 MANUAL OF MODERN RADIO."**

I need not repeat here the very simple rules you have to comply with in order to become the owner of the most important book on radio reception ever published. The veriest tyro—I mean the newcomer to the hobby of radio who does not know the right end of a valve from the back of a bus—will be able to read this book with enjoyment and profit; and he will find, when he reaches the last chapter, that "The Manual of Modern Radio" has taught him more about radio than he would have believed it possible to acquire after reading a dozen other books on the subject.

Turn to page 327 and fill in your reservation form NOW.

Our offer of John Scott-Taggart's latest and greatest work is a bargain of a lifetime. Seize your opportunity, and before Christmas the book will be yours. But remember, **THIS IS YOUR LAST CHANCE.**

So don't write to me next week and grumble at having lost your chance. You have been warned!

THE EDITOR.

between him and the snappiest broadcast ever "put over" to the thrill-thirsty American public. They are cramping his style. What is this all about? Well, when questioned he said: "I got a guy who wants to commit suicide in front of a microphone. Would that be a broadcast? It would be sensational. But they won't let him do it." It's scandalous that a mere Commission should thus paralyse Art.

A Radio Ruse.

A RECENT news item from China states that the Japanese army is experimenting with a radio-controlled train. The idea is that this train will be sent on ahead of another, which will be bursting with soldiers, guns, etc., so that while the Chinese bandits are trying to loot an empty train a very full one will arrive without notice and will knock seven bells out of them.

Clever, but is it done? Should an honourable Jap radio man stoop to such a trick, wearing his old school tie and all?

A Spot of Prophecy.

MR. CARLETON DYER, in a speech last month, gave his opinion that the key to the future development of receivers is the valve. He expects to see a two-valve superhet with A.V.C. in about two years, and receivers no bigger than cigar-boxes with separate L.S. units. As to television, he said that the receiver is now in a commercial, practical stage, but that the real difficulty will be the high cost of the transmitters and the clearing of television channels on the medium wave-band.

S.-W. Transmission.

DO you realise what a world of communications is tucked away in the amateur band? There are hundreds and hundreds of amateur transmitters all over the world in daily communication. America probably has most, and more freedom for them! But I'll admit that the U.S.A. amateurs deserve well of their Government because, on occasions of national importance, they really do come into snappy action and do vitally useful work.

(Continued on page 368.)



S.T. 500-

JOIN THE THOUSANDS

Although the "S.T. 500" has been out only a day or two at the time of writing, we of "Popular Wireless" have received such amazing testimony of the public's practical interest in the set that we take this opportunity of congratulating Mr. John Scott-Taggart on a great personal triumph.

Thousands are flocking to their dealers or buying direct. We are inundated with keen, interested enquiries about the set. Last week's issue of "Popular Wireless" was snapped up the moment it appeared.

Never have we at Tallis House known such—

BEFORE saying anything further about the "S.T. 500" I wish to thank all readers who have decided to build the receiver. Even at this early stage it is overwhelmingly obvious that my third National set for International reception has proved acceptable.

I cannot conceal the very deep appreciation which I feel towards those who have acted immediately, and thereby shown their trust in the receiver and their faith in me.

Let me urge those who are on the threshold of building this set to make the decision early. Christmas will soon be here, and before then there will be weeks of wireless enjoyment before you, of a kind which I believe many have no inkling.

Here is Your Set.

As far as I am concerned, this is the only set of its kind which I shall design for twelve months, and if you desire enormous volume and perfect quality, selectivity of a very high order and certainty of results, then I believe that here is your set.

I think that any attempt to hustle a reader into building a receiver is the greatest mistake that can be made. I want you to build it purely and simply on its own technical merit and without regard to any other consideration whatsoever.

I have outlined the major technical points in connection with the "S.T. 500," but I desire this week to deal with the set once more and in greater detail as regards certain aspects of policy and technique.

The fact that my receivers are frequently built as long as twelve months after they are first published is evidence of their

ability to withstand the competition of more recent receivers and the ravages of interference. Curiously enough, a fact which, on the one hand, is a compliment, but, on the other, an unpleasant aspect is that older sets of my design are persistently built, even though a new and better circuit is placed before the public by myself.

Eleven Exclusive Features 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

Obviously these sets are being built as a result of personal recommendations by those who already have one of my receivers, and there is thus the desire to have exactly the same results as those obtained on a neighbour's set.

If you do not build this set to-day, or next week, or next month, it will still, I

believe, be the set you will turn to in the end.

I am addressing now a public of about a quarter of a million, and it is fair to assume that this includes the keenest enthusiasts and the most cautious sceptics. Many of the former will act at once and take steps to have the receiver working in the shortest possible time. But others prefer to "wait and see."

Enterprise versus Caution.

What they are waiting for it is rather difficult to say. Probably the verdict of their friends who have acted with greater enterprise. I have no fault to find with caution in the choice of a set to build. I expect you to exercise caution before building my own and only to act after mature consideration.

The great trouble about home construction in the past has been that sets have been built in the heat of misplaced enthusiasm, and the results have been a cold douche. Indiscriminate set-building has been the curse of home construction. The manufacturers of parts have benefited from it, but I very much doubt whether, in the long run, such an attitude of the public pays the industry.

A month before the "S.T. 500" was completed I was chatting with a manufacturer who said: "Things are not what they used

"We of Tallis House Congratulate Mr. John

A GIGANTIC SUCCESS!

WHO ARE BUILDING IT

—general excitement and keenness about a new design. The "S.T.500" is obviously destined to break all the designer's own records—and these have never been even approached in recent years.

In obtaining the exclusive right of the "S.T.500" we interrupted a very long tradition of producing all our star sets in our own excellent laboratories.

But the "S.T.500" is an immensely successful exception. It offers a unique opportunity to readers and a bargain which may never be repeated. We urge you to build it. And now its inventor has something more to say to you about it.—The Editor.

to be. It is not so long ago that the public would build thousands of sets from any design that was published. Now they are getting fussy and particular. Instead of building sets without regard to the name of the designer, they now follow a group rapidly dwindling in numbers but increasing in influence."

He spoke regretfully as of palmy days that were no more and of golden harvests which would never be reaped again.

This particular manufacturer made components of indifferent quality. He was feeling the pinch of a more educated wireless public. He regretted that it should be in the power of a well-known designer to ensure that the quality of the apparatus the public received was of a standard which would do credit to the designer's circuit.

In the Public's Interest.

Fortunately he was an exception. The economic troubles of the last two or three years have eliminated most of the second-rate firms, and the successful ones welcome a designer who places the public first and foremost.

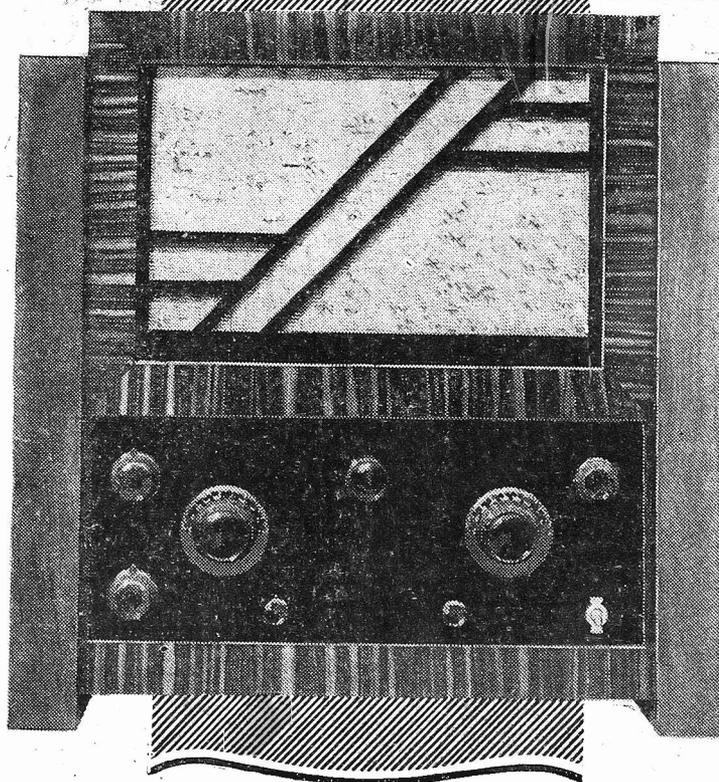
I myself am not in this industry as a representative of manufacturing interests, but of the public, and of the public alone. Every one of my sets is so plainly a set designed with both eyes on the public. There are very many who have built former

sets of mine who will want to build the "S.T.500." These will notice the unobtrusive way in which I have saved them a large sum of money and a considerable amount of trouble.

In the first place, I have not changed the coils which I specially designed for the "S.T.400." These, in turn, were—as regards the anode coil—the same as in the "S.T.300," and, as regards the aerial coil, only a simple modification consisting of the addition of an aerial-reaction coil is necessary.

In these days of multitudinous coils it would please the manufacturers much better if each of my sets had special coils. **But I decline to encourage the public who do me the honour of following my designs to expend money unnecessarily when apparatus previously used in one of my sets will serve as well.**

Although, when ordering the coils for the "S.T.500," you will call them "S.T.500" or "S.T.400" coils, the two types are identical. In the case of the Colvern coils



the numbering is now altered to "S.T.500," but other manufacturers, I notice, are calling them "S.T.400," which is perfectly in order. The fact is that I designed these coils myself not so much for an individual set, but for fulfilling certain technical requirements which might be found necessary in any set.

Saving Constructors' Money.

For a constructor to be able to use the same coils in several of my sets is some indication of my attitude towards the public and of my sincere desire to save them money. Perhaps that is why I resent so bitterly the purchase of inferior apparatus.

If you go through my list of components

.....
Scott-Taggart on a Great Personal Triumph"—The Editor

"S.T. 500"

(Continued from previous page.)

actually used in the set I doubt whether you will be able to save anything by substituting any other approved apparatus. I know perfectly well that immediately one of my sets is announced and details of com-

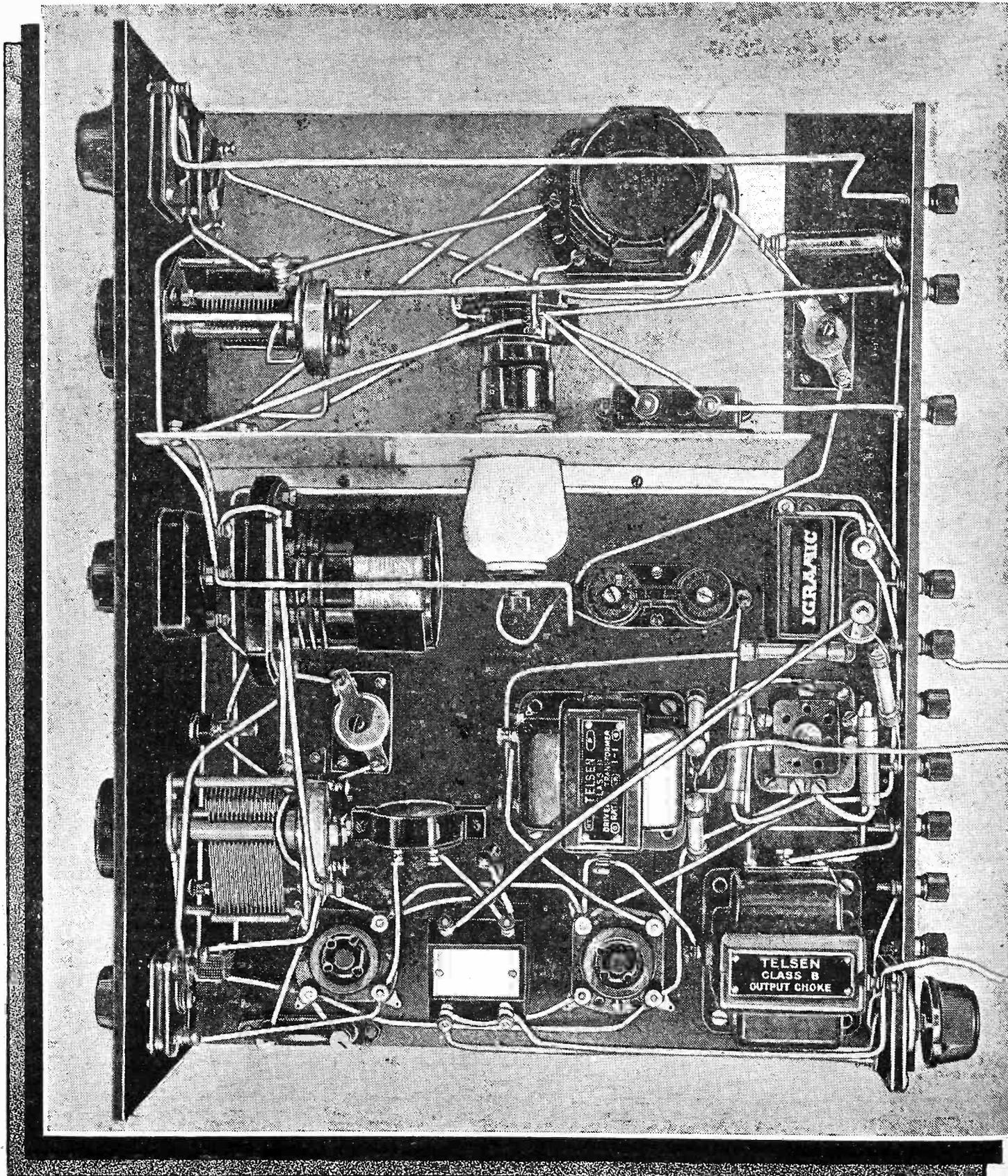
ponents are published there is a rush on the part of obscure and unreliable firms to "cash-in" on my reputation as a designer.

They believe that by associating themselves with a highly popular set, and a designer in whom the public have confidence they are adding prestige to apparatus which would never stand on its own legs or sell on its own merits.

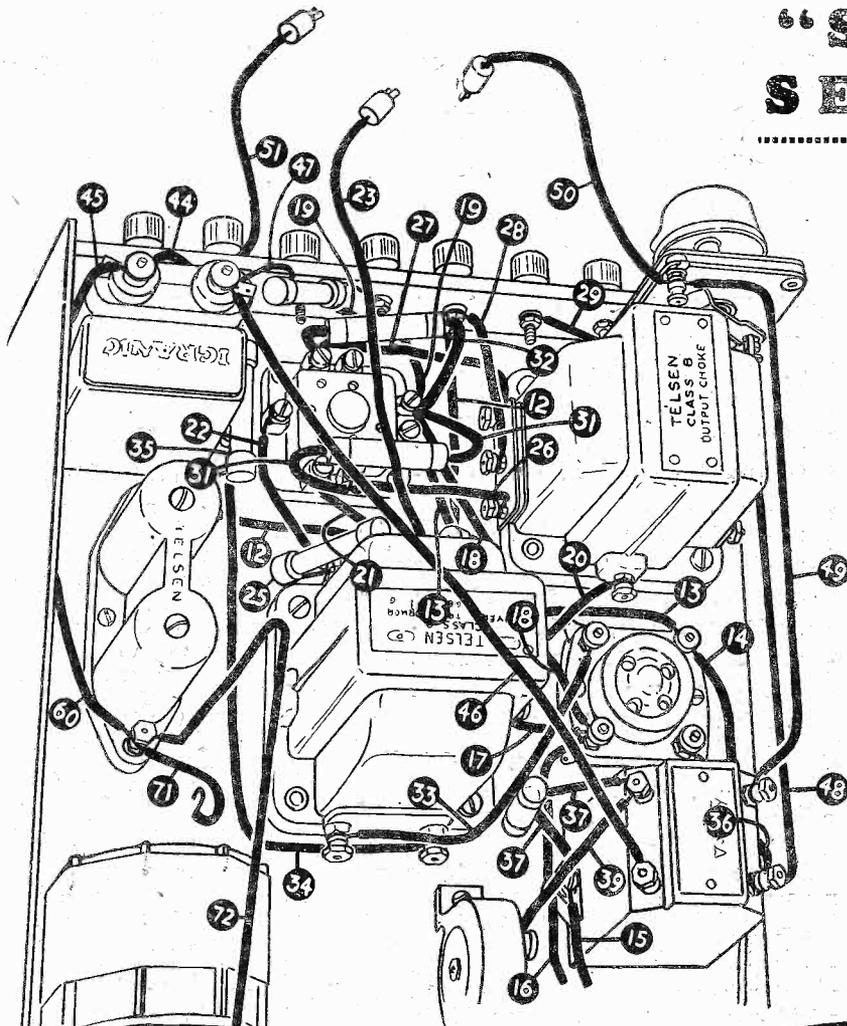
They "advise" this or that for the "S.T.500," and even go to unscrupulous

lengths at times to imply or suggest that I have approved apparatus the very existence of which I deplore.

To-day—yes, this very day—you will find some shop in your district displaying parts, or perhaps even a complete set, which I know (and who should know better?) will exasperate and disappoint some poor fellow who, in perfect good faith, believes that he is obtaining apparatus for the "S.T.500." But is he such a poor



"S.T.500"—YOUR SET FOR 1934



All these numbers correspond with those on the blueprint which was presented you last week.

which I had deliberately excluded from my list of alternatives, and the preset condensers were also of a certain manufacture which prevented a sufficiently low minimum capacity being obtained and which had therefore been rejected by me on that score.

I went back to my hotel and nearly cried myself to sleep. I knew some member of the public would buy that set, which I admit was a little cheaper than my own original one, and that the results obtained would be greatly inferior.

Manufacturers' Magnificent response.

One manufacturer's coils which I rejected were obviously wrong without a test, and when I spoke to the makers they replied: "Oh, we thought the reaction coils on both were the same." As a matter of fact, although the "S.T.500" aerial and anode coils have each three windings, no two are similar.

Incidentally, the sale of spurious coils for the "S.T.500" is not likely to be very profitable. Knowing the danger of bad results through unapproved coils, I urged the various manufacturers to keep their prices as low as possible. They have certainly responded magnificently in this direction, and the margin of profit must be extremely small.

To be able to buy a pair of tested

fellow, after all? If I have warned him with all the vigour and sincerity that I possess, must he not accept the full responsibility himself?

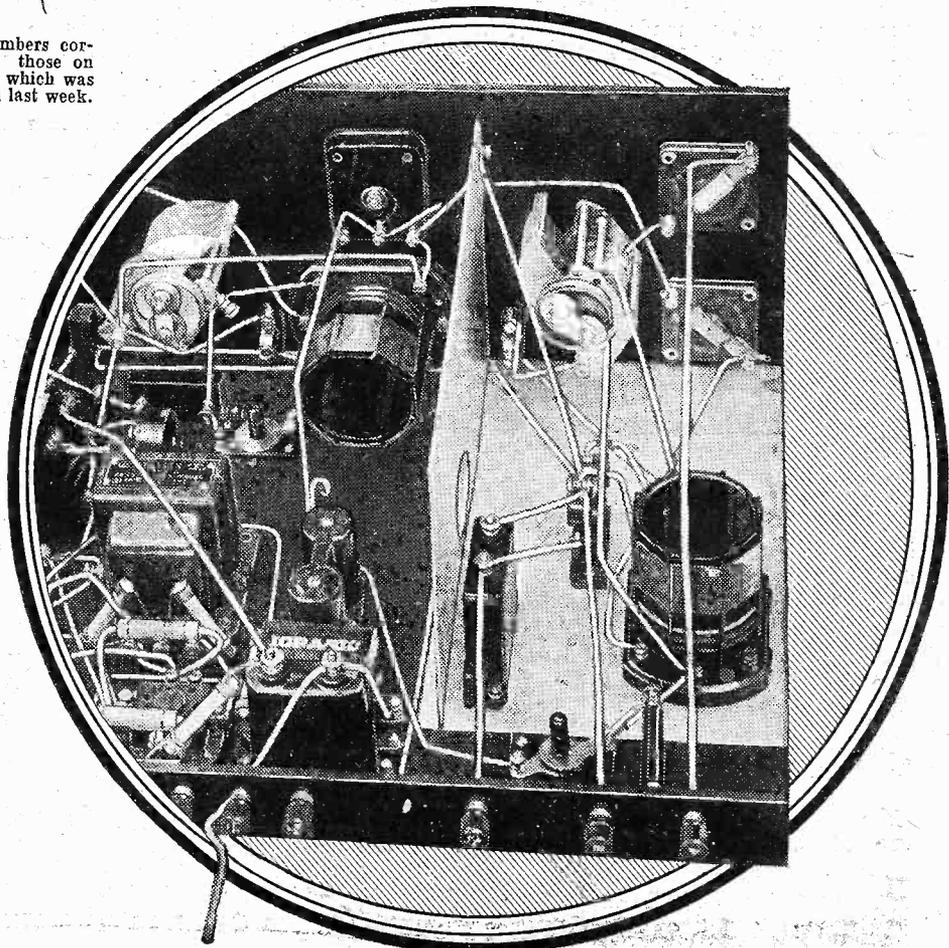
If he reads these words, and then accepts unapproved substitutes, surely the fault is wholly his own, and he must bear the consequences. The most astonishing thing, however, is that frequently these substituted parts will give quite good results.

I remember calling (during my wireless tour of Great Britain last year) at the house of a man who had built the "S.T.300" and was delighted with it. I knew at once, on switching on the set, that, although the results were good, they were nothing like those which my original set would have given. Here, then, was a man who was ignorant of the full performance of the receiver.

An Observed Case.

There are, however, many worse cases. I was in Nottingham some time ago, and saw a receiver of the "S.T.400" type in the window of a wireless shop there. The coils were of some wholly unknown type, the aerial coil was quite obviously an anode coil, while the anode coil in the set was clearly an aerial coil wrongly labelled.

The L.F. transformer was of a type



DISTANCE *with*

"S.T.500" coils by the leading manufacturers in the industry for 8s. per pair is something unheard of. The reason for the public's ability to obtain such components at so low a price is partly because the coils are already standard, having been developed by me for a previous set, and partly because of the huge number which will be manufactured and sold, and which, in fact, are to-day being sold in huge quantities. The manufacturers tell me that on no other set can they possibly afford to produce coils at so low a price.

There is a point in connection with coils which I can easily deal with here. Some designers feel that a new coil should be used in a set in order to give it an appearance of modernity and freshness. This is pulling wool over the eyes of the public.

Five Thousand Per Cent Better!

The coil that is different is not necessarily a coil that is better. In fact, the chances are that a new coil, while gaining in certain directions, may lose in others. I think this process is exemplified by some makes of iron-core coils.

Owing to the improved performance obtainable by the use of an iron core, the old fetish of compact size is once more rampant. The result is that the coils, while more efficient size for size than the air-core coils, are now made so small that all the technical merits of a large coil are lost. We have thus a very small coil which is no more efficient, or little more efficient, than a much larger air-core coil. The

"S.T.500" as RADIOGRAM

The glorious tone and full, rich volume which Perfected Class B gives to the "S.T.500" is equally obtainable from gramophone records. Mr. Scott-Taggart will shortly give full, simple details of how to add a radiogram switch. Meanwhile, build the set as it is and enjoy "distance with enchantment."

"S.T.500" coils are generously dimensioned, and there was no reason why they should be of the air-core type.

I have already indicated that for a moment I was tempted by the novelty and technical interest attaching to iron-core coils. I wondered whether the public would regard a set not using such coils as being just a little behind the times. I might have fallen in with this public view if the results obtainable with iron-core coils had been at least equal to those obtained with the "S.T.500" coils.

There was, however, no comparison at all. The use of Balanced-Phase Double Reaction

is so vastly superior to any results obtainable with iron-core coils that there was no moment of hesitation as to what arrangement I should employ.

The aerial coils with the special reaction employed in the set gave results which unquestionably were at least 5,000 per cent better than the best iron-core coil available to-day.

This is a tremendous increase, and the five thousand should be spelt out by the printer so that no reader should imagine that an additional nought has been added. Actually, the figure is very much higher, but it is difficult to measure the enormous amplification of an extremely weak signal. The obvious way to convince one's self is to try the system on the "S.T.500" itself.

Size of Aerial Coupler.

I have been asked already why I have used a .0005-mfd. aerial coupler, whereas I used a .00004-mfd. coupler in the case of my two previous National sets. Possibly I did not explain myself sufficiently clearly in the last issue, or else my correspondents had been so overwhelmed by the number of words published last week that they had failed to find the explanation in the article!

Let me make the position clear, because it is an extremely important one. On the "S.T.300" the aerial circuit selectivity was dependent solely upon the size of the aerial coupler. The aerial and earth system of the wireless receiver places a heavy load upon the first circuit of the set, and this results in very poor selectivity unless some



ENCHANTMENT

means is adopted of preventing the full effect of the load being placed on the aerial circuit.

My British patent 232659 of November 1st, 1923, covered the use of a small condenser in series with the aerial for the purpose of separating it electrically to some extent from a tuned aerial circuit. This arrangement has been adopted by the B.B.C. for many years as their recommendation for obtaining greater selectivity. I more recently developed improvements on the simple arrangement of ten years ago so as to enable variable selectivity to be obtained by the user of the set.

Benefiting Both Ways.

This was done by placing the control of the aerial coupler actually on the panel of the set so that different degrees of selectivity could be obtained at will at different times of the day and on different portions of the dial, according to the amount of interference experienced. This itself was an important innovation, but the size of the condenser as regards its maximum value was limited by the amount of interference to be expected.

I found that, although the use of an aerial coupler involved an inevitable loss of signal strength, yet it was no use having a bigger condenser than .00004 mfd. because, even when a long distance away from the B.B.C. station, the interference between stations was so great that one always had to have only a small capacity in series with the aerial, thereby reducing the aerial load.

Until I introduced multiple reaction, it was regarded as inevitable that greater selectivity could only be obtained at the expense of signal strength. If the aerial coupler is reduced to obtain a high degree of selectivity, signal strength must suffer.

By applying a perfected system of reaction to the aerial circuit the whole see-saw law is upset, and it is possible to obtain greater selectivity while at the same time increasing enormously the amplification. We thus get the benefit both ways; but my particular point now is that not only do we get greater selectivity and sensitivity for a given capacity of aerial-coupler setting, but, since the aerial losses and general load effect across the aerial circuit are to be largely wiped out by the special reaction arrangement, we can afford to increase the aerial load by using a larger value of aerial coupler.

Avoiding Signal Waste.

Since the amount of high-frequency current fed into the aerial circuit is governed by the capacity of the aerial coupler, it will be seen that far more energy can be fed into the



ALLEUROPE—

tuned aerial circuit than on any previous known arrangement. This is a matter of vital importance, because on all other sets, except my own "S.T.400," which uses a less perfected system of aerial reaction, a great proportion of the incoming signals is completely wasted. **I am not putting the fact too strongly when I say that to obtain selective results on the aerial circuit as much as 80 per cent of the aerial current is wantonly wasted and prevented from energising the aerial circuit.**

Startling Improvement.

I am not blaming designers. I have done exactly the same thing myself, although I have provided means for reducing the wastage when a full degree of selectivity was not desired, or was not necessary. The inexorable law as regards loss of signal strength when selectivity was to be obtained governs us all. **But at last the "S.T.500" provides a means of feeding almost the whole of the aerial energy into the aerial circuit.**

When the aerial coupler has a fixed value, the merits of this increase as wavelength increases. This is because the reactance of the aerial coupler increases with wavelength. The result is that the longer waves suffer most by having a smaller aerial coupler, and the increase to nearly ten times the size (which is accomplished in the "S.T.500") provides a startling improvement on the longer-wave stations.

To hear the aerial reactance overcoming the heavy aerial load is a delight to anyone who has been suffering for years the burden of aerial losses.

Amongst my early correspondence there

LA FRANCE



have been some letters from readers who ask whether aerial reaction is not likely to cause interference with neighbours. My retort is that there are certainly a couple of million receivers of the det. and 2 L.F. type which employ aerial reaction, and the "S.T.500" is no more likely to cause interference than these. In fact, it is less likely to do so, because the reaction is extraordinarily smooth and the chance of radiation is very much less. Moreover, the great reserves of selectivity and sensitivity on the "S.T.500" make it unlikely that the set will be worked "full-out" except on rare occasions. I have no fears at all on the score of radiation, and the set is actually far more stable than nine-tenths of the screen-grid sets built by constructors.

Keeping Input Within Bounds.

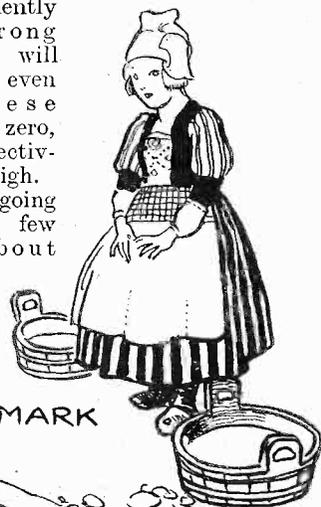
Although the aerial coupler has a maximum capacity of .0005 mfd., it will only be rarely that this maximum capacity will be used. If you are listening to, say, Radio-Paris or a medium-wave station during the daytime you may easily use a large value of the aerial coupler and perhaps no reaction at all; but under normal conditions the aerial coupler will probably be adjusted to a value corresponding to a position the knob nearly full left.

The aerial coupler serves as an input volume control on the high-frequency current and owing to the high magnification of the set as a whole it is important not to overload the circuit, because this will not result in any louder signals, but merely in distortion and very poor selectivity. It is, therefore, better to use too little rather than too much aerial coupler, especially where aerial reaction is employed.

You cannot, and obviously need not, obtain a greater output than 1,500 milliwatts (2,300 with 150 volts H.T.). The full output from the set is obtainable with a certain definite value of high-frequency input. If you increase this high-frequency input you exceed this value, and will not get any louder results, but you will have the disadvantages already described.

If you are unable to reduce the input sufficiently by reducing the aerial coupler to zero you will have to reduce the anode coupler also. Neither of these couplers will give absolute zero, and consequently a very strong local signal will come over even with these couplers at zero, although selectivity will be high.

I am now going to say a few words about



DENMARK



GERMANY



HOLLAND



- IS YOURS



the anode-coupler differential condenser. All differentials have a moving vanes terminal, and also two terminals connected respectively to the two sets of fixed vanes between which the moving vanes travel.

Different manufacturers arrange their terminals in different ways. The moving vanes terminal is always easy to identify because there is usually a pigtail connection to it, although one manufacturer has turned out a model in which the contact is of the rubbing type. As soon as I saw that the pattern had been altered, I stopped using this manufacturer's condensers, but I notice that this season he has reverted to the much more reliable pigtail connection.

Nevertheless, there will be many tens of thousands of various older patterns of differentials in use or in the shops. It is therefore not possible to guarantee that if you use a different differential for the anode coupler the knob will produce the same effect. The reason is that on the original "S.T.500" set, when the reaction knob is turned full left, the high-frequency current from the anode of the S.G. valve will to a large extent pass to the fixed plate

of the differential connected to the vertical screen.

You will find this wire marked 76 on page 292 of last week's POPULAR WIRELESS (dated October 21st). You will also notice that the other fixed terminal is connected by a wire 65 to the selectivity-range adjuster .0001-mfd. preset condenser. If you arrange your connections to the fixed vanes terminals so that, when the knob (looking from the front) is over to the left, the moving vanes are opposite the fixed vanes connected to the vertical screen, then you will obtain the same results as on the original set.

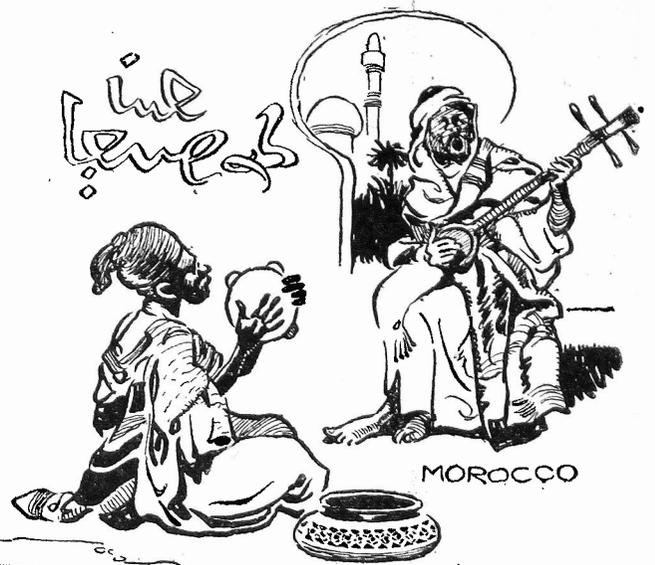
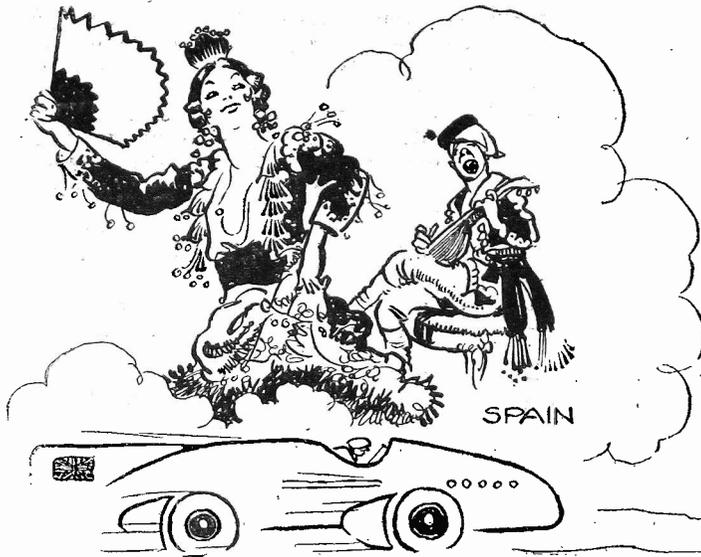
Connecting Differentials Correctly.

You might be able to do this by looking at the differential condenser, but it is often rather difficult to see in what position the moving vanes are in or even where the fixed vanes are placed. It is therefore desirable to try altering the connections of wires 74, 76, and also, be it noted, wire 73 from the coil.

It is very simple to find out whether you have connected the differentials the right

way round or not, because, when the anode coupler is full left, signals should be weakened; this test, of course, should be carried out with all reaction knobs at zero, i.e. full left. The anode-tuning condenser should be slightly retuned after turning the coupler to the left, so that you retain the stations you are receiving. If signals grow weaker when the differential anode coupler is turned to the left, then whatever differential you may be using is correctly connected.

If, however, signals became weaker when you turned the anode-coupler knob to the right (looking from the front), and after the



usual slight retuning of the anode-tuning condenser, then you have the connections to the fixed terminals the wrong way round and you should take off the wire 74 where it joins the terminal and connect it to the other fixed vanes terminal of the differential.

Needless to say, changes of connection of this kind should only be made with the H.T. battery disconnected. The wire 76 and the wire 73 should both be disconnected from the fixed vanes terminal, and both connected to the other fixed vanes terminal.

In making any alterations of this kind, see that no wire goes close to wire 52. This wire is perhaps the most important in the whole set, and when reversing connections keep any other wires at least $\frac{1}{4}$ in. away from it.

A still simpler alternative method, and one which I would prefer in most cases where possible, is to turn the differential anode coupler upside down, and then connect the wires mentioned to the fixed vanes terminals.

Direction of Reaction Control.

It is important to notice that these suggested alterations will not make the set work any better. **The set will work just as well whichever way the fixed vanes terminals are connected, but the anode-coupler knob will have to be rotated in the opposite direction to that given in my various instructions.** It is much simpler to have the anode and aerial couplers producing the same effect for a given direction of rotation.

If the reaction differential is of a different type than the one I use, its knob may, or may not, also have to be rotated to the left instead of the right to obtain more reaction.

Here, again, the operation of the set is not influenced in any way, but I think that reaction should be increased by turning the reaction knob clockwise, i.e. to the right. Probably a great many readers have experienced the reverse effect on other sets using differential reaction.

Some Simple Tests.

All you have to do is to take the connections 67 and 56 and reverse them to the two fixed terminals. Any alteration of the connections of wire should be so made that the wire clears the anode-tuning condenser by at least half an inch; the fact that the wire has to be bent will not matter.

Here are some simple tests to see whether you have your differential condensers the right way round:

(1) If you have used the exact models and makes of differential condensers in my set, and you have made the connections as illustrated in the various drawings, then the result will be correct.

(2) If you have used a different model of Telsen differential or a different make of differential for the anode coupler, you may have the connections reversed.

(3) If you have used the anode-reaction condenser specified, your anode reaction will be correct, and you can then proceed to put your anode differential coupler right. The way to do this is to set your anode-reaction condenser to zero, your aerial-reaction condenser to zero, and the anode coupler half-way.

Now tune in a station on the two dials. Turn the anode-coupler knob to the left and retune slowly on the anode-tuning condenser so as to keep the station. If

signals are now weaker your connections are correct. If they are stronger or the set oscillates, then your connections to the fixed vanes terminals on the anode coupler should be reversed.

(4) If both your differential condensers are different from those actually used in the set (as regards the Telsen, check whether the latest model is used), then carry out the following test: Turn the aerial-reaction knob full left; keep the aerial coupler about half-way; set the anode coupler half-way; set the selectivity-range adjuster at nearly minimum, i.e. undo the adjusting knob.

Tune in a station on the two main dials and then apply reaction by turning the reaction knob to the right, looking from the front. This reaction should improve signal strength if the anode-tuning condenser be suitably retuned. By increasing the reaction to the right you should be able to make the set oscillate. If, however, the set oscillates with the reaction knob full to the left the reaction is working the

wrong way and you will have to reverse the connections of the fixed vanes terminals. (5) Having put the reaction right, set it to zero fully left. Tighten up the selectivity range adjuster to maximum capacity. Now

test the anode differential by moving it to the left. Retune the station slightly on the anode-tuning condenser. If the station is weaker the anode-differential condenser is correctly connected. If stronger or if the set oscillates, then your connections require reversing on the anode differential.

Preventing Confusion.

All this sounds rather complicated, but it actually is not so if you will follow out the instructions. Remember always that the set will work just as well whichever way round the connections may be, and that it is only to prevent confusion that the correct connections should be made.

* * *

A great feature of the "S.T. 500" is the perfected Class B which enables mains-set volume and richness of tone to be achieved.

"But," will cry a thousand listeners, "I don't want volume." Another thousand will say quietly: "My home is a modest one. There is no point in excessive noise; it would only irritate me."

Wireless designers, when they wish to "write down" to the wireless public, talk of "room strength."

I say there is no such thing as "room strength." I acknowledge no standard other than realism. A weak signal—one consistently weak—would not be real to me. One may wish to "turn down" the power for a variety of excellent reasons, but a generous reserve of output is essential for realism.

It is a fact—and also a serious reflection on receiver design—that "turning down the wireless" results in most cases in better quality. Speech becomes more natural and music more "real."

Ask yourself this question: "Is the quality given by my set better when the volume is reduced?" If the answer is "Yes," you are admitting the failure of your set.

Nine-tenths of those who prefer their wireless sets on the quiet side do so, not because they like quietness, but because greater volume will expose and exaggerate every latent vice in the receiver and speaker.

Distortion Called Volume.

This is the unpalatable truth. Only hundreds will admit it and thousands do not even know it. All they know is that "loudness" is unpleasant. They hear Distortion and they call it Volume!

Is it surprising that loudness has become from the earliest days associated with "noise"? My dictionary defines "noise" as: (1) Loud outcry, clamour; din or disturbance; (2) evil report, scandal; (3) a loud or harsh sound of any kind; (4) a sound of any kind; (5) an agreeable or melodious sound. How rare!

It may be rare to hear a melodious noise, but it is the crucial test of a modern set. Look at a photograph through a magnifying glass and every imperfection will be thrown into relief. Is that any reason why one should go through life wearing not merely rose-tinted spectacles but smoked glasses?

Increasing the volume in the average set makes results worse to all but insensitive ears. Why? Simply because distortion is revealed or—more likely—is created. Overloading of the detector, L.F. or output valve occurs with resultant blurr, dither or definite blasting. The speaker, perhaps, reveals its defects, box resonances develop, spurious vibrations occur. "Turn it down! Please!"

A Revelation to the Listener.

It is "turned down," and all is well—or appears so. And one more listener is convinced that he or she likes signals at "reasonable room strength"!

The same listener will, later, turn on his gramophone and listen to perhaps the same music at a volume *five times as loud* as he like it on the wireless!



SWITZERLAND



SWEDEN



ALGIERS



POLAND

Balanced-Phase Double Reaction—

Why is a gramophone loud? Would a gramophone which played records at "room strength" sell? No. And in three years a wireless set giving "reasonable room strength" will, if anywhere, do so on the dust-heap.

Explanation: A modern gramophone gives much better quality reproduction at the higher sound levels than does the average constructor's set. Loud signals, if of perfect quality, can prove a revelation to the listener.

Really excessive volume—even if sufficient to vibrate the whole body—can be tolerated if the quality is flawless. One-fiftieth of that power can make one shriek even if there is only a small amount of distortion.

I ask you to follow my lead as regards the "S.T.500." The use of improved Class B, the design of the circuit, in fact the "S.T.500" as a whole, will bring to your fireside the thrill of realism.

Class B in the "S.T.500."

The reader will have to choose which of several courses he follows as regards Class B. There are various combinations of driver valve and transformer ratios. This information is obtainable from the Class B transformer manufacturers.

As regards the driver, the choice is between a small-power valve or an L.F. type of valve. The small-power valve (L.P.2) takes mere current and costs 1s. 9d. more than

the L.21. The power output of the small-power valve is about twice that of the L.21. Quality is also considerably better.

As regards the overall results, you will get half as much again out of your Class B valve if you use the small-power valve L.P.2. The maximum you can get with H.T. up to 150 volts is 1,500 milliwatts with the L.21 as against 2,300 milliwatts with the L.P.2 which I advise.

On the score of sensitivity, power output and quality I very definitely prefer the L.P.2 and B.21 combination. Nevertheless, I feel that many of the public will lean towards the L.21. And they will be wrong.

There will be lots of temptations to use apparatus different from what I advise. But if you fall for it you must accept the responsibility.

I give you alternative choices, but reluctantly. You are probably not in a position to experiment with all sorts of combinations as I have done. I have no intention of throwing the responsibility on your shoulders and leaving you stranded at a cross-road, uncertain which of several apparently attractive roads to follow. I definitely tell you what I think is best. In this case I prefer the L.P.2. The H.T. current (since considerable negative bias is employed) is 2.5 milliamp as against 1.7 milliamp—a saving of only three-quarters of a milli-ampere; the extra 1s. 9d. in price is well worth while, and most readers will have a small-power output valve already.

The Need for Selectivity.

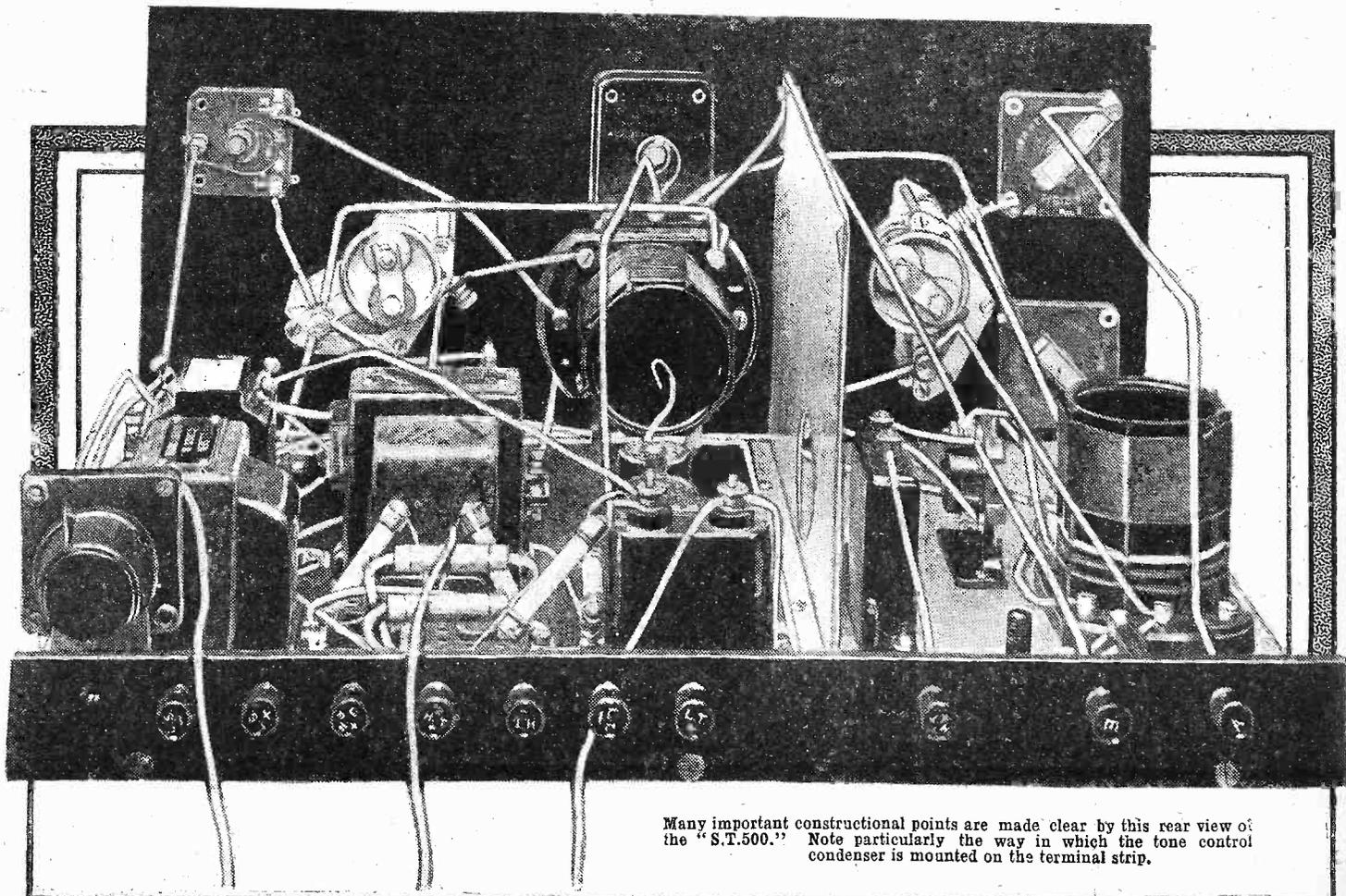
Apart from quality there is need for greater selectivity. The position has been getting worse every year. Country is fighting country in the ether, and the battle, while a bloodless one, has taken toll of listeners' pleasure and entertainment.

So acute has the problem become that many thousands of listeners are crying out: "We should be satisfied if we could only receive half a dozen foreign stations if they could be received perfectly."

This is a cry of despair. It is a cry which I have consistently refused to listen to.

I have never yet designed a receiver intended to give very good results on a very few stations. The reason is simple. Firstly, I consider that the reception of a few stations perfectly is a despairing aim, and that something far more ambitious should be sought for the constructor and found by the designer. Secondly, the designing of a receiver which will get a few stations very well is practically no different from designing a set which will get many stations very well.

Of course, one can produce a very simple set, such as a detector and 2 L.F. stages, and claim that it will receive a few stations very well. It will do nothing of the kind. The claim that it will involves, on the part of the designer, a wholly uncritical frame of mind and limited experience—or downright humbug.



Many important constructional points are made clear by this rear view of the "S.T.500." Note particularly the way in which the tone control condenser is mounted on the terminal strip.

—For Unprecedented Selectivity and Power

Stations are so close together, their powers vary so enormously, that ordinary selectivity methods are inadequate even for "local" reception except within the immediate neighbourhood of the B.B.C. stations. If trouble can occur when ten miles from the B.B.C. (remember Mul-lacker's jabber), how much more necessary is it to provide for the future!

There are several reasons why the "S.T.500's" adjustable controls are necessary. In the first place, the conditions of reception of no two persons are alike. Aerials differ widely, and even next-door

fact, I can remind you of half a dozen proverbs such as "Well begun is half done," "The first blow is worth two," "Muddy springs will have muddy streams."

The types of aerial and earth, however, is less important than the situation of the house. Everyone knows that the nearer one is to a B.B.C. station the greater is the interference. In fact, the interference from, say, the Scottish Regional station may be five hundred times greater for one reader of this article than for another.

Efficiency Demands Controls.

The signal strength from foreign stations as well as from the B.B.C. varies very greatly from place to place, and there must be some means in the set of either cutting down the signals to proportions which can be handled or increasing them from an unduly low level. This cannot be done without controls.

Then, again, the amount of interference varies at different points on the dial. For example, greater selectivity is required in London, or, in fact, anywhere else, on the lower half of the dial. This is partly because, although the stations may be 9 kilocycles apart, the percentage change in frequency becomes less. A wireless

receiver therefore behaves entirely differently at different points on the tuning dial. When a change is made over to the long waveband, conditions are entirely different once more, and here again efficiency and selectivity vary at every degree on the dial.

Saving a Bad Situation.

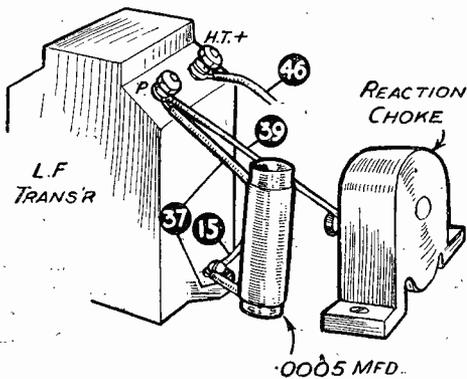
If efficiency falls off, what are you going to do if you have only a one-knob control? If selectivity decreases at the bottom end of the dial you will be powerless to improve matters. You will be conscious that you are getting poorer results, but you will be unable to do anything about it. It is here that the extra controls on the "S.T.500" will save you from such a situation.

Another extremely important factor in a receiver is the H.F. amplifying valve and to a lesser extent the other valves. The H.F. valve governs the amount of amplification obtained, the selectivity, and the inherent reaction of the set. The inherent reaction is due to stray couplings and the capacity coupling inside the valve. It tends to make the whole receiver oscillate, and this instability will ruin performance.

All sets, whatever steps are taken to avoid these couplings, are prone to self-

(Continued on page 384.)

SELF-SUPPORTED CONDENSER



Showing how the .0005 mfd. condenser (C₁₀) is connected by its own wiring tags to the L.F. transformer.

neighbours will have a different aerial system and a different sort of earth. In fact the different kinds of earth vary probably more than the aerials.

The character of aerial and earth govern the load on the first tuned circuit of the receiver. A small aerial and a poor earth will often result in greater selectivity, greater instability and weaker signals. A small aerial and a very good earth may give greater selectivity, poorer signals and greater stability than if a poor earth were employed (the latter helping inherent reaction). **How in the name of reason can the same set perform in exactly the same way on all these aerials and earths?**

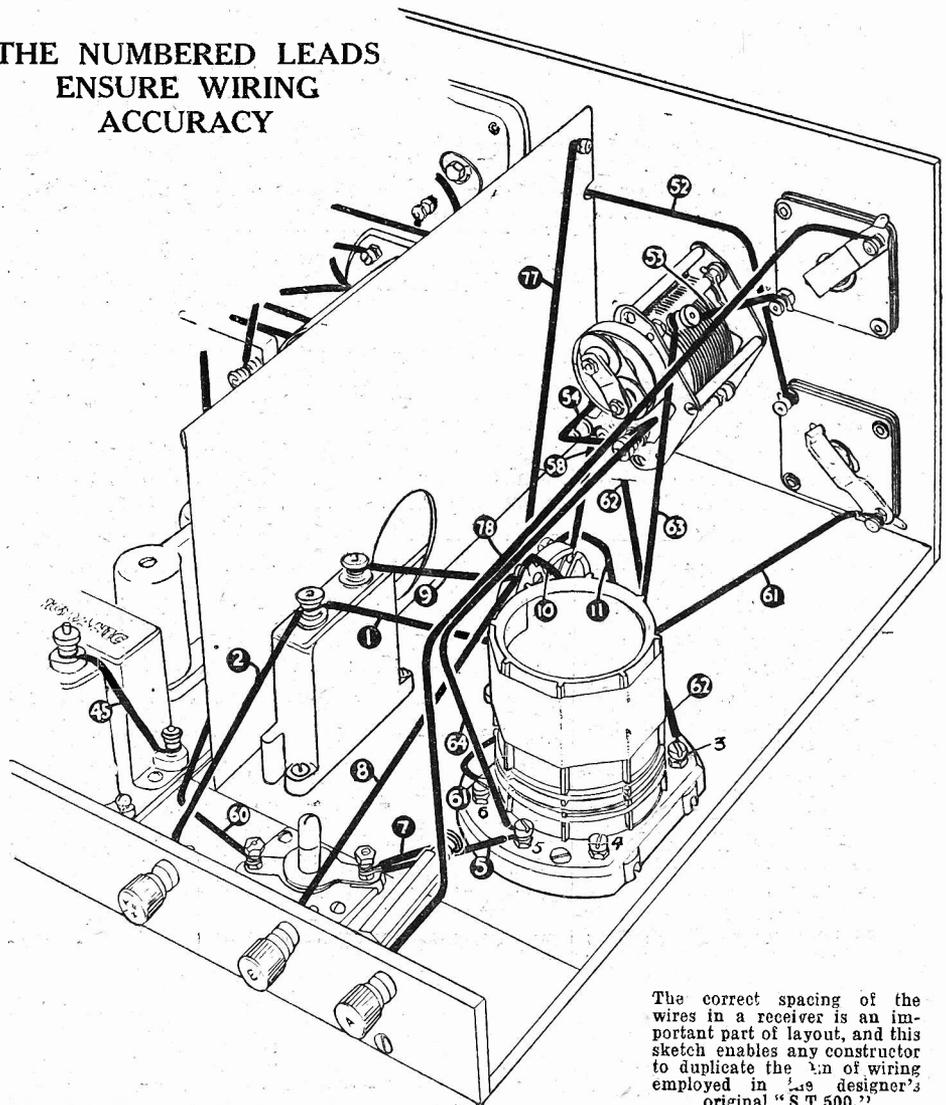
Compensation for Aerial Differences.

There must be some form of compensation for the difference, sunless, of course, one is prepared to forgo the advantages obtainable from a good aerial and a good earth and to dispense with the means for getting better results on a poor aerial and earth.

The aerial coupler on the "S.T.500" enables you, so to speak, to alter the length of your aerial, while the aerial-reaction control will enormously strengthen the incoming oscillations in the first circuit, which hitherto has been the most neglected of all. A good beginning is half the battle, and this is superlatively true in radio. The present practice of sacrificing volume by a wasteful system of aerial selectivity is a confession of technical failure, and the way that the "S.T.500" overcomes this trouble has been fully explained.

Meanwhile, remember the proverb that good beginnings make good endings. In

THE NUMBERED LEADS ENSURE WIRING ACCURACY



The correct spacing of the wires in a receiver is an important part of layout, and this sketch enables any constructor to duplicate the kind of wiring employed in the designer's original "S.T.500."

★ THE MIRROR OF THE B.B.C. ★

By O. H. M. ★

EUROPEAN BROADCASTING—A SERIOUS SITUATION

North Regional Gets Its Director Back—How the Empire Transmissions are Received—A World-Wide Broadcast—After the Lord Mayor's Show.

THE dispersal of the delegates to the European Broadcasting Conference in Holland without final agreement creates a serious situation. There are rumours of reference to the Permanent Court of International Justice, but these can be discounted. The big countries will hardly take the risk of losing some of their channels, which would be quite a possibility if the smaller countries were able to state their case before an independent judicial tribunal.

I believe that one final effort will be made through foreign offices. January is getting near, and unless agreement is reached there will be general chaos.

Mr. Liveing Returns to Manchester.

Mr. E. G. D. Liveing, the North Regional Director of the B.B.C., is returning from London to Manchester after seven months at Headquarters. His return will be widely welcomed in the North, where he is extremely popular. The idea of switching round Provincial and London officials is having good results in creating a more comprehensive understanding of the numerous problems of broadcasting.

Christopher Stone's Popularity.

Christopher Stone's appearances on the music-hall stage both in and out of London seem to be a great success. I hear he is planning a special tour with Jack Hylton. This is another sign of Mr. Stone's great popularity.

Malcolm Frost's Return.

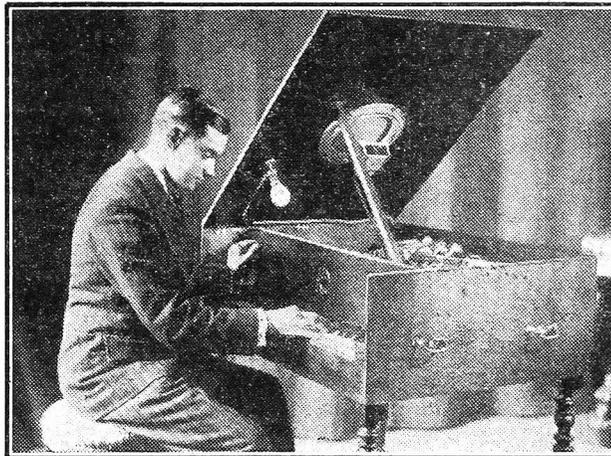
Mr. Malcolm Frost, the B.B.C. Empire Service "Ambassador," just back from his world tour, has some definite ideas about the short-wave service. He found this was not nearly as well received as Broadcasting House was inclined to believe from his correspondence. In Australia, for instance,

there was hardly any reception. On the other hand, I gather that Mr. Frost did well with B.B.C. recorded programmes for which there was a brisk demand both in the Orient and in Australasia.

New Transmitting Stations.

It is now definite that if any kind of agreement can be reached about wavelengths in January, the B.B.C. will start at once a new transmitter for the Highlands of Scotland and another one for the Newcastle area. There is, however, no promise as yet of a transmitter for North Wales. The

AN ELECTRIC VIOLONCELLO



Readers of "Popular Wireless" who have built the "Valvonium," recently described in these pages, will be interested in this photo of an electric violoncello. Note the loudspeaker mounted on the top of the instrument.

new transmitter for Northern Ireland will be built as already planned.

Armistice Day Plans.

Listeners throughout the whole of the British Empire, as well as in all parts of Great Britain, will have an opportunity of

hearing the Armistice Day broadcast from the Cenotaph in Whitehall on Saturday morning, November 11th.

All B.B.C. transmitters, including those which radiate the Empire services on short waves from Daventry, will be working, and this relay from the Nation's and Empire's memorial to the Glorious Dead, in London, will be radiated by wireless for the first time to the most distant parts of the earth.

The broadcast is due to begin at 10.30 a.m., G.M.T., with music by the bands of the Grenadier, Coldstream, Irish and Welsh Guards, and will continue until the close of the service which follows the Silence at 11 a.m. and the sounding of the Last Post.

It is interesting to mention the approximate times at which the broadcast will be heard in different parts of the Empire. At Vancouver it will be 3 a.m.; in Nigeria mid-day; the Sudan and South Africa 1 p.m.; in India and Ceylon 4.30 p.m.; Western Australia 7 p.m., and South Australia 8.30; in the cities of Melbourne, Sydney and Adelaide it will be 9 p.m., and in New Zealand and the Pacific Islands about 10.30 p.m.

In Memory of Percy Pitt.

Dr. Adrian Boulton is to conduct the B.B.C. Orchestra on November 23rd, in a concert to be broadcast to London Regional listeners in memory of Percy Pitt, the anniversary of whose death last year falls on that day.

The programme will consist of the music of the B.B.C.'s first Musical Director, and Arthur Catterall will be the violin soloist.

Carnival Again.

Few novels have lent themselves so readily for adaptation as radio plays as Compton Mackenzie's "Carnival," which the author and Holt Marvell prepared for presentation before the microphone nearly

five years ago.

This story of London before the War will be revived on October 31st and November 2nd, and produced by Val Gielgud, the Productions Director of the B.B.C. Lilian Harrison will play the part of Jenny, Charles H.

(Continued on page 378.)

"OTHELLO" was a great success, and as perfectly played as one could wish for. But for one fault I would have said that Malcolm Keen as Jago was every bit as good as Godfrey Tearle, who played Othello. Jago didn't move along as rhythmically as Othello did—i.e. he tended to convert his poetry into prose, and all too frequently there was a reshuffling of words in his lines.

Godfrey Tearle gave a masterly interpretation of the part of the Moor. There was a refreshing restraint about his acting; the modulations of his voice were exquisite; and, unlike other Othellos I have listened to, he didn't rant.

He never once began a speech on a fortissimo only to find himself unable to work up the required crescendo. He always started quietly, and could increase to a mighty fortissimo with telling effect.

The noise problem was once again apparent. I cannot suggest a solution, however. The crowds are essential if the right atmosphere is to be got, but they do interfere with the dialogue. Even Othello lost some dignity through his inability to silence the mob. At

THE LISTENER'S NOTEBOOK

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

least, that was the impression it left on my mind.

Rural Britain by a Professor sounds as if it might be dull. Rural Britain by Professor J. A. Scott Watson, however, was anything but dull. For instance, his descriptions of the sturdy Ayrshire folk, of the stock they breed, of the homesteads they inhabit, of the stock-markets they conduct, compare very favourably with anything of the same nature I have ever come across.

Listeners who are also book-lovers will certainly find in Professor Watson's talks something to remind them of the best descriptive passages of rural Britain to be found in the pages of literature.

This is yet another of a new series of talks to emphasise the tremendous progress made in broadcast talks. A radio-talks revival, if it were possible, and on the same lines as the present drama revival, would be an astounding revelation. Both in manner and matter there is no comparison between the talks first broadcast and those that now fill the air.

A curious thing about the drama revival is the absence of any disparity in character and substance between the early plays now being revived and the very latest ones. I formed this opinion after hearing the first pair of plays, and "The White Chateau" has only confirmed this opinion.

"The White Chateau" contained all the elements and problems of the most modern radio-play. There was a large cast, noises of every description had to be transmitted, including a symbolic voice. I can't say the symbolic voice was very convincing, but the voices of every character and all the noises were clearly audible. I wish I could recall those earlier productions better. If I could, I would probably sense a feeling of greater certainty in the revived productions than was apparent in the original.

One cannot read the same book over and over again, no matter how interesting it is. But one can read the same author indefinitely, providing he is good and his output prolific enough. The same applies to listening, especially to radio sketches. Whereas I am growing tired of Haver and Lee, I am still interested in Mabel Constanduros and Michael Hogan.

Both these pairs are first-rate artists in their own particular way, but with Haver and Lee it's like reading the same story for the nth time. It's appeal

(Continued on page 378.)

TELSEN

'S.T. 400' COILS

for Mr. John Scott-Taggart's

P.W.

'S.T. 500'

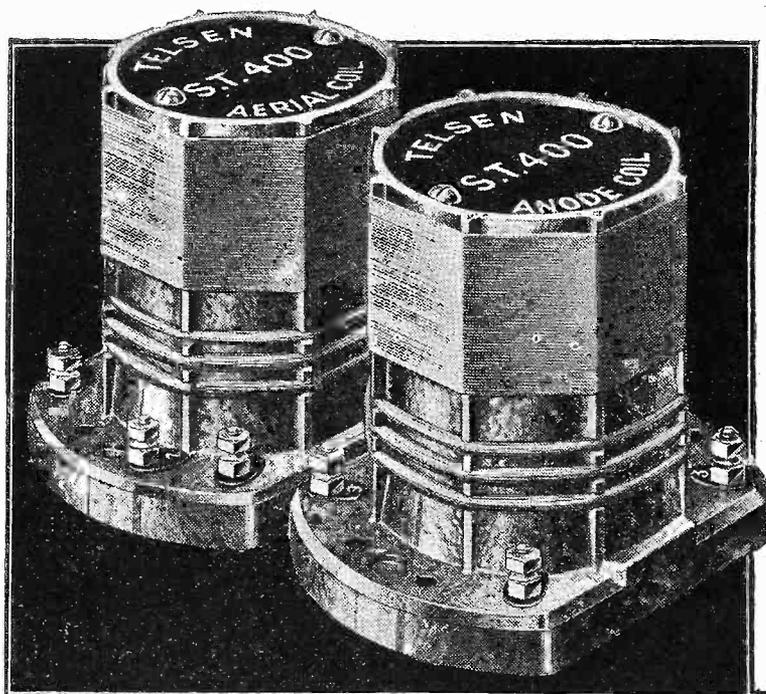
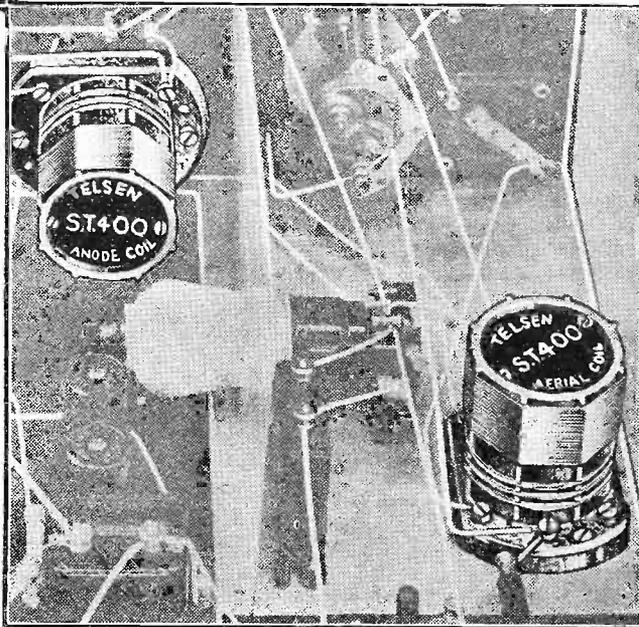


Illustration below shows the position occupied by the Telsen 'S.T. 400' Coils in a built-up 'S.T. 500' Receiver.

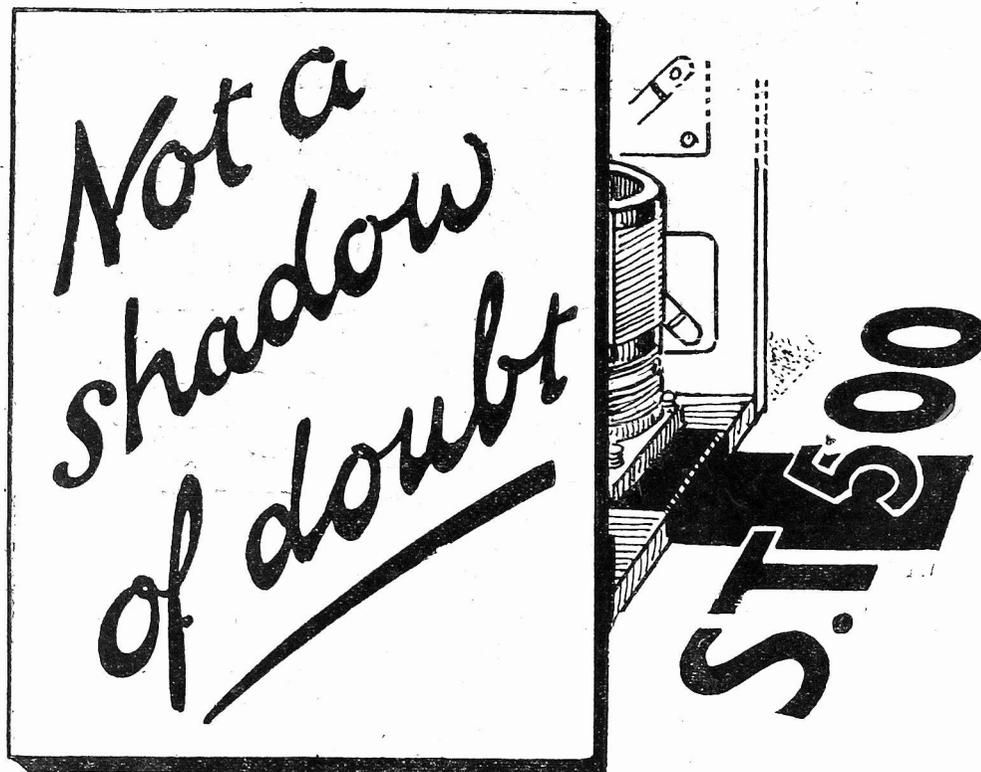
RECOMMENDED for use in the S.T. 500 by Mr. John Scott-Taggart, the Telsen S.T. 400 Coils have been specially designed for their purpose, to ensure immaculate performance with enduring efficiency. The Aerial Coil consists of plain long and medium wave windings connected in series, with a separate reaction 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/-**



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The whole success of your receiver depends upon the components that you use in it. For the "S.T.300," the "S.T.400," and now again for the "S.T.500," Mr. Scott-Taggart has selected Colvern Coils because every pair of coils that is despatched from our works is thoroughly tested and guaranteed to be identical with those used in the original receiver.

REMEMBER, COLVERN SPECIALISE IN COILS

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ECKERSLEY EXPLAINS-



This week our Radio Consultant-in-Chief describes the vexed theory of side-bands in a new way. At the same time he explains that in spite of numerous suggestions made to the contrary, "side-bands are not mathematical fictions."

I HAVE just been looking at a table concerned with the constants of coils. I read, in a corner I had so far neglected: "For lower B.B.C. wavelengths coil-price—For Daventry and Radiola coil-price—" I wondered why, and then I saw the heading "Coils for Trap Circuits"—and many pieces of my technical past came back to me.

Looking Back.

The Navy Rejector, an experiment in which a fixed-wave receiver had twenty circuits and ten valves (R. valves) in cascade; a circuit so "sharp" that Morse signals "rang" because of persistence of oscillation. And all the old stuff of selectivity—a publication in about 1926 by the Westinghouse people of America saying that "by a new principle" they could work stations 1,500 cycles apart. Then Dr. Robinson and his stenode.

All sorts and conditions of people defying, with magnificent courage, the fundamental laws of physics. The people who invent television circuits to work "on a single frequency," the people who make "knife-edge" selectivity, the people— It's tiring, as one gets older, to see the same old stuff trotted out again and again and again.

Producing New Frequencies.

Everyone must know by now, surely, that if you modulate the intensity of one frequency so many times a second you produce new frequencies. I mean, if you have a carrier-wave which is caused by

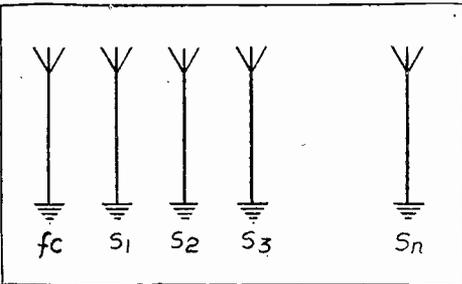
setting up alternating currents in an aerial of frequency (say) one million, and you increase and decrease the intensity of those currents one thousand times a second, you produce two new frequencies in addition to the old.

Two Side-Bands.

You have, in fact, additional to the original carrier-wave of one million, a million plus one thousand and a million minus one thousand. The two new frequencies (a million plus and a million minus) are called side-bands. This you all know.

Perhaps what may astonish you is to know that side-bands are not mathematical fictions.

FOR SECRET TELEPHONY



This diagram is used by P. P. Eckersley to explain the principles of secret telephony transmissions.

I would like to explain this side-band theory in a new way. I have said that modulation produces new frequencies. If I am right, then you could not tell the difference between a system in which, as to-day, a carrier-wave was modulated 1,000 times a second, say, and a system in which the transmitter consisted of two transmitters, one making a carrier-wave and the other making the side-band!

Carrying this a step further, suppose we had a broadcasting station which had not one transmitter but several hundred transmitters, one for creating the carrier-wave and all the others for creating the side-bands.

For instance, choose a carrier wavelength of 300 metres or a frequency of 1,000 kilocycles. Now add the side-band transmitters. Add them like the notes of an organ or a piano. Take the octaves first. Start with middle C, a note of 256 cycles per second.

Well, the frequency of the carrier was 1,000,000, so middle C would be "created" as a note (after rectification in a receiver) by another wireless transmitter, quite separate from the carrier-wave transmitter, working on a frequency of either 1,000,256 cycles per second or 999,744 cycles per second.

A "Radio Organ."

By adding twice as many wireless stations to the original carrier-wave station as there are notes on the piano or organ, you start with a rather amusing wireless piano or organ. True, it is very costly, and no one would ever be so silly as to use such an arrangement.

I drag up the whole subject to show you that, in theory, and (provided you were clever in various subtle ways) in practice, too, it would be impossible to tell the difference between a station which radiated side-bands from separate transmitters and one which had its side-bands created by the ordinary processes of modulation. Side-bands are exactly the same as new station's radiations heterodyning with a carrier-wave.

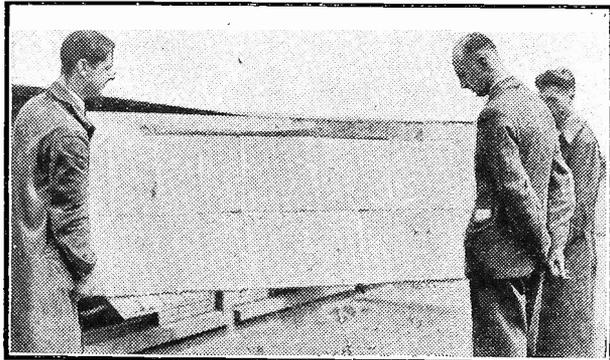
There is another interesting thing. If you set up all those hundreds of different radiators or transmitters, each differing a little audible amount in frequency, you could try the experiment of changing the carrier-wave frequency from one end of the spectrum to the other.

Easily Explained.

Look at the diagram: f_c represents the carrier-wave, S_1 , S_2 and S_3 the side-bands (we are only using one set). S_n is the highest frequency audible, say 10,000, added to f_c , the carrier-wave frequency.

You could take f_c and shove it round outside S_n , when all the noises become inverted, always provided the man (who switches on the transmitters according to what were the right notes when f_c was next to S_1) goes on with this technique.

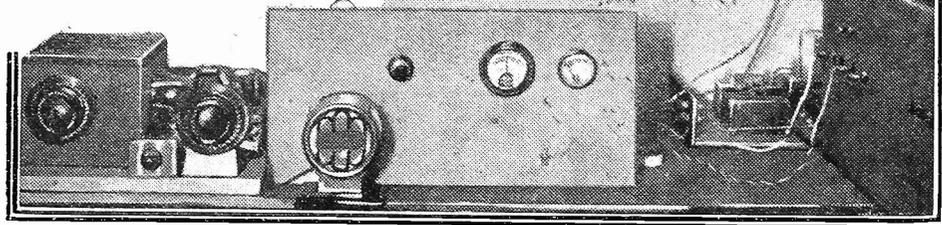
This is the principle of "secret" telephony, but "what one fool can do another can." I have tried to make the side-band theory clear. I hope I have succeeded.



EIGHT FEET OF BLUEPRINT

This tremendous blueprint, which is over eight feet long, is completely taken up with one circuit diagram. It is a small part only of a new Automatic Telephone Exchange, the complete circuit occupying a space many times larger. How would you like the job of wiring it up?

Short-Wave Notes *By* W.L.S.



MY recent remark that I have discarded "super-regens" for five-metre work (or for anything else) has prompted "K. H. S." (Ross-on-Wye) to write to me. He points out that the circuit using a separate regenerator (like my own 5-metre receiver) can be "switched" with the greatest of ease to cut out the super-stage. He uses a detector-and-L.F. receiver with a separate super-valve which can be switched in and out at will.

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It always strikes me that if one wants to increase the strength of a weak, clear signal, the cleanest way to do it is to add an L.F. stage. The super will work wonders with it, but, as "K. H. S." says, it's no good when there is interference about. (Query: Does anyone remember a time when there wasn't?)

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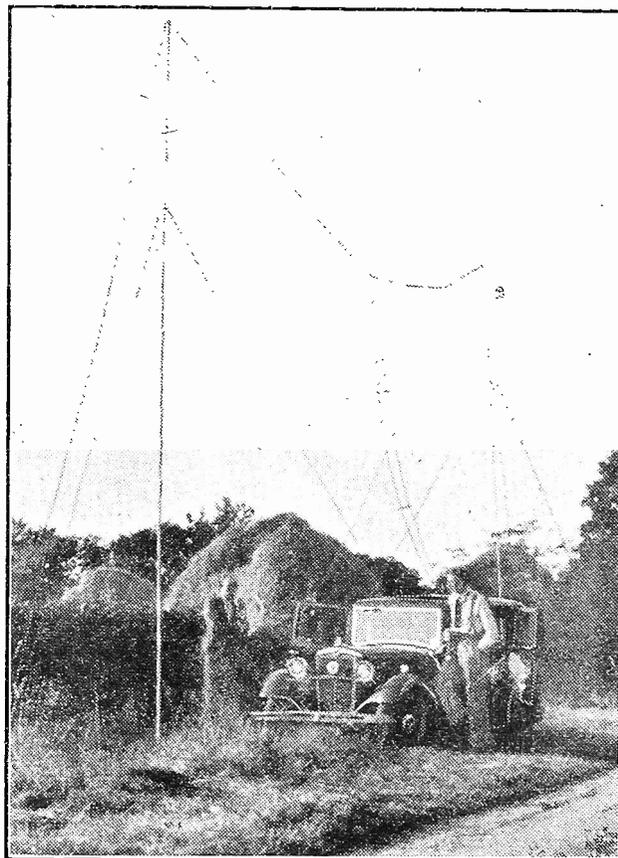
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A PORTABLE FIVE-METRE STATION



This is Portable Experimental Station G5FK. The impressive-looking masts and aerial weigh only a few pounds, and when dismantled form a bundle but five feet in length. Note the twin leader line leading down to the car.

you can find a silent space between the three different dial settings.

I listened to DJ B when I had read this letter, and happened to find the very thing, exactly as "T. C." describes it. I have heard funny transmissions, but this is unique. The queerest part of it is that the main carrier is perfectly constant, while the two subsidiary ones are doing a kind of St. Vitus' dance. Explanations, guesses, hazards, etc., eagerly awaited.

Getting Ready for Winter

During a general rebuild of my station in readiness for winter activities I decided that it would be a good plan to make myself a really permanent receiver. I have such a habit of tinkering with receivers until they are mere ghosts of their original ideas that something of the sort had to be done.

Accordingly I took the trouble to accumulate just the parts that I wanted, and proceeded to make a real "commercial job" that will be so difficult to alter that it will simply have to be left alone. And now I have the consolation that whatever circuit I am playing with my receiver will still be ready for action at a moment's notice. (Or will it? Where *did* I put that accumulator? And, there's no grid bias! And so on.)

Two Valves Only

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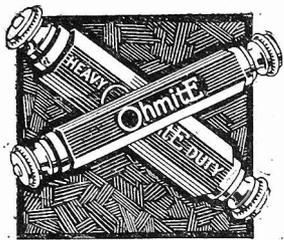
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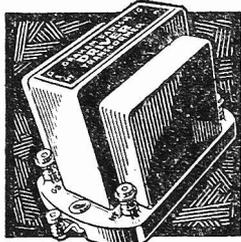
(Continued on page 383.)



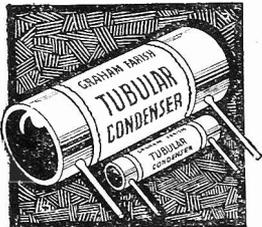
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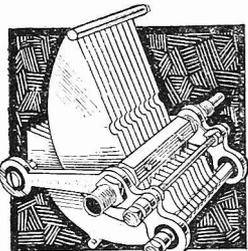
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3 watts 2/3



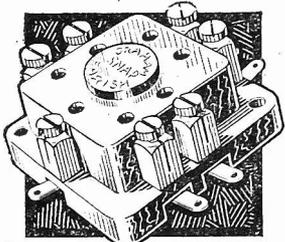
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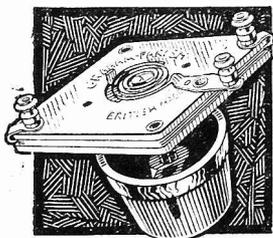
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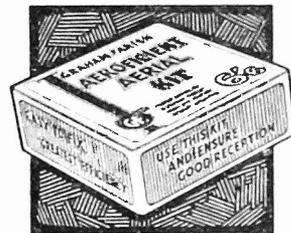
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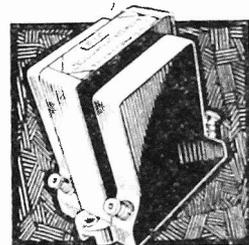
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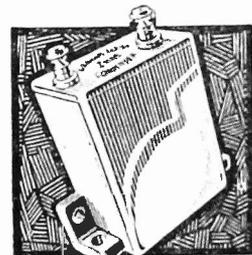
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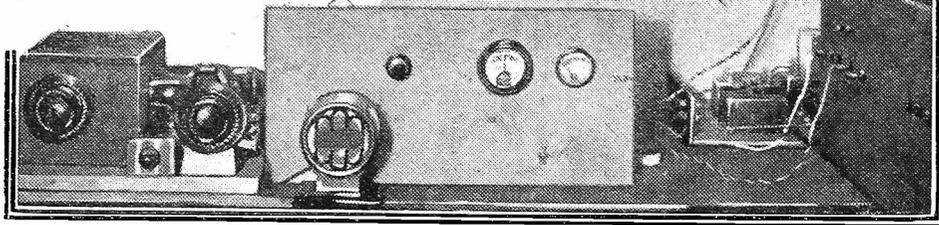
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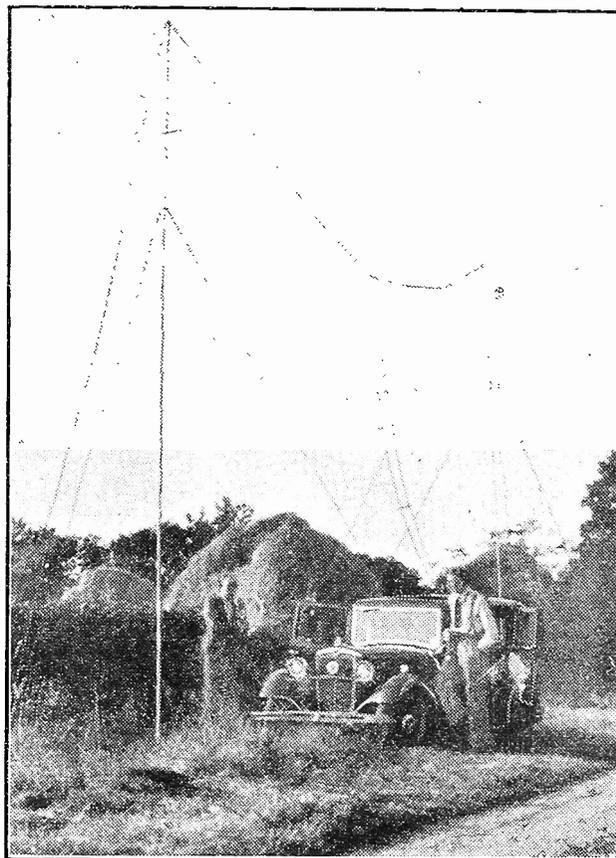
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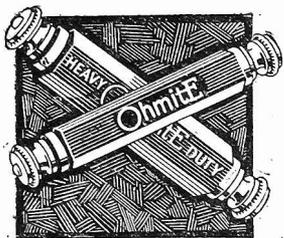
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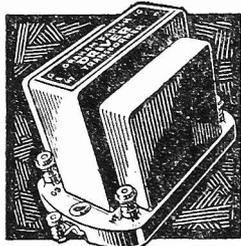
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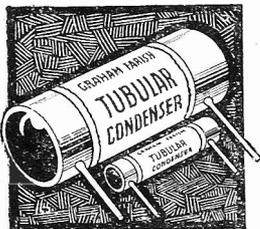
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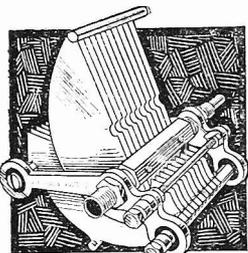
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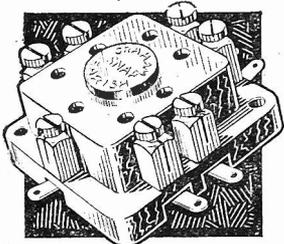
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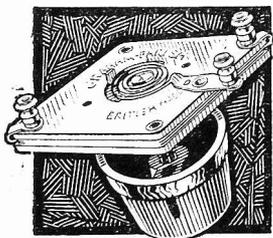
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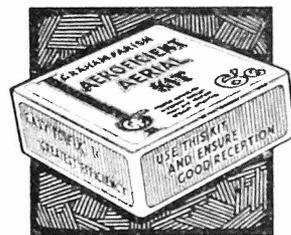
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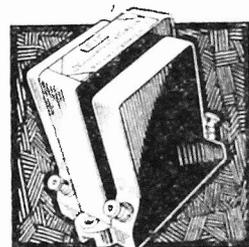
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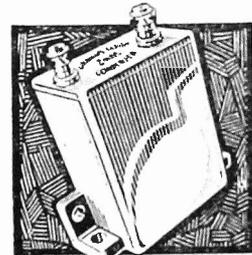
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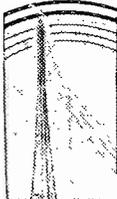
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STATIONS WORTH HEARING

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 improvement in all-round field strength that is now observable helps to show how necessary it is for the Lucerne Plan, however it may be modified in the meantime, to come into operation at the earliest possible moment.

During the summer naturally little is heard of the smaller and more distant stations. Hence, even if they are working off their wavelength, as is so often the case, they are responsible for little, if any, heterodyne interference.

As the days draw in these small, far-away stations are more and more strongly heard, and unpleasant whistles begin to make their appearance in portions of both the long and the medium wavebands that were previously clear of them.

Spoilt by Heterodynes.

Though the number of stations that can be received without interference is large, there are now far too many whose transmissions are spoilt by heterodynes. The trouble is largely due to stations which have no conscience in the matter of altering their wavelength from night to night as they may think fit and to broadcasting pirates. The latter are unauthorised stations which have no right whatever to be in operation. The average number at work on the broadcast band is from a dozen to a score.

Under the Lucerne Plan each country is pledged to allow only authorised stations to operate and to see that they keep very closely to their authorised wavelengths. Whether such an ideal state of affairs can ever be realised time alone can show; but there is no question that if the countries of Europe will abide loyally by the provisions of the Plan a very great improvement must result.

The Swiss station, Monte Ceneri, is at work again on almost exactly the same wavelength as Kalundborg. This causes a good deal of interference with the Danish station, and there seems to be no excuse, since Switzerland will have no long wavelength under the Lucerne Plan and Monte Ceneri will actually be working on 257.1 metres.

A Change Round.

The interference with Huizen that readers must have noticed is caused by a Roumanian station, Brasov, which is trying out a new plant that will come into use shortly. The Lucerne allotment gives the wavelength of 1,875 metres to Brasov, Huizen being down to share 1,345 metres with a Russian station.

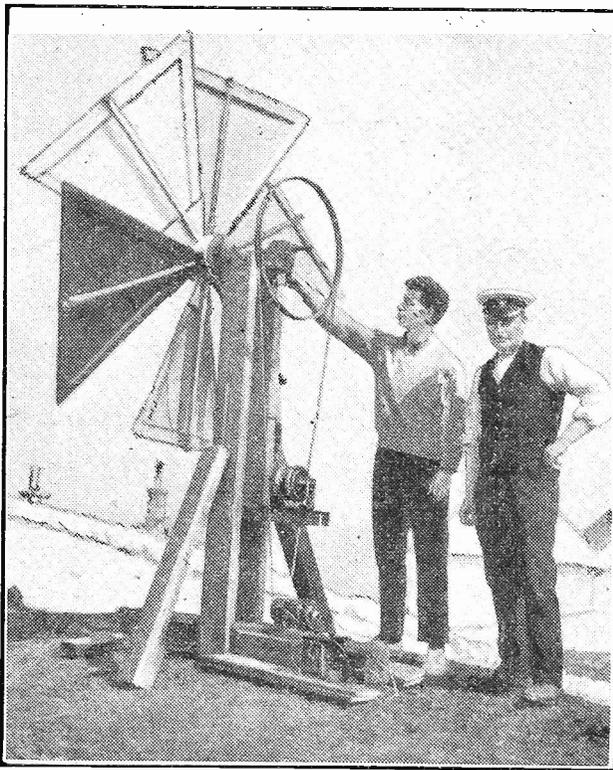
The French Regional scheme is making good headway, and already four super-power stations are nearing completion. These are Nice, Lyons, Toulouse P T T and Paris P T T. Nice will be a 60-kw. station, but the other three will have ratings running into three figures. Work will shortly begin on three other Regional stations, Rennes, Marseilles and Lille.

Remembering how well we now hear Toulouse Midi with an output of but 8 kw., you will realise that we may expect something rather extraordinary from the 120-kw. Toulouse P T T with a power fifteen times as great. And if a 10-kw. Fécamp already gives the loudspeaker full scope, what about the 100-kw. Rennes or the 60-kw. Lille, whose distance will be still shorter?

We shall hear little of Stuttgart (Mühlacker) between now and the middle of January, for the big station is being closed down during the rebuilding of the aerial masts, and the bulk of the work is being undertaken by the old 1.5-kw. Stuttgart transmitter.

The new Mühlacker aerial will take the

CHARGING WITH A WINDMILL



Two lighthouse keepers at St. Abb's Head, Berwickshire, have rigged up this accumulator charger with the aid of a bicycle wheel and car dynamo. Power is, of course, obtained from the wind by the triangular vanes.

form of a single lattice tower over 600 ft. in height. This will not be the world's tallest wireless aerial, for the tower of W L W, at Cincinnati, Ohio, which is now nearing completion, will be nearly 800 ft. in height when it is finished and the masts of the new longwave station at Droitwich will be over 700 ft. high.

Short-Wave Radio Link.

Europe's most northerly broadcasting station will be in operation before very long. This is Vadsoe. If you look at the map you will find Vadsoe in the very north of Norway, quite close to the Russian

frontier. The station is to have an output power of 10 kw. and is to relay the Oslo programmes.

Since it is more than 1,200 miles from Oslo, the telephone lines cannot be used for the purpose, and the link between the relay and the parent station will be made by a directional short-wave wireless transmitter. This is, I believe, the first time that short-wave transmissions have been used for the regular relaying of programmes by a medium-wave station.

Those Atmospherics.

Reception conditions during the latter part of September were rather spoilt by the prevalence of atmospherics, but there has since been a considerable improvement in this respect. Atmospherics are not at all unusual just at the "turn" of the year, and they were to be expected this autumn when unsettled weather conditions followed the long, dry summer.

When the Roumanian station already mentioned is not at work Huizen's transmissions are excellently received on the long waves. Radio-Paris is, as ever, a fine provider of programmes, but Zeesen has "off" nights every now and then. These

will probably cease to exist when the new transmitter, with its special aerial, is built. Warsaw is coming in very strongly, but occasionally a heterodyne is noticeable. Even the giant Luxembourg suffered on one recent evening from this kind of interference. Oslo is now good both in daylight and after dark.

The stations at the top of the medium waveband have now come back to splendid form. Budapest can be relied upon for good loudspeaker reception, and Munich is almost as good. Vienna is well heard, and reception will be still better when the second aerial mast is completed.

A Good Selection.

Brussels No. 1, Florence, Prague and Langenberg are a fine quartet which never disappoint the listener. There has been a good deal of jamming on the waveband immediately below Langenberg, but Lyons Doua and Beromünster are well heard when not interfered with.

Rome is always good, but Stockholm is showing curious variations, being very strong

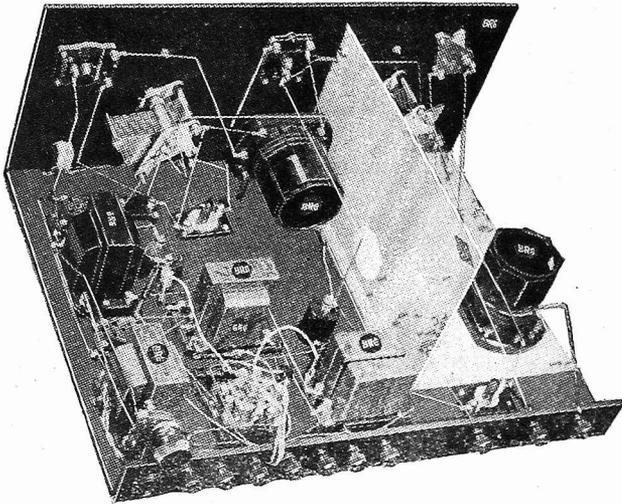
on some days and barely audible on others. Belgrade is equally fickle, but always worth trying for, since, if it is coming in well, excellent entertainment is assured.

Little or nothing is now heard of the Spanish stations, but these should improve considerably within the next few weeks. In Portugal the new Lisbon station—a 20-kilowatt working on 282.2 metres—will probably come into action very soon now.

Katowice, Toulouse Midi and Leipzig should never be missed, and Strasbourg is generally as good a transmission as one could wish for.

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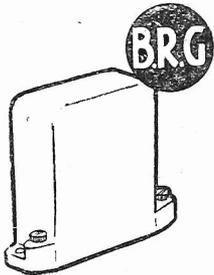
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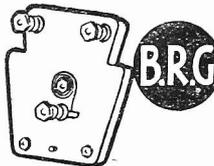
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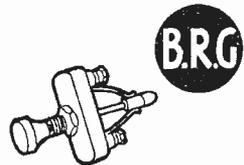
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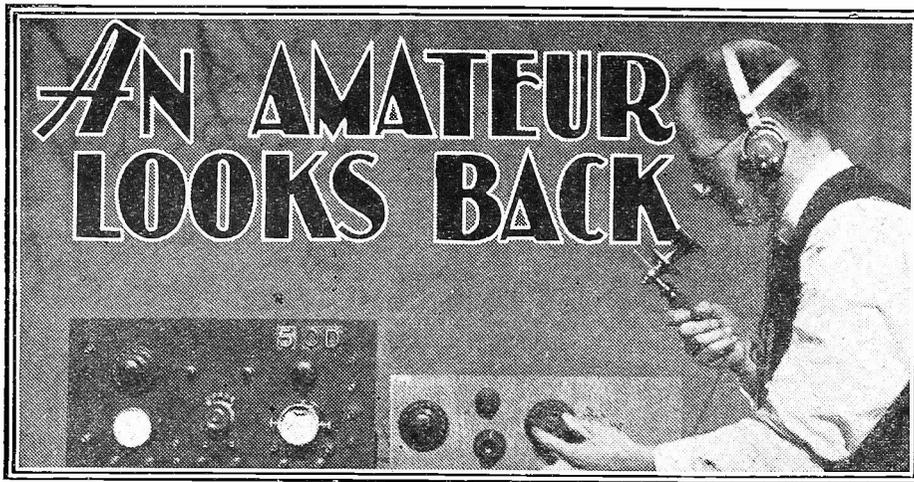
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THE following is in the form of notes taken from my log book, and may prove of interest to some readers.

On referring to my log I find that it was in November, 1920, when I first took up wireless as a hobby. It very soon took a grip of me, and with the aid of a friend I erected an aerial 30 feet high, one end fastened to a poplar tree (which, years later, when I took up short-wave work, I found very troublesome during stormy weather). The antenna was 60 feet long, and the lead-in was passed through a window of a boxroom. This room was known as my wireless den, and was so precious to me that I kept it locked up.

It soon became arrayed with maps showing all the wireless stations then operating. These were practically all coast stations using Morse code for working with ships at sea. At this time there was neither voice nor music on the air, so I settled down to master the Morse code.

Crystal and 'Phones.

I built a crystal receiver which comprised a long cardboard tube wound with enamelled wire, and a sliding contact running up and down the tube varied the wavelength. A home-made crystal detector and a pair of headphones, and I was all ready for testing out the apparatus.

It was a really exciting time, as I had never heard a wireless signal. The headphones were put on and slowly moving the slider on the big coil up and down, I listened very carefully for any signal.

I had only been listening about half an hour when I heard my first signal. The call sign was G C C, and proved to be the Admiralty land station, Cullercoats, working on a wavelength of 600 metres.

It was nearly an hour before I heard another signal; this also was an Admiralty station, B Y B, at Cleethorpes, using a wavelength of 3,000 metres.

One of the next stations to be picked up was F L, Paris, on 2,500 metres; as the aerial was slung from the top of the Eiffel Tower, this was an appropriate call sign.

Early D.X. Reception.

I had begun to pick up fragments of messages and was anxious to do some long-distance work, and on consulting the schedule of regular transmissions I found that a spark station, B Y Z, Rinella, in the Mediterranean, was on the air every evening at 9 o'clock on 2,700 metres.

I commenced listening just before the appointed time, and was fortunate enough

at the first attempt to intercept the transmission. In those days this was considered quite good as signals were only just audible in the 'phones. All this happened in 1920 and early 1921, and may not sound very exciting, but to me and two or three other enthusiasts in Lincoln it was exciting to hear a signal at all, as one might listen

Great though the thrills of distant reception can be under modern conditions, they hardly compare with the excitement that a few letters in the Morse code held for enthusiasts of ten or twelve years ago. The experiences of listeners in early days are well illustrated in these notes, written around entries from an amateur's log.

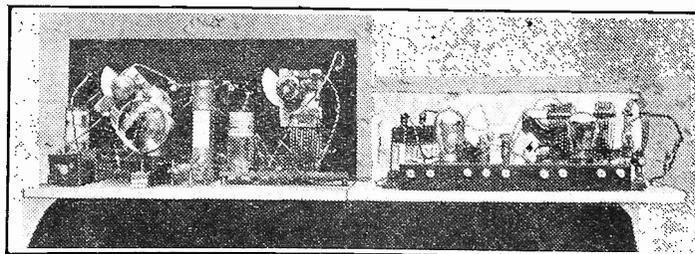
By RALPH BATES

on a crystal set for an hour and not hear a transmission.

In May, 1921, my first one-valve receiver was completed, and I soon made good progress with the Morse code as I was able to pick up ten times as many stations.

A station operating at Vossegat in Holland with the call sign B E, on 1,000 metres,

THE PRINCIPLE APPARATUS OF 50 D



A behind-the-panel view of short-wave transmitting and receiving apparatus that proved very successful in the hands of the author of the article on this page. A front view of the same gear is seen in the heading photograph.

used to transmit a weather report in Dutch at 7.40 every evening very slowly, and repeat the report much faster. I was able to copy the slow transmission, and to this station I owe my thanks for teaching me the Morse code.

I heard the first voice on the radio in November, 1921, from the aircraft station at Croydon on 900 metres.

Then came P C G G, the Hague in Holland, that pioneer of broadcasting music,

etc., on 1,000 metres. He was just nicely audible on the 'phones on one valve, and I have sat for hours listening in my den in the winter months with very cold feet.

A Pioneer Transmitter.

One of the first amateur transmitters I heard was our old friend Burbury of Yorkshire using the call sign 2 A W. The wavelength used at that time was 1,000 metres, and one favourite item sent out by this station was a gramophone record "I'm forever Blowing Bubbles."

Then 2 M T, Writtle, commenced to give weekly broadcasts for half an hour every Tuesday evening on 700 metres. The programmes were unique and I do not think I missed one. Captain Eckersley, late of the B.B.C., was in charge of this station, and his cheery voice would announce "two cinnamom calling." He was engineer, programme director, etc., as well as an artiste on many occasions.

British Broadcasting Commences.

In November of 1922, British Broadcasting commenced from the transmitters 2 L O London and 5 I T Birmingham. Christmas Eve of the same year I was sitting up rather late and was searching for anything I could find and was fortunate enough to pick up the American station W G Y about 1.15 a.m. on 326 metres, using a three-valve set. The reception was quite good on the headphones.

January, 1923, wireless became more interesting, as I was fortunate enough to obtain a transmitting licence.

I should mention that I was allotted the call sign 5 O D, and was allowed to work on 440 metres and also a choice of the waveband 180 to 200 metres. Scores of other amateur transmitters were picked up from all parts of the country, and many times I tried to make contact but failed. However, I had my first thrill with the transmitter on Sunday morning, June 17th, 1923, about noon.

Establishing Two-Way Contact.

I picked up an amateur in Grimsby, 2 Q H, on 440 metres, and as usual, replied in Morse. Then I listened, and was more than surprised to hear him answering my

call. We kept up communication for about half an hour, his last message being "my batteries are running down."

The 600-metre waveband always afforded good practice in the Morse code and was full of interest.

S.O.S.!

On July 30th, 1923, it was close upon midnight when I

went to bed, and I had a sudden fancy to hear if anything was going on in the shipping world, so went to my den, as I thought, for a few minutes, just before turning in. I slipped on the headphones and tuned in to 600 metres. I looked at the clock and noticed that it was five minutes past midnight. I had only been listening for five minutes when I had one of the biggest thrills of my experience.

(Continued on page 374.)



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PRECISION INSTRUMENTS



Describing how a "cut-out" for a loudspeaker diaphragm may be made with a minimum of calculation.

By T. B. SANDERS.

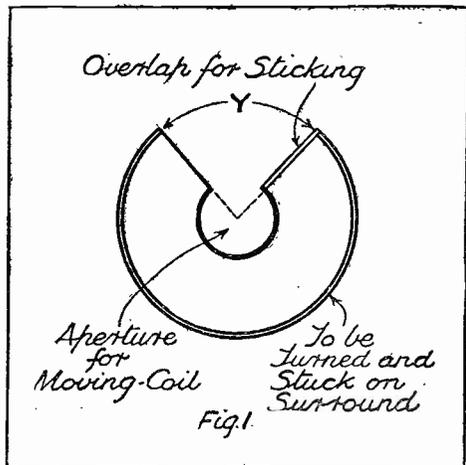
THE many experimenters who have had the misfortune to damage the diaphragm of a moving-coil loudspeaker will readily agree that, at first sight, it seems a very simple matter to effect a repair.

All that needs to be done is to make a new cone, stick the moving coil on and mount a new surround. Of course, all this requires care in manipulation, but not more than the average constructor customarily bestows on the assembly of apparatus.

Deciding the Size.

The "snag" arises when deciding what the size of the new cone has to be. It is not generally possible to use the old cone as a pattern, as it invariably becomes too damaged when removing it from the surround and taking from it the moving-coil.

ACCURACY WITHOUT—



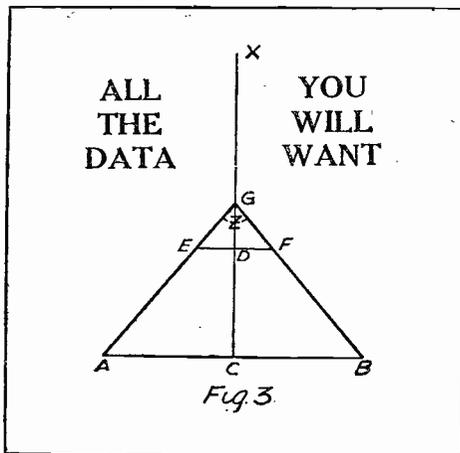
Everyone knows that to make a cone you have first of all to cut a shape like that shown in Fig. 1. It is, however, not such an easy matter to determine what dimensions this shape should have so that it forms a cone which will exactly replace the original one.

Fig. 2 is a diagrammatic representation of the invariable arrangement of a moving-coil and its associated cone diaphragm. Some of the leading dimensions of this can very easily be made with an ordinary ruler. The distance A B, for instance.

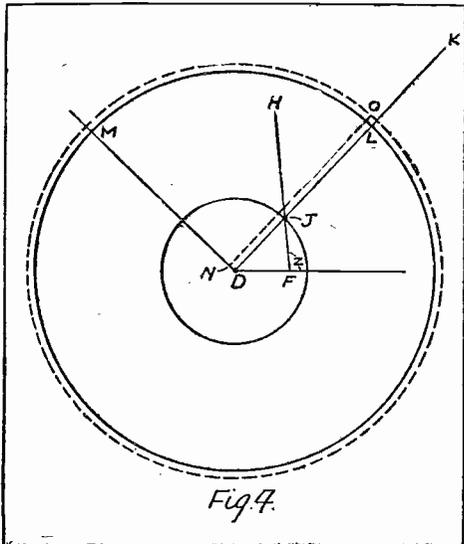
Start, then, by drawing a line on a piece

of paper the same length as A B, as in Fig. 3. Then bisect it and draw a line at right angles (C X.)

Another simple measurement to make is from the face of the moving-coil to straight out to the "face" of the cone. This may



In conjunction with the few simple rules in the accompanying article, these four diagrams provide all the data required to make an accurately fitting diaphragm for a moving-coil loudspeaker.



be done by clamping a sheet of paper in the surround-clamping ring and poking a piece of straight wire through. The measurement is C D (Fig. 2 and Fig. 3).

Even more easy is the measurement E F, since this is merely the outside diameter of the moving-coil former. On your guide drawing set it off as shown in Fig. 3.

Now join A to E, continuing to cut C X, and join B to F, continuing to cut C X, which gives the point G and the angle Z, which may be measured with a celluloid protractor.

This is the "angle" of your cone, and a most important quantity. You have also got the measurement A E or B F of the cone side, which is also useful to know. With these discoveries you can proceed with the cutting of the shape of Fig. 1 with every confidence.

How It is Done.

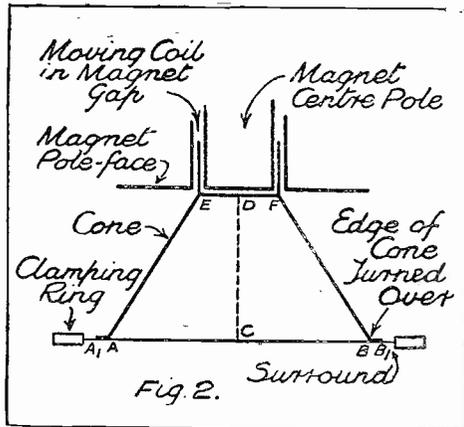
On the material of which the cone is to be made draw a line and set off on it the distance D F of Fig. 3 (the radius of the coil former) as in Fig. 4. At F draw the line F H so that the angle Z is the angle of your cone (Z in Fig. 3). At J a point is marked so that F J equals D F, then extend D through J to K, and with D as centre draw a circle whose circumference goes through J.

Now from J set off along the line D J K the distance A E or B F of Fig. 3 at L. With D as centre again draw another circle whose circumference this time goes through L.

You will now have two concentric circles, the smaller of which is the aperture for the moving coil and the larger the circumference of the cone. It remains to find what angle of paper has to be removed (Y of Fig. 1) to form the cone.

First of all, multiply the distance D F (Fig. 4) by 360, and divide the result by the measurement D J (also Fig. 4). Then subtract the answer from 360, and you have

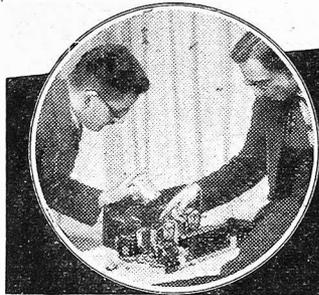
—DIFFICULT CALCULATION



the angle Y of Fig. 1, which may now be set off on Fig. 4 to make the angle M D L.

Before, however, you cut out this angle draw parallel to D L the line N O (Fig. 4) to form the overlap for sticking the cone. You will also want a piece on the edge of the cone to turn over (A A₁ and B B₁ on Fig. 2) to stick on the surround. The dotted circle on Fig. 4 shows this.

All that remains to complete the repair is to stick the cone, mount the moving coil and centring device and assemble on the surround—all of which is well within the scope of most experimenters' ability.



RADIO STEP-BY-STEP

OUR SPECIAL
SUPPLEMENT for
BEGINNERS

THE first thing that must be realised is that wireless waves have nothing to do with air. It is true that radio artistes are often said to be "on the air," but this is a misleading Americanism.

If wireless communication depended upon the existence of air it would frequently fail. How, for example, could a radio set, shut in an air-tight room, tune in the London stations if air were essential? And that has been done.

Not Always Convincing.

We mention this because the old argument that you can still receive a programme on a portable set, even though the windows of the room are shut, does not seem always to prove convincing with some beginners earnestly attempting to ferret out the whys and wherefores of wireless.

And, after all, it is sound criticism to say that air seeps through to everywhere a radio set is commonly used!

Nevertheless, as we have said, it has been scientifically proved that the total absence of air constitutes no deterrent to the wireless wave.

How, then, does it manage to exist?

A Simple Theory.

Well, there is a fairly simple theory, and this presupposes that the whole of space, including even the space between the particles of atoms, is pervaded by a substance known as ether. (Not the medical variety!)

This ether is supposed to be thinner than the thinnest gas. Water can soak through many substances. But air is thinner than water and can soak through numerous substances that are "water tight."



When an announcer speaks into a microphone he causes waves to be sent out in all directions—

The ether is said to be so "thin" that it can soak through anything, even such things as glass, steel, rock and so on,

universe floating deep down in a sea of this wonderful stuff. As you walk along the street or flash along the roads in a fast-

WHAT ARE WIRELESS WAVES?

as though they were mere sponges.

But it must also be so stiff that it can be vibrated.

The ether theory is by no means universally accepted. Another theory is that wireless waves (and also light and heat waves) consist of series of particles shot off from the transmitter like bursts of machine-gun bullets.

Yet another theory maintains that the whole of space is filled with fields of electrical energy, and that light and wireless waves are superimposed on this.

But this is really only another and perhaps more logical conception of the ether.

Undoubtedly, for purposes of explanation, the ether theory is the best. Providing you can overlook its somewhat fantastic properties—i.e. that it soaks through everything, all gases, fluids and solids, and yet has sufficient "body" to maintain waves—it is a perfect foundation on which to build your ideas.

Therefore we plump for the ether. Think, then, of the whole

moving vehicle you disturb the air.

But the ether remains unmoved by such activities. You are so porous to this thin stuff, and your movements are so relatively slow, that there is no more effect than there would be if you very, very slowly moved a very wide-meshed sieve through water. (You are the sieve; the ether is the water!)

However, if a sudden shock is inflicted on the ether it causes a vibration to ripple through it.

The broadcasting station creates a continuous series of shocks in the ether while it is working.

The central point is the disturbance which creates the vibration.

But to understand what a wave is we must revert to the water simile.

A wave in the sea is not a rolling forward of the whole surface of the sea. Although it may look to the observer as though a wave is a piled-up mass of water tearing along over the ocean, actually what happens is similar to the shake of a stretched rope which causes a loop of rope to ripple along.

An Explanation.

But the loop arriving at the far end is composed of different rope from the loop that starts the motion, isn't it?

Let us examine a wave in detail.

Supposing a stone is dropped into a pool of water (Fig. 2). The stone depresses the water at the point where it hits it, and that makes the water all round lump up.

When this lumping up subsides (in a fraction of a second) an effect known as inertia causes it to act like the stone itself did and depress the surface.

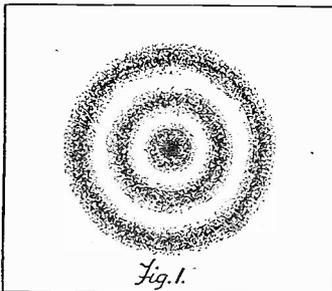
Gradually Reduced.

That creates a new lumping up a bit farther out, and the operation is repeated. But each successive lumping up and depression is smaller than the last, because the effect is spread out over an increasingly larger area.

That, to leap ahead a bit, is the reason why a broadcasting station's waves get weaker the farther you are away from it!

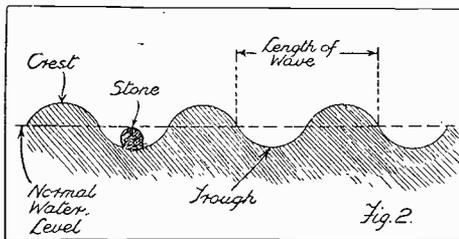
There are other reasons why in certain circumstances a station is heard better (or worse) than one's distance from it might at first presuppose and we shall deal with them in due course.

ETHER VIBRATIONS



For purposes of explanation this diagram may be assumed to represent a cross section of the ether.

A WATER ANALOGY

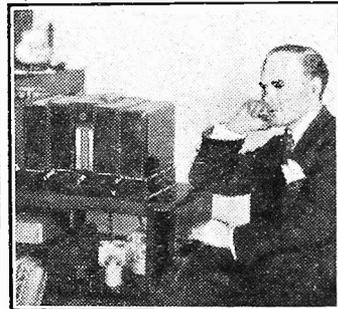


When a stone is dropped into the water it depresses the water at the point where it hits it, and that makes the water lump up.

The vibrations adopt a wave motion. That is to say, they can be compared with water waves in some ways, although it must be remembered that,

while waves on a sea or lake occur on the surface, waves in the ether start from a central point and extend in every direction.

If you can visualise Fig. 1 as the cross section of the ether you should be able to get the idea easily enough.



—These waves, develop electrical energy in the listeners' aerial which is passed through the set and is reproduced as sound waves by the loudspeaker.

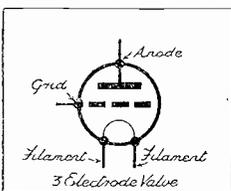
Special Beginners' Supplement—Page 2.

THERE is no need to be confused by the wide variety of valve types if you bear in mind that, with a few exceptions, all valves are either amplifiers or rectifiers.

The best method of recognising the various types is to consider the work they are called upon to perform rather than to endeavour to remember the letters and numerals by which the different valves are identified in a maker's list.

Every set needs a detector to rectify or detect the received impulses.

DET. OR L.F.



This symbol is the theoretical representation of an ordinary three-electrode battery valve.

In fact, the detector is the basis of any receiving circuit because unless there is some means of separating the

speech or music from the broadcast carrier-wave nothing at all will be heard in the loudspeaker.

Generally, the type of valve chosen for this important duty is one of the ordinary three-electrode variety.

These three-electrodes consist of a filament, grid and anode in the battery type and a cathode (with its heater), grid and anode in the indirectly-heated mains version. The battery valve has four pins and the mains type five pins.

Practically any three-electrode valve will work satisfactorily as a detector, but some are better than others and for this reason the valve makers usually list special types for this particular work. Much depends upon the design of the circuit, but it is safe to say that any valve of the "H.L." variety will make an efficient detector.

General-Purpose Duties.

The letters "H.L." indicate the suitability of the particular type for general-purpose duties, and it happens that the characteristics of this class of valve are just right for effective detection. In addition to its work of detecting, the three-electrode valve also amplifies, thus combining two functions simultaneously.

There is a special kind of valve detector known as the diode (two-electrode valve) which does not amplify, but since the diode is



The Class B valve is unlike the other battery types in that it has seven pins. This is because it is really two valves in one bulb



not in common use we shall not deal with it at this stage.

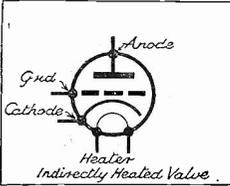
Certain types of valves are intended for use purely as amplifiers. For instance, the range of a receiver is dependent upon its ability to magnify the very weak impulses picked up by the aerial. The transmissions from broadcasting stations hundreds of miles away require considerable amplification before they become worth while from the entertainment standpoint.

Distant Reception.

A set designed for long-distance reception is provided with high-frequency amplification; that is to say, it has a valve (or valves) whose sole purpose it is to magnify the received broadcasting in its raw state, prior to detection.

The valve generally used for high-frequency amplification is the screened-grid (S.G.) valve, and it has four electrodes, viz., a filament, grid, screening grid, and anode. In the indirectly-heated mains type the

A.C. OR D.C.



Mains valves of the indirectly heated type can be recognised by the extra electrode, called the cathode.

filament is replaced by a cathode and heater.

The S.G. valve is a very efficient device, and when used in a properly designed circuit it is capable of magnifying the minute currents picked up by the aerial to many times their original strength.

The screening grid and anode are both joined to the positive side of the high-tension supply, the anode terminal being located at the top of the glass bulb surrounding the valve elements.

A Great Advance.

The screening grid is joined to the pin at the base of the valve, which in the three-electrode type goes to the anode.

The S.G. valve was brought out in 1926, and it may be truly said to have revolutionised H.F. amplification, for prior to the advent of the S.G. valve, any attempt to obtain really appreciable amplification before detection

was invariably accompanied by instability; thus the H.F. amplifier as we know it to-day was then quite impracticable.

But, the S.G. valve overcame this, and the secret of its success is the second grid, which we have previously referred to as the screening grid.

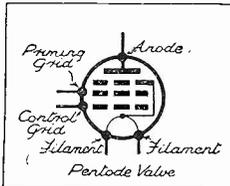
There are other types of valves which can also be used for H.F. amplification. For instance, there is the special H.F. pentode, but generally speaking, the S.G. valve is the type employed in the vast majority of present-day receivers.

There are two kinds of S.G. valves—namely, the standard S.G. and the Multi-mu.

Volume Control.

The multi-mu (or variable-mu) is externally identical with the standard S.G., but it is designed to be used in conjunction with a potentiometer arranged so that the negative bias applied to its grid can be varied within certain limits. The effect of this is to provide a very convenient and effective method of volume control, and the multi-mu S.G. amplifier has now attained a greater degree of popularity than the non-multi-mu version.

PENTODE



In a pentode there are three grids, one of these being connected internally to the filament.

Although primarily intended for H.F. amplification, the S.G. valve is sometimes employed as a detector, but its use in this sphere is chiefly confined to special circuits, such as those of the short-wave type.

The L.F. Side.

When the impulses picked up by the aerial have been amplified at high frequency and rectified, it is necessary to magnify them still further before they are sufficiently strong to work a loudspeaker.

This final process is called low-frequency amplification.

The number of low-frequency stages rarely exceeds two, and one is often adequate.

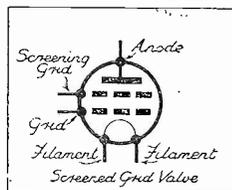
If there are two stages, the first valve in the low-frequency

chain will be of the three-electrode type, while the one which follows it, and which is known as the output valve, can be a power, super-power, pentode or Class B valve (depending upon the circuit).

In fact, there are a wide variety of valves designed for use in the output stage and space does not permit us to deal with them all at this juncture.

Power and super-power valves have three electrodes and derive their name from the fact that they have to supply power to the loudspeaker. They do not greatly increase the overall magnification of the set.

S.G. TYPE



The screen-grid valve has two grids, an anode and filament.

On the other hand the pentode is an excellent amplifier and is frequently used in single stage low-frequency amplifiers where the maximum volume is desired in return for a comparatively small input. A pentode has five electrodes (hence the name), three of which are grids. Three-electrode power valves and pentodes are obtainable in both battery and mains types.

A recent development is the Class B valve, an output valve specially designed for the battery user. The Class B valve is in reality two valves in one glass bulb. It requires a seven-pin valve holder, and has the advantage of extraordinary economy in H.T. current consumption combined with large output power.

Theoretical Symbols.

On this page there are four small sketches which represent four commonly used types of valves. When you next see a theoretical circuit in POPULAR WIRELESS you will have no difficulty in recognising the valves.

The bulb containing the electrodes (grid, filament, anode, etc.) is shown as a black circle. Inside this circle are the electrodes, the grid being represented by a row of dashes, the anode by a thick black line, the filament or heater by a thin semicircular line and the cathode by a thicker line just above the heater. With the help of black lines representing the external wiring in the set it is possible to show, not only the type of valve, but also the way it is joined in the circuit.

This is an ordinary battery three-electrode valve suitable for use with a 2-volt accumulator. Valves of this type are employed as detectors and low-frequency amplifiers.



The screen-grid valve has a terminal on the bulb as well as four pins in the battery type, or five pins in the mains version.



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1	PETO-SCOTT ebonite terminal strip (ready drilled)	9	
	PETO-SCOTT flex, screws, connecting wire	2	6
2	COLVERN S.T.500 coils	8	0
2	ORMOND type R.493 '0005-mfd. tuning condensers	15	0
3	GRAHAM FARISH "Litios" '0005-mfd. variable condensers	6	0
1	TELSEN type W.353 '0001-mfd. diff. reaction condenser	2	0
1	POLAR '0003-mfd. diff. reaction condenser	3	0
1	J.B. type 1088 B/B pre-set '0001-mfd. condenser	1	0
1	J.B. type 1087 B/B pre-set '0005-mfd. condenser	1	0
1	TELSEN Class B driver transformer, ratio 1-1	2	6
1	TELSEN Class B output choke	8	6
1	VARLEY "Nictet" L.F. transformer, 3-5 to 1	7	6
1	TELSEN type W.74 S.F. choke	3	6
2	BENJAMIN "Vibroholder" 4-pin valve holders	1	8
1	W.B. "Universal" 5-pin valve holder	1	0
1	GRAHAM FARISH 7-pin valve holder	1	3
1	LISSEN disc type LN.5092 H.F. choke	2	0
1	FERRANTI 1-meg. synthetic grid leak and holder	1	6
2	DUBILIER 1-watt metalised 5,000-ohm resistances	2	0
2	DUBILIER 1-watt metalised 10,000-ohm resistances	2	0
1	GRAHAM FARISH 250-ohms "Ohmite" resistance	1	6
1	IGRANIC 2-mfd. fixed condenser	3	0
1	T.C.C. 1-mfd. fixed condenser, type 50	2	6
1	DUBILIER type B.B. 1-mfd. fixed condenser	2	6
2	T.C.C. '005-mfd type 300 tubular condensers	2	6
1	GRAHAM FARISH '0005-mfd. tubular condenser	1	0
1	LISSEN '00005-mfd. mica condenser	6	
2	LISSEN type LN.5070 push-pull on-off switches	1	8
1	BULGIN S.80 toggle on-off switch	1	6
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BROADCAST receivers can be divided into two classes, viz. those which obtain their current from batteries and those designed for plugging into the mains and known as all-electric sets.

In some cases the high-tension current is derived from the mains, while the low-tension supply and grid bias are obtained from batteries. Receivers in this category are basically of the battery-operated type, and the mains high-tension supply could, if necessary, be replaced by a suitable battery.

Battery Sets.

In the case of the normal battery-operated set three different batteries are needed for supplying current to the valves and to maintain them in their proper operating conditions.

The filaments have to be heated up to a certain temperature before any electron emission can take place. Similarly, the anodes have to be maintained at a positive potential, otherwise the valves will not work at all.

Low-frequency amplifiers (not Class B valves) and screen-grid H.F. valves of the multi-tube type are among those valves requiring negative grid bias on their grids in order that efficient operation shall be achieved.

The Filament Current.

The filament current in a battery receiver is obtained from an accumulator, usually consisting of a single 2-volt cell. This is because the valves used in the vast majority of sets are of the 2-volt type. The accumu-



H.T. SUPPLY

H.T. batteries are composed of a large number of dry cells joined in series, the total voltage being that of one cell multiplied by the number of cells.

lator used for filament heating is called the low-tension or L.T. battery.

An accumulator requires regular charging, and given proper attention will provide trouble-free service for a very long time. When you go to buy an L.T. battery you will probably be asked what capacity you require.

This is because all accumulators have a definite rating of so many volts and so many ampere hours. All single accumulator cells give a voltage of two, irrespective of their ampere-hour capacity.

RADIO BATTERIES

If a battery of, say, 6 volts is needed for any particular purpose three cells are connected so that their respective voltages are added together.

But although each cell gives 2 volts, the amount of current it can supply is solely dependent upon its ampere-hour capacity.

Suppose, for example, the ampere-hour capacity is thirty. This means that it will, when fully charged, supply 1 ampere for thirty hours, 2 amperes for fifteen hours, and so on.

Similarly, a 60-ampere-hour cell would supply 1 ampere of current for sixty hours and 2 amperes for thirty hours.

Now a valve filament consumes current, hence the L.T. battery must have a sufficient ampere-hour capacity to supply the current for ALL the valves without having to be recharged too often.

That is why the dealer asks you what capacity you require.

You can figure this out for yourself or, alternatively, put yourself in the hands of the dealer, telling him the number and types of valves you are using in your set.

Suppose you have a three-valve receiver with, say, one screen-grid, a detector and a super-power valve. Suppose, also, you look up the valve maker's list and find that the S.G. valve takes .15 amp., the detector 1 amp. and the super-power valve .25 amp. The total filament consumption is 1.5 amp., and if you used the set for four hours a day your valves would consume 2 ampere hours (half an ampere multiplied by four).

Therefore a 30-ampere-hour accumulator would last for about fifteen days before it needed charging.

The liquid used in an L.T. battery is dilute sulphuric acid, and you must take care not to spill any of this acid upon the carpet or your clothes, because it will eat the material away unless you quickly neutralise its effects with ammonia or a strong soda solution.

FOR L.T.



A Block accumulator of the type used for L.T.

If you are wise you will find a reliable charging station and ask them to keep your battery regularly charged and topped up with water. At the end of this series you will no doubt be well equipped to carry out many of these maintenance jobs yourself.

Next we come to the high-tension battery. In most cases this is a dry-cell unit giving a maximum voltage of 108 or 120, and provided with tapplings for intermediate voltages. Those who use high-tension accumu-

lators are usually in a position to do their own charging or are fortunate in having available a regular charging and collection service.

The dry battery is by far the most common source of H.T. for the average battery-operated receiver. A dry-cell unit consists of a number of individual cells joined together in series (so that their respective voltages are added).

A dry cell is not really dry, because the active material in its construction is a paste of sal-ammoniac solution. The sketch shows one form of this type of cell. The case is of zinc, and inside this is a lining of sal-ammoniac paste. In the centre of the cell is a rod of carbon, and this is separated from the active material (the paste) by a layer of manganese dioxide. The top of the cell is filled in with pitch.

The cells used in high-tension batteries are quite small, and consequently the current that can be taken from them is also

small. But this is all that is required of them, because they are only called upon to supply a few milliamperes (a milliampere is one-thousandth of an ampere) to the anodes of the valves.

Nevertheless, H.T. batteries are made in different capacities, the super-capacity types having larger cells than the "standard" types.

It therefore behoves the beginner to see that his particular H.T. battery is the correct capacity for his set, otherwise he may overload the cells and so considerably shorten the life of the battery.

The Size to Use.

Three-valve sets with super-power or pentode valves need one of the larger batteries, and it is uneconomical to use the "standard" types. On the other hand, the smaller sizes will give excellent service with one- or two-valve sets.

It is all a matter of current consumption, and in the absence of experienced advice it is a good plan to ask the battery makers, telling them what valves you have.

The third battery in the set is the one used for grid bias. This is a small dry-cell unit similar to the H.T. battery, but having only a few cells.

Varying Demands.

With some battery sets a 41-volt grid-bias unit is ample. With others 15 or 18 volts may be needed. This depends upon the valves used, the super-power types requiring more grid bias than the small-power variety.

A grid-bias battery will last for a long time without replacement, but if there are no means

GRID BIAS



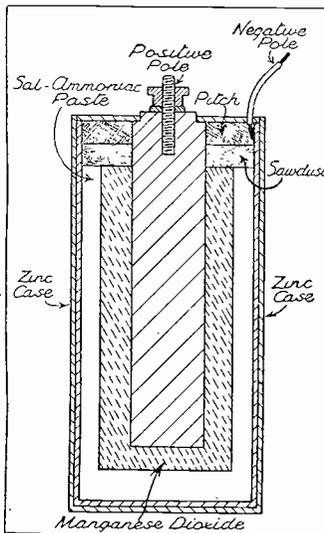
A grid-bias battery is similar in construction to that used for high-tension supply, but has fewer cells.

of testing its voltage it is a sound scheme to renew it every six or eight months.

Too little grid bias, e.g. a run-down grid-bias unit, causes the valve to consume more high-tension current and so throws a heavy strain upon the H.T. battery. Moreover, it may ruin the valve, in addition to having a detrimental effect upon the reproduction.

Also grid-bias voltage should never be adjusted while the set is working. That is to say, the low-tension supply to the valve filaments should be switched off before any of the grid-bias plugs are removed. This applies particularly to a power or pentode valve and should be made a rigid rule.

INSIDE A CELL



This sketch shows the internal construction of a dry cell. The positive terminal makes direct connection to the carbon rod seen in the centre.



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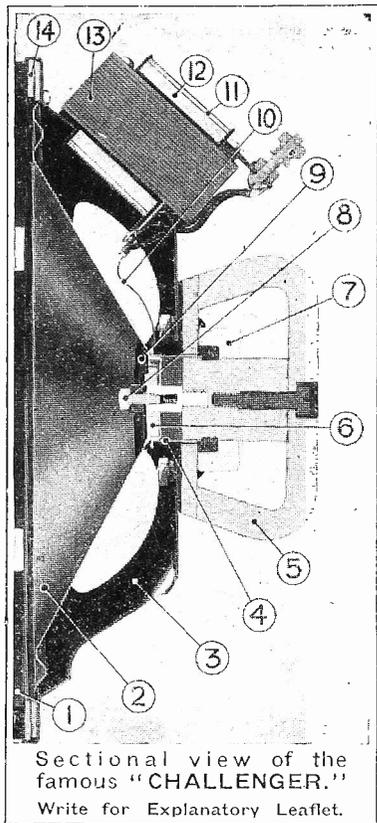
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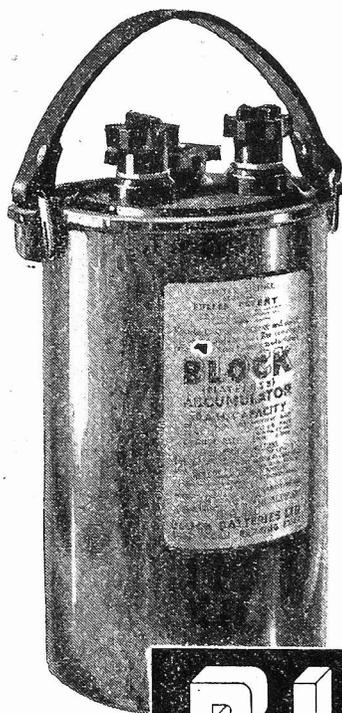


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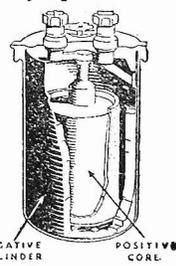
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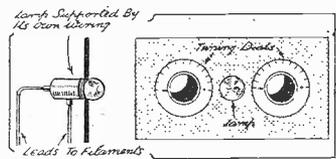
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TWO IN ONE.

THE following is yet another version of a panel light; this time it serves as indicator also. By placing a cross on the bulb, one line serves as indicator with lamp on, and a quarter turn brings the other line across, and this serves as indicator with lamp off. It can, of course, be used with one or two dials.

To make the cross on the bulb, proceed as follows: obtain a piece of transparent adhesive tape, cut to about the size of a shilling and make six small cuts round the edge. Now wet two pieces of black thread (each an inch long) and place these on the



Making a panel-light serve two purposes.

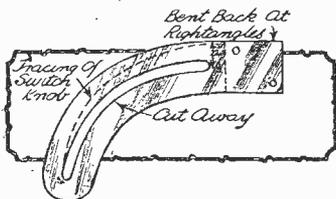
tape so as to form a cross. Now light bulb, wet the glass, press tape into position, and snip off surplus thread. A very neat and efficient job will result.

SAFETY SWITCHING.

THE following is a description of a switch attachment designed to prevent tampering with the inside of an all-mains set with the "juice" on:

If the lid of the cabinet lifts completely off it should be hinged. A tumbler switch (of the wall-mounting, not panel-mounting type) is fixed on the inside of the side of the cabinet, 3 in. from the top and 2 in. from the back. It is connected in the live mains lead before the present switch. It should, of course, be fixed so that the knob moves up and down.

A piece of card, about 6 in. by 4 in., with a flange along the short side, is pinned to the back of the cabinet, with its surface parallel to the side of the cabinet and lightly pressing on the switch knob. The switch knob is liberally coated with ink and the



The metal is simple to cut and bend.

cabinet back is closed. The path traced by the switch knob on the card is therefore marked on the card (see dotted line in sketch). A template is then drawn as sketch.

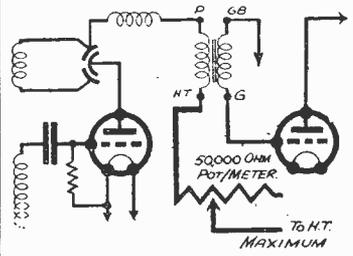
Distance marked "a" is the distance switch knob moves from "off" to "on" positions. This assumes that the switch knob was up when the tracing was taken. This is then cut out in stout brass or aluminium. The slot is best cut with a fine fret-saw. The end is bent back at right angles, as indicated, and the arm is screwed in the position formerly occupied by the card, and so that the switch knob passes through the slot.

The switch knob should be up when the back is open. Then, as the door is closed, the knob, passing along the length of slot, will be pressed down and

the set switched on. Thus it is impossible for the "juice" to be on when the set is open.

ECONOMISING H.T. CURRENT.

HAVING built a det. 2 L.F. set recently, and finding the voltage on the anode of the detector valve rather



It reduces the anode volts.

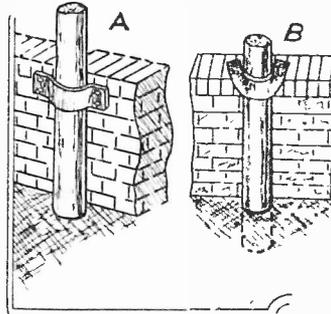
critical, I sought to "kill two birds with one stone."

I disconnected the H.T. + cable from the transformer connected to the anode of the detector valve, and connected the transformer H.T. terminal instead to one terminal of a 50,000-

If this home-made condenser is connected between the aerial and the aerial terminal of the set, selectivity can easily be varied by sliding one of the metal plates in or out and thus varying the aerial coupling.

FIXING AERIAL MASTS.

THIS hint will probably be useful to those who intend to make use of a handy wall for supporting the aerial mast, instead of going to the trouble



A. The wrong way. B. The correct method.

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 ls. 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 in the October 14th issue was sent by Alan J. F. Green, Penylan Pentyle, Port Talbot, Glam., to whom a guinea is being awarded.

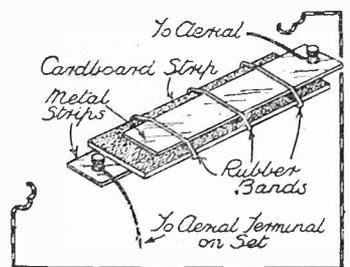
ohm potentiometer which I mounted on the panel. I then connected the sliding arm of the potentiometer to the nearest terminal at a potential of 120 volts (or more), i.e. the L.S. + terminal of the set. The other terminal of the potentiometer was left free. Thus I did away with one plug, at the same time having a control of H.T. detector volts.

A HOME-MADE PRE-SET.

A USEFUL pre-set condenser can easily be made as follows.

A strip of stiff cardboard should be cut to a suitable size (say 4 in. x 1 in.) and two strips of copper or other thin metal should be cut to a slightly smaller size.

Terminals should be affixed to one end of each of the metal strips, which should then be fastened to opposite sides of the cardboard by means of rubber bands.



A simple gadget for improving selectivity.

of digging a deep hole and then fixing stay wires from the top of the pole to the ground.

When I first erected my pole in this manner, I fastened it to the wall in the way shown at A, which is the obvious way of doing it; but after the first gale I found that the force of wind on the aerial wire had dragged the 4-in. nails from the wall. After this experience, I erected the mast differently, by first of all digging a small hole about a foot deep and firmly planting the lower end of the pole in this.

I then fastened it to top of the wall as shown at B. By fixing it in this way, the pull on nails, being indirect, is comparatively slight, and my aerial system will now withstand the severest gale. The pole is a heavy 2 1/2-in. scaffold pole.

LINEN-DIAPHRAGM LOUDSPEAKERS.

MANY readers who have constructed double-linen-diaphragm speakers may have found difficulty in preventing slight chatter on loud passages occurring at the point where the two diaphragms are joined. The following method will be found thoroughly effective.

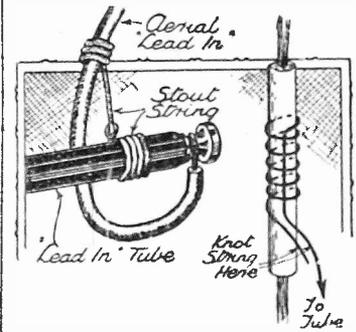
Insert a paper washer between the metal cone-shaped washer and the linen on each side of the speaker. Then, when the two diaphragm centres are drawn together, apply some Secretone to each.

This will soak through the linen to the paper washers, and the two diaphragms will be securely fixed together, and any chatter due to slight looseness will be eliminated.

AN IMPROVED LEAD-IN

USERS of insulated lead-in wire are frequently annoyed by breaks, disconnecting the aerial. The constant swaying of the down lead chafes and frays the wire until it snaps.

The writer has found that by using

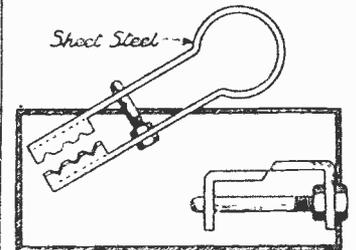


Try this for fixing your lead-in.

a piece of stout string, tied as shown in the sketch, this trouble is almost entirely eliminated. The string takes practically the whole strain which would otherwise fall on the strands of the lead-in wire.

STRIPPING INSULATION.

A USEFUL insulation stripper can be made up from sheet steel, as shown. The usual stripper has an end-on application, but in some instances the one shown will be found useful.



An ideal wire scraper.

As the jaws of the tool must be kept in alignment a guide-peg is found necessary. The tool will be found very useful in difficult corners and positions where it would be difficult to apply an end-on stripper.

SHORT-WAVE CALIBRATION.

COMMENCING at the right-hand side with 0, I measured off on a large graph sheet up to 600 millimetres in tens. This is as much as one sheet will hold, but extensions can be made on other sheets at either end of the scale or range. Up the right-hand side of the 1 marked off in tens 0 to 100 (the condenser markings).

I multiplied the millimetres by 10 and then used the figures as kilocycles, a range from 6,000 kc. to 12,000 kc. now being available. I used Moscow 50 m. 6,000 kc., 74 0 station, and marked on sheet the point where it came in on condenser, and then Rome, 254 m., 11,810 kc. Drawing a line through both points gave me an approximate point for any intermediate station.

(The line must be very carefully and minutely drawn.)

(Continued on next page.)

RECOMMENDED WRINKLES

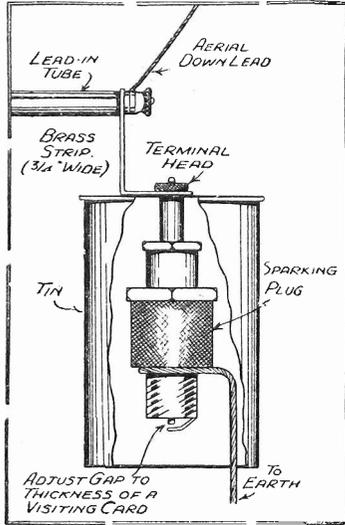
(Continued from previous page.)

A SAFETY DEVICE.

HERE is a radio idea of my own in the form of a lightning arrester which I find quite practical in use and quite inexpensive.

All that is needed is an old sparking plug a strip of brass and a tin of suitable dimensions—a cocoa tin about 2½ in. diameter is quite suitable.

The brass strip is bent in L formation, length of base being 1 in., vertical portion 3 in. (see sketch), a hole being drilled at the top and bottom for fastening on "plug" and lead-in tube, as shown.



Well worth making.

A hole is then drilled in the bottom of the tin, through which the terminal part of the "plug" is inserted.

The brass strip is then clamped in between the tin and terminal head.

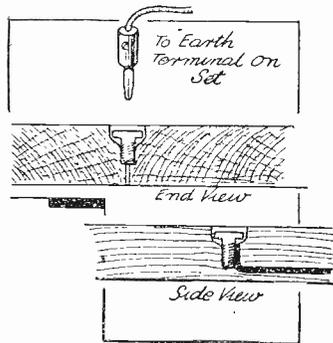
A length of wire should be fastened round the base of the "plug" before insertion into the tin; this runs to earth.

The device fastens on the lead-in tube, as shown, and a coat of paint given to the tin ensures a permanent and water-proof job.

HIDING THE EARTH.

IT is sometimes impossible to take advantage of a good "earth" without trailing unsightly wire round the room. The following method may overcome the difficulty.

First consider where your best "earth" is, and then decide how it can be reached by running a lead between the floorboards. Next secure a small plug and socket, costing about 1d. or 1½d. To the socket solder a length of 16-gauge copper wire. Then make a hole between the boards sufficiently large enough to wedge the socket firmly, sinking it just below the surface. Its position should be directly underneath the set and as near the wall as possible. The boards should now be gently levered apart at intervals with a screwdriver, and the wire



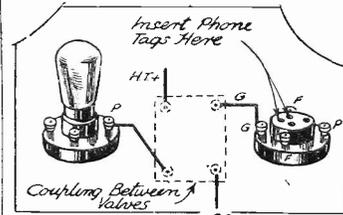
No more trailing wires.

pressed in, and finally connected to your "earth."

A short piece of flex from the earth terminal of the set should be connected to the plug, which can, of course, be disconnected at any time from its hardly perceptible "earth point" in the floor.

SIMPLE TESTING.

IN various articles dealing with trouble-tracing in stages, utilising 'phones, it is stated that they should be placed in the anode leads of the valves whose stages are being tested. Now, this obviously requires breaking a lead, or leads.



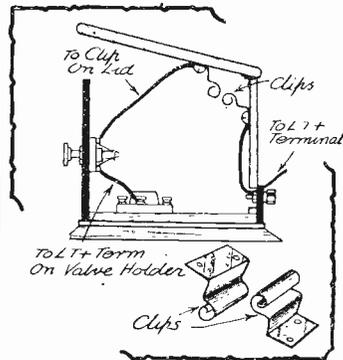
Try it yourself.

It will be known that the signals from one stage are applied between grid and filament of the succeeding valve, therefore if 'phones are placed in the grid and filament sockets of a stage, then (except where the preceding stages are H.F.) the signals from the preceding valve will (or won't!) be heard. This saves breaking any wires, merely necessitating the removal of a valve.

LONGER VALVE LIFE.

FOR the guilty, as well as the innocent here is a tip which makes it impossible to pull out the grid-bias plugs while the set is switched on. Two springy brass clips (as per sketch) and a slight alteration to the L.T. switch wiring are all that is required.

For the reader who is unable to make the clips shown, two pieces of metal which make contact when the lid of the wireless cabinet is closed will do quite well, provided the contact is reliable. The idea is to make a break in the L.T. wiring whenever the lid is opened for the purpose of adjusting the G.B. wander-plugs.



An excellent safety tip.

The G.B. battery should, of course, be clipped inside the set (it generally is). Irrespective of the position of the on-and-off switch, this method will prevent the swing of excessive current caused by removing G.B. plugs, and thereby prolong the life of your valves.

REMOVING BROKEN DRILLS.

WHEN drilling a very small hole—for instance, ⅛ in. (for 6 B.A. tapping) in iron panel brackets, etc.—the drill often breaks off, and, unfortunately, flush with the surface of the iron. To remove it, without injuring the metal and spoiling the position of the hole a good idea will be found in the following:

First heat the metal slightly round the hole and then drop a few spots of acid (from wireless accumulator) into the hole where possible. In cooling, the acid is drawn in and slowly attacks the metal and the drill.

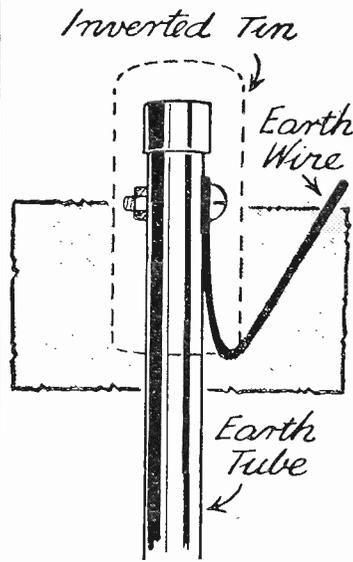
Then, after five minutes or so, with the aid of a pair of watchmaker's forceps inserted into the flutes of the drill, work the drill about, when it will be found to eject itself quite easily. Afterwards wash forceps and hole in a solution of washing soda to "kill" the acid.

When the hole is now tapped it will be found to give a full thread; thus the amount of metal removed is infinitesimally small.

For brass, use the same plan, but dilute nitric acid instead of sulphuric acid, because it will act more quickly. To handle the acid use an ordinary fountain-pen filler and also for forcing the washing soda solution down the hole.

CONNECTION PROTECTION.

IN order to maintain the efficiency of an "earth" it is desirable that where the earth wire joins the conventional earth tube, usually under a nut and bolt, it should be protected

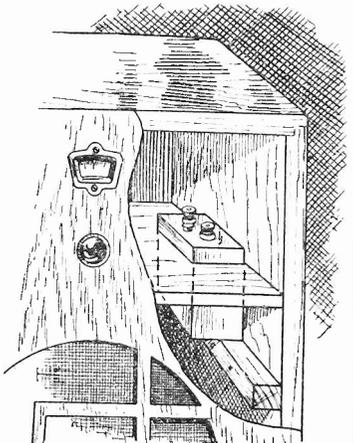


It prevents corroded joints.

from the elements to avoid corrosion and the ingress of dirt. A simple way to effect this is to place a discarded shaving-stick or other round tin over the end of the earth tube and wire, the latter being bent down so that water cannot reach the actual junction of wire and metal.

ACCOMMODATING THE ACCUMULATOR.

A HOLE is cut out of the end of the baseboard the same size as the base of the accumulator. Inside the set, if the loudspeaker is beneath the



Spilled acid is avoided.

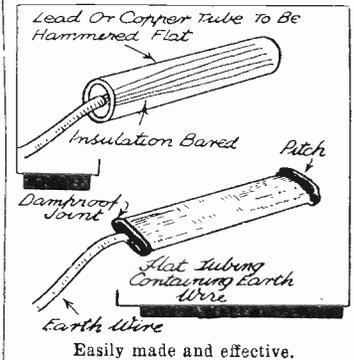
set itself, a wooden batten can be fixed as a rest for the accumulator.

The batten, which runs from the front to the back of the cabinet, should be fixed about a distance of 1 in. less than the length of the side of the accumulator from the baseboard. For instance, if the side of the accumulator is 8 in., the distance from the baseboard should be 7 in.

The accumulator is then in a sunken position through the baseboard, leaving room for an output choke or a transformer to be fixed against the side or back of the cabinet.

EFFICIENT "GROUNDING."

A NOVEL and efficient earth is easily constructed in the following manner.

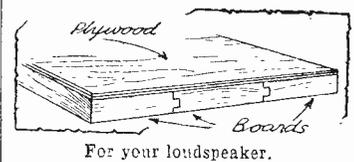


A length of common lead tubing is obtained and is joined to the earth wire by stripping an equal length of the wire of its insulation and threading the bare wire down the length of the tube. This is then hammered flat, and the two ends of the tubes sealed with battery pitch.

One of these earths that was in use for several years, when examined, was in very good condition, due, no doubt, to the careful sealing of the ends of the tube.

A HOME-MADE BAFFLE.

ONE often finds while trying to make a baffle that the timber merchant cannot supply a board wide enough.



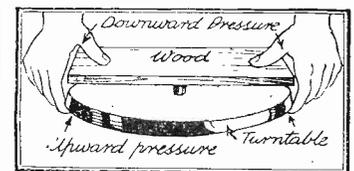
For your loudspeaker.

Here is a simple and cheap way of overcoming the difficulty.

Buy the widest boards possible; tongue and groove them, filling grooves with glue when fixing; cover the front with plywood. This can now be polished and will look and work like a one-piece baffle.

REMOVING A TURNTABLE.

DIFFICULTY is often experienced in removing the turntable from the spindle of a gramophone motor, especially if it has got "bedded down" through long usage. I find that this is greatly simplified if a piece of wood is



An even pull does the trick.

put on to the top of the spindle and the turntable and wood pressed together, as shown in sketch. This method also stops unnecessary strain being put on the spindle shaft.

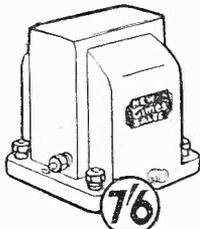
S.T. 500

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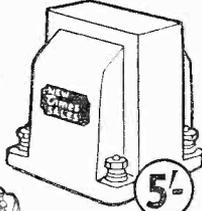
N.T.S. Differential Condenser.



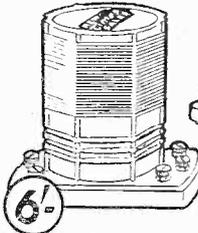
N.T.S. Class B Driver Transformer

N.T.S. Class B Output Choke

N.T.S. Baseboard Trimmer.

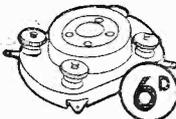


N.T.S. Super L.F. Transformer.

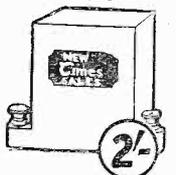


N.T.S. S.T.500 Coils.

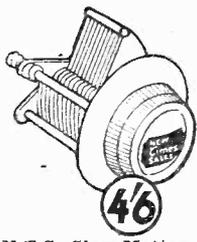
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N.T.S. Valve Holder.

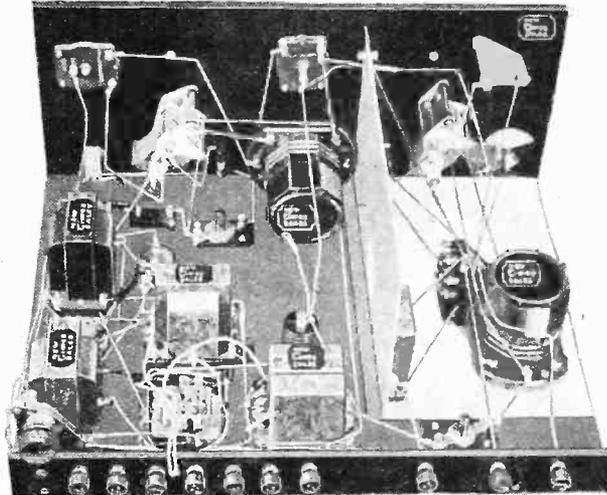


N.T.S. Fixed Condenser.



N.T.S. Slow-Motion Condenser.

THIS LIST OF PARTS SAVES YOU MORE THAN A GUINEA



Balance in 11 monthly payments of 6/9

KIT 1

Comprising Kit of matched parts as listed, including ready-drilled panel and terminal strip, S.T.500 Screen, Peto-Scott Metaplexed Baseboard and "Class B" Output Choke. With Free Full-Size Blue Print and Copy of "Popular Wireless" Oct. 21st. Less Valves and Cabinet. Cash or C.O.D., Carriage Paid.

£3 : 15 : 0 or 12 monthly payments of - **6/9**

KIT 2 As Kit 1, but including 4 specified valves only. Cash or C.O.D., Carriage Paid.

£6 : 0 : 0 or 12 monthly payments of - **11/-**

KIT 3 As Kit 2, but with Peto-Scott Specified Console Cabinet, Cash or C.O.D., Carriage Paid.

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KIT 4 As Kit 2, but with Peto-Scott Specified Console Cabinet, Cash or C.O.D., Carriage Paid.

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If Permanent Magnet Moving-Coil Speaker required, add 15/- to Cash Price or 1/3 to list and each monthly payment.

FINISHED INSTRUMENT

Assembled from N.T.S. components and broadcast tested, complete with valves and in specified Peto-Scott Walnut Cabinet with Peto-Scott Permanent Magnet Speaker. Cash or C.O.D., Carriage Paid.

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As above, but Ready to Play in Peto-Scott Specified Walnut Console Cabinet with Peto-Scott Permanent Magnet Speaker. Cash or C.O.D., Carriage Paid, **£9 : 15 : 0**, or 12 monthly payments of **18/-**.

THESE PARTS are MATCHED, TESTED AND GUARANTEED

1	PETO-SCOTT plywood baseboard with Metaplex section, 16" x 12"	1	9
1	N.T.S. panel, 16" x 7" x 3/16", ready drilled	3	0
1	N.T.S. S.T.500 screen	1	6
1	N.T.S. terminal strip, ready drilled	1	9
1	N.T.S. bracket for tone control condenser	6	3
2	N.T.S. S.T.500 coils	6	0
2	N.T.S. slow-motion .0005-mfd. tuning condensers with dials	9	0
3	N.T.S. .0005-mfd. solid dielectric reaction condensers	4	6
1	N.T.S. .0001-mfd differential reaction condenser	1	3
1	N.T.S. .0003-mfd. differential reaction condenser	1	6
1	N.T.S. baseboard pre-set .0001-mfd. condenser	1	6
1	N.T.S. baseboard pre-set .00005-mfd. condenser	1	9
1	N.T.S. Class B driver transformer, ratio 1:1	7	6
1	N.T.S. Class B output choke	6	0
1	N.T.S. super transformer	5	0
1	N.T.S. S.G. choke	2	6
2	N.T.S. 4-pin valve holders	1	0
1	W.B. "Universal" 5-pin valve holder	1	0
1	GRAHAM FARISH 7-pin valve holder	1	3
1	N.T.S. disc type H.F. choke	1	6
1	N.T.S. 1-meg. leak w. wire ends	1	0
2	N.T.S. 1-watt metallised 5,000-ohm resistances	1	6
2	N.T.S. 1-watt metallised 10,000-ohm resistances	1	6
1	N.T.S. 250-ohm resistance	2	0
1	N.T.S. 2-mfd. fixed condenser	3	0
2	N.T.S. 1-mfd. fixed condensers	3	0
2	N.T.S. .005-mfd. tubular condensers	1	6
1	N.T.S. .00005-mfd. tubular condenser	1	6
1	N.T.S. .00005-mfd. mica condenser	1	3
2	N.T.S. push-pull on-off switches	1	4
1	N.T.S. toggle on-off switch	1	3
10	N.T.S. terminals	1	8
	Flex, screws, 3 wander plugs, connecting wire, etc	2	0

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and copy "Popular Wireless" S.T.500 issue.

GUARANTEED MATCHED AND TESTED PARTS



TWO NEW SWITCHES

I THINK that of all types of switches the "toggle" is the neatest and most generally satisfactory and the push-pull (or the majority of them) the crudest.

There is an attractive phrase, "a touch of the switch," which is often employed in eulogising electrical apparatus. It envisages a light tap with one finger which at once makes the gear spring into action or causes a complete change of conditions.

But it certainly does not apply to some of those stiff push-pull switches which need to be yanked out, like a dentist drawing a horse's tooth, and driven in with such force that the panel sways back with creaks and groans.

They are as much the relics of the stone age of electricity as the toggle is representative of modern technique. Bulgin makes some beautiful little toggles. You know what they are, of course; outwardly, at least, they resemble miniature light switches. And in that they work with crisp up-and-down motions they are familiar to handle to anyone whose house is wired for electricity.

This, to my mind, is a great advantage; the kind of standardisation that is sensible. I always use toggles for on-off purposes. Hitherto they haven't been available for much else.

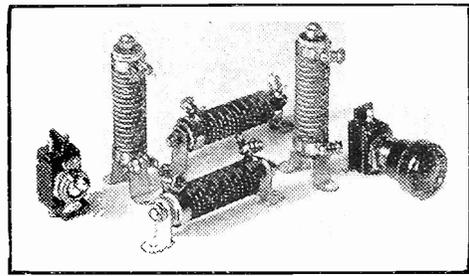
But now Bulgin has produced one of the double-action, double-pole, double-throw type which has many uses. And it retains the simple, easy, crisp action that is the hall-mark of the good toggle.

No half-way positions are possible; it snaps over to one side or the other, and that is that.

It is rated at 1 ampere, 250 volts; which, in itself, is rather wonderful for so small and neat a device.

The price is 2s. 3d., and that includes a metal indication plate bearing the words, "Radio Gram," "On/Off," and any other of several alternative markings.

The same mechanical principles which make these Bulgin toggles so successful, and a similar high degree of electrical reliance, are to be found in yet another new Bulgin switch.



Heavy duty anode resistances, and double-pole double-throw toggle and rotary switches of Bulgin manufacture.

This is a rotary-action mains-miniature switch. It has a handsome walnut knob arranged for rotary operation. Its action is perfect.

Rated at 250 volts 3 amperes, this switch costs 1s. 9d., and it can be supplied with a longer bush for panels up to 1-in. thick, if desired, at 2s., but there are no indicating plates in either case.

I have tested both these new Bulgin switches for flash-over and insulation resistances, and find them completely O.K. And I would like to take this opportunity of saying that of a number of Bulgin switches which I have had in constant use for some long time none has developed the slightest fault.

Yet another recent addition to the now widely comprehensive Bulgin range is a Heavy-Duty Anode Resistance.

This can be obtained in numerous values from 300 ohms (this can carry 270 milliamperes) to 40,000 ohms (with a current-carrying capacity of 25 milliamperes).

The component is equipped with terminals, unlike the above-mentioned switches, for these have only soldering tags, and is designed on particularly robust lines.

The winding is accommodated on a grooved porcelain former. We have already used numbers of these Bulgin resistances with entire success.

A NOVEL VALVE HOLDER

In an age of radio, when the valve, as never before, dominates almost every sphere of progress, the Ostar-Ganz Universals stand out as worthy of very special consideration.

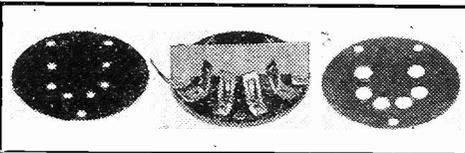
Anyway, that is my personal opinion, based on very recent experiences with sets and amplifiers using them.

Their versatility, the fact that they enable one to design a set equally suitable for either D.C. or A.C., is a quality of great importance. But it must not be allowed to over-shadow the fact that Ostar-Ganz valves are good purely as valves.

The rather special treatment they demand in respect of smoothing is eliminated when an ingenious valve holder that has been designed for them by Ostar-Ganz is used.

It is a quite inexpensive, simple component, but embodies special shielding.

A portion of this comprises a small vertical shield which divides the sockets. You can clearly see it in the accompanying view of the pieces comprising a complete holder.



Made specially for Ostar-Ganz "universal" mains valves, this holder has a special shield between some of the sockets.

This shield continues and completes the good work done by a shield which runs up the base of the valve itself.

Practical experiments reveal that the scheme functions admirably. Freedom from hum, even with high magnification, is given.

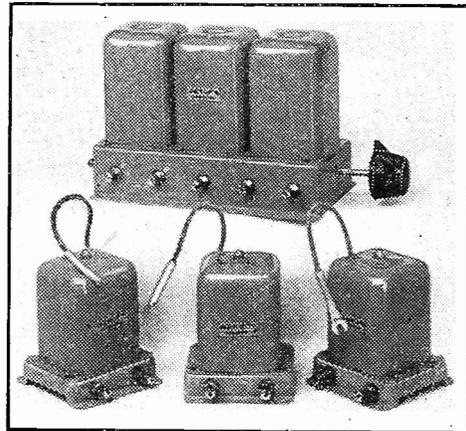
HOME construction is now in fullswing. The various R.M.A. exhibitions are over; all the carefully guarded secrets are out, and "P.W.," by the publication of Mr. Scott-Taggart's latest and greatest set—the "S.T.500"—has given the greatest boost to home construction that the Industry has ever known.

Now is the time to buy and to build. While it is true that home-construction is no longer a seasonal pastime, there is inevitably a certain amount of hesitancy (and very wisely so) immediately before the dawn of radio's "New Year." But now, very definitely, the slogan everywhere should be "full steam ahead."

It may perhaps be wondered why I should be so keen to press the matter. As a matter of fact, to whatever extent I may be inclined to press the matter, you can take it from me that it is in your own interests. That is the idea of "The Link Between," and from information which has come to hand, as a result of my various trade liaison activities, there

WEARITE COILS

The great revival of the superhet is now a matter of history, though there are probably some readers who do not realise that there was a superhet renaissance. They may even think the "super" is a modern thing that was steadily developed in the way, for example, that the all-mains set progressed.



Wearite triple-coil unit and intermediate coils employing iron-core coils.

But we had our supers in the earliest days of broadcasting. Then the system fell from favour and for years languished in an obscurity bordering on extinction.

Giving credit where credit is due, I believe that we owe quite a deal to Messrs. Wright and Weaire for the great revival. Anyway, they very actively assisted by introducing apparatus and ideas that put the super firmly on its feet again.

It is, therefore, appropriate that Messrs. Wright and Weaire should be among the first to apply the new iron-core technique to a triple-coil assembly particularly suitable for this and other up-to-the-minute designs and to intermediate transformers for superhets. These latter are skilfully designed components, and on test we have found them perfectly satisfactory in every way.

They are admirably constructed and are unusually compact; that is for coils as such. Advantage has been taken of the fact that efficient screening can be employed with small physical dimensions.

The switch action of the triple coil assembly is definitely good. It is curious how many components of this nature have fallen below standard on account of what is after all little but a mere mechanical detail. But the Wearite assembly does not.



Weekly jottings of interest to buyers

is a possibility that prices may rise.

I don't say that it is definite, in fact, anything that can be done by "P.W." to maintain on an economically sound basis the present low levels—even, if possible, to bring them still lower—will most certainly be done. That is a

matter that depends very largely upon the prices of raw materials. All the same, there is just the possibility, and since nearly all the new season's secrets are now out, there is absolutely no reason for waiting any longer.

Increase of Set Prices?

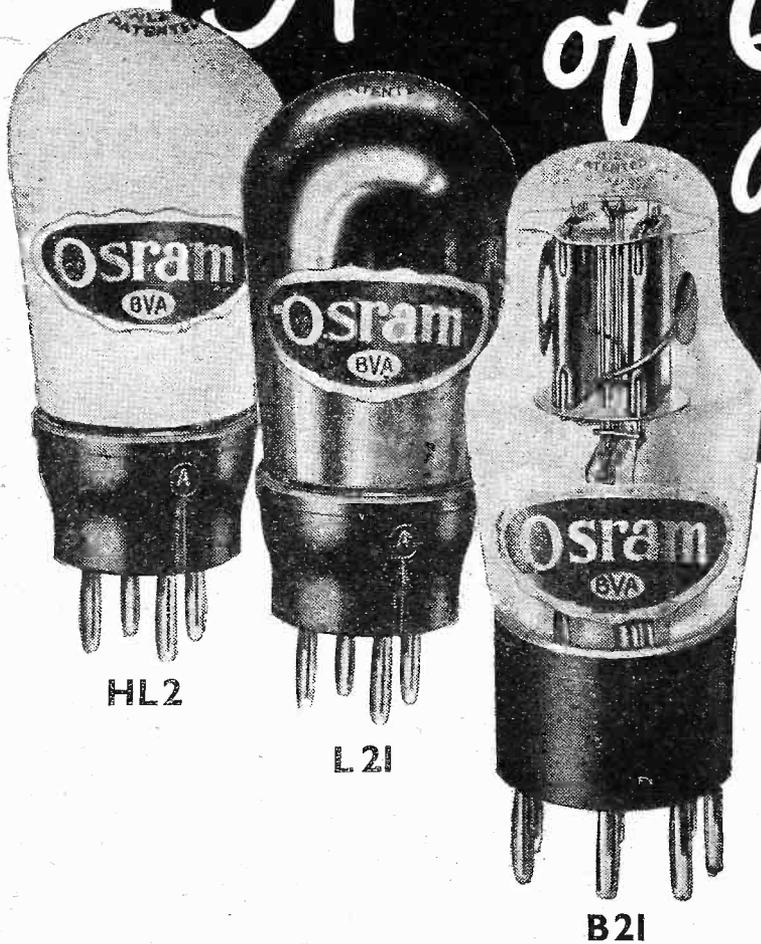
This timely hint applies particularly to readers who may be contemplating the purchase of a commercial receiver. I have heard from several reliable sources that there is a distinct possibility of set prices going up within the next month or so.

Frankly, and to express my own point of view, I should be very surprised if any advances are actually made, either in the

(Continued on page 376.)

EVERYTHING **The G.E.C.** ELECTRICAL
your guarantee

A Combination of Quality and Volume



**NEVER BEFORE
ATTAINED IN
BATTERY RECEIVERS**

A trio of 2 volt Valves which lifts the standard of Battery Set performance to an entirely new level of UN-DISTORTED POWER.

- 1** Complete absence of microphonics—due to the multiple anchored Wembley Filament fitted to the Osram HL2.
- 2** Maximum economy in H.T. current consumption and high sensitivity—due to the efficient characteristics of the Osram L21.
- 3** Great volume with pure tone on all types of broadcast, whether piano music, speech, or full orchestra—due to the unique low impedance design and duplicated grid construction of the Osram B21.

HL2

NON-MICROPHONIC DETECTOR. Filament current 0.1 amp. Amplification Factor 27. Impedance 18000 ohms. Mutual conductance 1.5 m.a./volt.

PRICE 7/-

L21

ECONOMYDRIVER. Filament current 0.1 amp. For 120 v. H.T.: Standing anode current 1.7 m.a. approx. Working grid bias $4\frac{1}{2}$ volts. Mutual conductance 1.8 m.a./volt.

PRICE 7/-

B21

DOUBLE TRIODE 'CLASS B' OUTPUT. Total filament current 0.2 amp. For 120 v. H.T.: Standing anode current 1.65 m.a. approx. Working grid bias $4\frac{1}{2}$ volts. Average anode current 6.0 m.a. Interval transformer ratio 1.25—1.

PRICE 14/-

Osram

2 VOLT BATTERY

Valves

WRITE for the OSRAM VALVE GUIDE (1933-4 Edition) sent post free.

MADE IN ENGLAND

SOLD BY ALL RADIO DEALERS

NOW'S THE TIME FOR BUILD YOURSELF THE



Some American Stations which can be received with certainty:~

- CINCINNATI W8XAL - PITTSBURGH W8XK
- BOUNDBROOK N.J. W3XL & W3XAL
- SCHENECTADY W2XAD
- WAYNE N.J. W2XE

KIT OF PARTS WITH 4 VALVES COMPLETE

£5.26

TRIUMPH OF NEW "SKYSCRAPER" ALL WAVE ALL WORLD RADIO!

GREAT FREE CHART

LEARN HOW TO BUILD & OPERATE A SET WHICH GIVES YOU AMERICA & AUSTRALIA AS WELL AS ALL EUROPE

TELLS EXACTLY WHAT TO DO AND OPENS TWO NEW WAVELENGTHS TO HOME LISTENERS

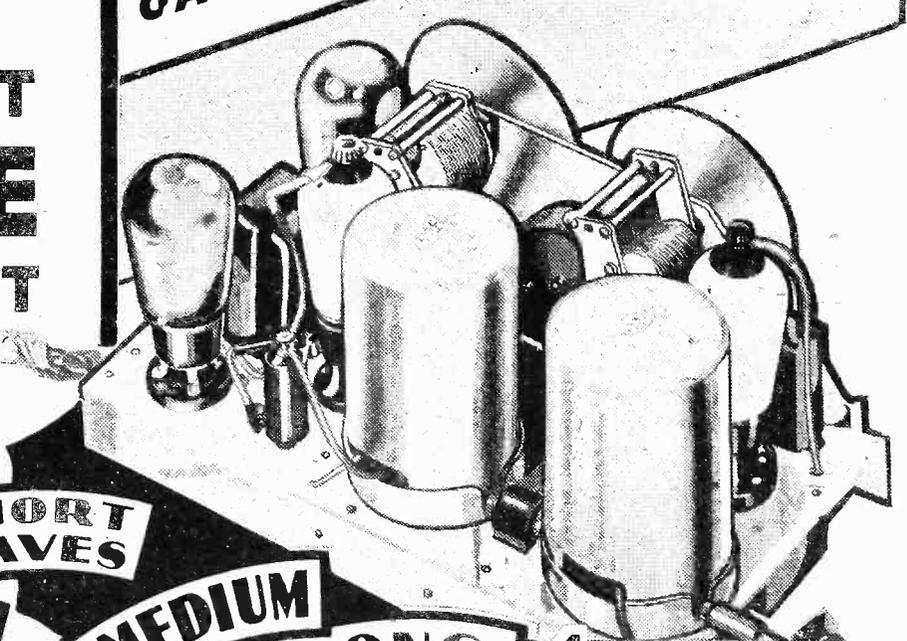
SHORT WAVES

ULTRA SHORT

MEDIUM

LONG

4 WAVELENGTHS INSTEAD OF 2



SHORT-WAVE LISTENING! ALL-WAVE "SKYSCRAPER"!

At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World Skyscraper 4 tunes from 12 to 2,100 metres. It brings two complete new wavelength ranges within reach of the ordinary listener—stations and programmes which before he was never able to receive—Ultra-Short and Short-Wave transmissions from the ends of the earth.

SUCCESS IS CERTAIN— GET THE CHART AND JUDGE FOR YOURSELF

And remember you get these stations through Double Balanced Pentode Output giving brilliant reproduction on a Moving-Coil Speaker—as much power as a Mains Set from ordinary high-tension batteries. Lissen have made this All-Wave All-World radio available to Home Constructors first, because it brings back the thrill of conquest to hear America and Australia *direct* on a set you have built yourself, it makes you an enthusiast to realise what a wonderful thing you have created! And when you see the Great Free Chart of the All-Wave All-World "Skyscraper 4," which tells you how to build it and how to work it and why it gives such marvellous results, you will agree at once that it will be wise of you to build for yourself rather than buy a factory assembled receiver which cannot give you these new and intriguing short-wave stations. The **FREE CHART** simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. **YOU CAN'T GO WRONG!** But get the Chart and see for yourself—then build the Lissen All-Wave All-World "Skyscraper 4," the **SET THAT SPANS THE WORLD!**

COMPLETE WITH WALNUT
CABINET AND MOVING-COIL
LOUDSPEAKER.

£8 . 2 . 6

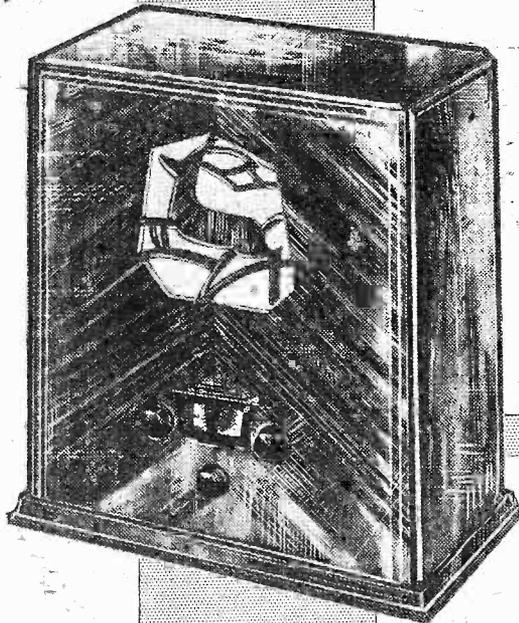


CHART FREE

POST THIS COUPON

To LISSEN, LTD.
Publicity Dept.,
Isleworth, Middlesex.
Please send me **FREE**
CHART of the All-Wave
All-World 'Skyscraper.'

NAME

ADDRESS.....

P.W. 1234

LISSEN ALL-WAVE ALL-WORLD "SKYSCRAPER" 4

ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

(Continued from page 331.)

They are well organised and seem to have plenty of time and money for their hobby. I should like to see something organised in this country which would ensure emergency communication.

Bouquet from Back of Beyond.

HERE, so far as we can decipher it, is a note from an esteemed citizen of (illegible), in (we think) Portuguese East Africa: "Dears Masters Poplarys,— Making oportunes of to inscribe primary cartel to excellenz wireless journal. If you pleas. Thanks so much. Yes. Was desire to makking muzic-receval, thus to harks to musiques allover ter-rastriel glob, but fearfully sadness finding non battriss attainable for here.



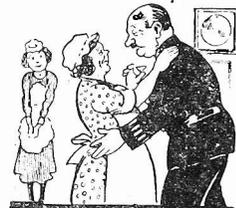
"Why not do poplars wirless indicate merchantes display battriss to thees toun? We have monnay for pay." Poor bloke! I advise him to sit back and thank his stars that he has "momay," even if he lacks "muzic" from the "glob."

"Ariel" as Knight-Errant.

THE "Morning Post" thinks it a little ungracious of Lady Snowden to attack women announcers, she having left the B.B.C. It certainly would have been improper for her to have done so in public while she was on the Board, but why should she not now if she thinks that their voices are not, as a rule, suited to the microphone? She has many supporters of her views amongst listeners.

Genuine Diehard Story.

CAN you believe it! I met a man to-day who was "thinking about getting a radio set." He said that neither he nor his wife is very anxious to have one, but the maids might like it—and could he have one which could be switched on to the kitchen, and switched off the drawing-room. I allayed his doubt, but did not attempt to make him a convert.



This kind of chap must be left to work out his own salvation. As he is an LL.B. and a chartered accountant, with no ear for music, I presume that you forgive my diffidence. I suppose he is the sort of man that spends a hectic evening in analysing the balance sheet of the Gas Light and Coke Company!

A Missing Word.

MASTER J. C. W. (Colwyn Bay) invites my attention to a reference by a coroner on an electrocution case to "a current of over 200 volts." Have I ever heard of a current of 200 v.? Add the word "pressure," old son, and the matter will not be so very bad. Experts like you, me, and Marconi must not be too severe with coroners.

Why, I once heard a mere common banker refer to the air-waves which ran down his aerial, and all I did was to ask him whether he had ever caught the little beggars running up!

Fibre Needles.

I AM indebted to J. L. C. (Forest Hill, S.E.) for the information that there is a fibre gramophone needle, suitable for use in a pick-up, which will play up to six of the heaviest recordings without requiring to be sharpened.

I shall try these, provided that they fit my pick-up, and report the result. I hope, however, that I shall not lose in crispness or

SHORT WAVES

Jones: When friends come in and listen to my radio they are simply glued to their seats.

Brown: What a quaint way of keeping them there!

It is stated that having the ears pierced is a cure for defective eyesight. A correspondent who has a wireless and gramophone enthusiast living next door to him says he has unwillingly persevered with the treatment for years.

Optimist: G-g-g-good—m-m-m-m-morning, M-Mister S-Studio M-M-Manager. D-d-did you adver-tise for a g-g-good r-r-r-radio an-n-nouncer?

A farmer, writing to the Press, says he thoroughly enjoys the Children's Hour on the wireless. It would be a graceful response if some toddler were to write expressing the interest he (or she) takes in the Fat Stock Prices.—"Punch."

A radio set has been invented which can be attached to the back axle of a bicycle. The next thing we shall hear is that someone has designed a set to broadcast the Children's Hour to perambulators.

"Here is, in process of development, an education of the best kind; by not abusing its privilege of supplying the public with unprejudiced facts from which to gauge the truth for itself, broadcasting cannot help but build a better-informed society," we read in the "Radio Times."

But does it?

There issues from the B.B.C.

A standing rule that those who chatter into its microphones shall be

Debarred from controversial matter

(Although it doesn't seem to tether The gentleman who talks about the weather).

A golden rule, and one that I'd

Extend to after-dinner speeches, And also like to see applied

In places where a parson preaches;

Because the helpless hearers lack The opportunity to answer back.

brightness or detail what I hope to gain by way of surface quietness. No one has commented on my suggestion for an agate needle. What does J. L. C. think?

Another Crystal Diehard.

W. H. T. (Cleveland Square, W.2) asks why I have "such a down on" the crystal. He still uses one, in combination with an ancient pair of French phones! I have no more objection to crystal-phone reception than I have to the flint-steel tinder box, the stage coach, and the hour glass and other obsolete devices. I could, however, write a page about why I prefer valves and an M.C. loud-speaker.

Moreover, during the war I had so much companionship from phones that my poor ears shrink at the very mention of them! I congratulate W. H. T. on his luck in getting all the radio he needs without any upkeep costs. His luck, however, prevents him from entertaining a roomful of friends!

Brazil No Home for Crooks.

ABOUT that Brazilian police wireless! I had the luck to get some accurate data from the Marconi people, who did the job. The idea was to provide inter-



communication between the central police-station in Rio de Janeiro and provincial police-stations and motor-cycle patrols; also communication between the Rio marine police-station and ships

in the harbour or at sea.

All this has been worked out and executed. The Rio central station has two telegraph-telephone transmitters (medium and short-wave) and two receivers. The medium-wave set can be used for broadcasting a "police hour" when news about lost-and-found persons and goods, traffic orders and new regulations is radiated.

The Complete Crime Disturber.

THE short-wave station can communicate with all the Brazilian states and many foreign countries. Moreover, there have been installed seven other short-wave stations: one at the H.Q. of the Marine Police of Rio, four at strategic points for police operation in the Federal District and two in police launches.

The road-patrol service comprises six motor-bikes and sidecars, with sending and receiving sets which are in constant touch with police-stations.

All this anxiety for poor, honest crooks—just because Marconi would mess about with electric sparks at Bologna! Is it fair? Well, we've got to remember that crooks as a whole have already used radio to aid them in their nefarious schemes!

Northward Ho!

AT Vadsö, Norway, they are building a broadcasting station which is said to be the most northerly of all, with icicles twelve feet long on the aerial and a chorus of seals.



Intensive research has revealed to me that Vadsö stands on Varanger Fjord; further research on a map indicates that it is in or about latitude

74 N. It is a 10 kw. station, and will relay Oslo, frost and polar bears permitting. "Excuse me, but your reindeer is eating my lead-in." Ouf! I prefer our right little, tight little heat-wave, even if it does mean a few more crackles.

TELSEN BINOCULAR H.F. CHOKE

Specified by **MR. JOHN SCOTT-TAGGART**

for the P.W.

"S.T. 500"

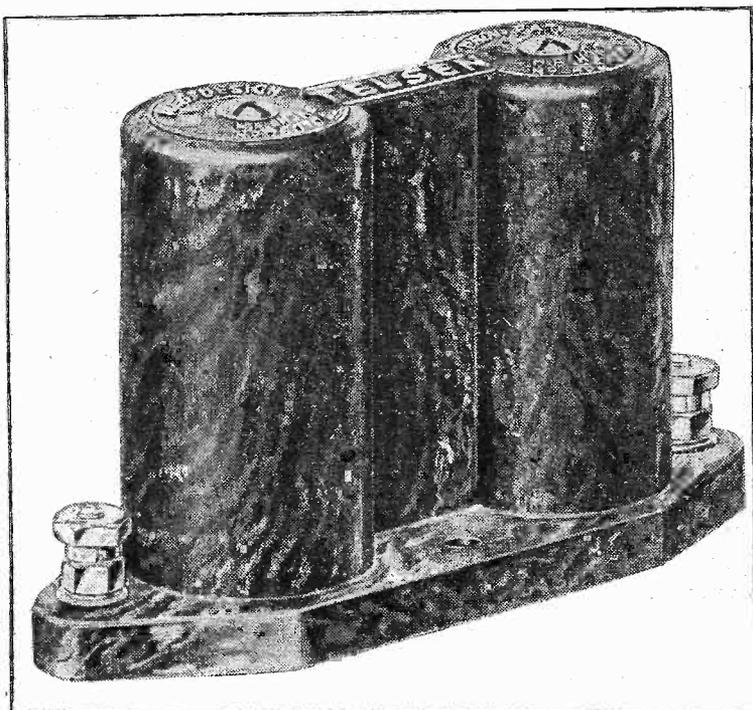
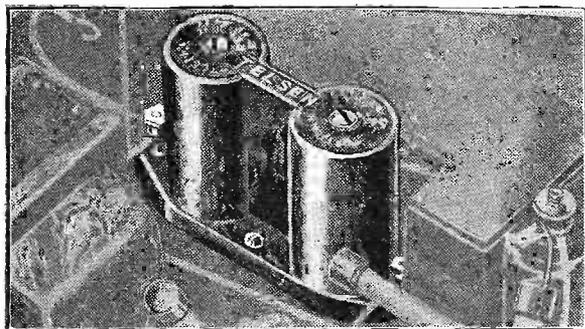


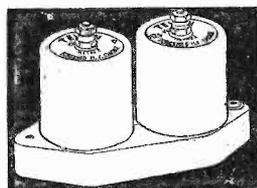
Illustration below shows the position occupied by the Telsen Binocular H.F. Choke in the built-up 'S.T. 500.'

EXPERT designer and home constructor alike concur in their choice of the Telsen Binocular Choke where lasting efficiency at low cost is the first requirement. Its external field is negligible, with a very low self-capacity, while its inductance is as high as 180,000 micro-henries

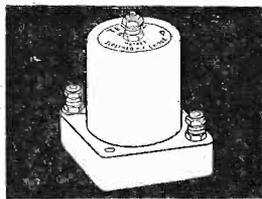
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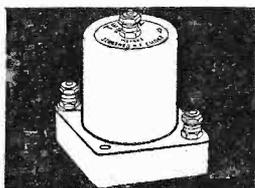
TELSEN COVER EVERY H.F. CHOKE REQUIREMENT



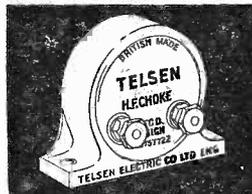
TELSEN ALL-WAVE SCREENED H.F. CHOKE - - - - 4/6



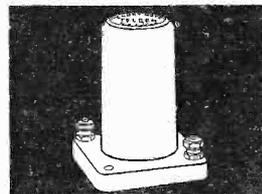
TELSEN STANDARD SCREENED H.F. CHOKE - - - - 2/6



TELSEN SHORT WAVE SCREENED H.F. CHOKE - - - - 3/-



TELSEN STANDARD H.F. CHOKE - - - 1/6



TELSEN SHORT WAVE H.F. CHOKE - - - 2/6

TELSEN FOR EVERYTHING IN RADIO

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

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

"THE SET IS TOO LIVELY."

G. M. (Birmingham).—"The set is too lively. It is an A.C.3—S.G., detector and power—and as soon as I connect aerial and earth it goes into oscillation; but it is very sensitive, and without any aerial I can hear a lot of stations.

"Another thing which I do not understand is that if I put aerial lead to a .0001 fixed condenser and the other side of this to the terminal on the top of the screened-grid valve it works fine as a two-valver.

"What can I do to make the S.G. stage work as it should?"

It would appear that there is undesirable interaction between the S.G. and the detector stages, and the usual cure for this is to increase or improve the screening. Are you using the correct screening (and screened components, if these were recommended) as prescribed for the original model?

If coil cans are used see that they make good electrical contact with the metal bases. If a simple metal screen of the vertical type is employed make sure that it is properly earthed and that any foil on the baseboard, etc., which is used for screening is soundly connected, as it should be.

Sometimes the frame of a condenser is left "in the air" instead of being earthed, as the designer intended, so this is another point to watch for.

In general, all the "earthed" wiring is important, clean contacts and sound joints being essential.

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) What foreign stations are now the London Regional's neighbours (i.e. occupying the adjacent wavelengths)?
- 2) What is the voltage of one of the cells of an H.T. or grid-bias battery?
- 3) If a .0003-mfd. condenser were connected in series with a 2-mfd. condenser, would the effective capacity of these two be high or low?

because with a high-amplification receiver it is necessary that all the screening should be effectively at earth potential.

In general, also, it is vital that the general layout and run of the wires should follow those of the original design, any considerable departure being likely to introduce feed-back trouble of the kind you are experiencing.

Similarly it is imperative that the aerial lead-in wiring should be well spaced from the detector and low-frequency end of the set and from the loudspeaker and its leads.

The observance of these precautions prevents instability unless the valve-operating conditions (especially of the S.G. valve) are incorrect. But if the specified valve and power supply are used there should be no difficulty on that score.

WIDE DIFFERENCES IN THE CONDENSER-DIAL READINGS.

V. A. B. (Stockport).—"Where I was staying on holiday they had a three-valver which was so good that I took a copy of the diagram (circuit, with values) to get built up on return home.

"It is a great success, but the two tuning condensers are fifteen degrees different on most stations. Is there anything I can do

"P.W." PANELS, No. 141.—PALERMO, ITALY.

Palermo's wavelength is 537.6 metres—immediately above Munich's, and about two degrees below the dial-reading for Budapest.

The programme usually begins at about 11.45 a.m. As the power employed is low—only three kilowatts—the station is not well received in this country except under freak conditions.

The call is "Radio Palermo," and is given by a woman announcer. The distance (from London) is about 1,130 miles.

to make them come close together? Otherwise the set is a winner."

Owing to different stray capacities it is very difficult to get two condenser dials to remain closely in step over the whole of a tuning range, even when the coil units are chosen with that end in view. And if different makes or types of tuning condenser are employed the capacity change is sure to get more or less out of step at different dial readings.

You could ensure that the readings would be close and remain very nearly in step by using two identical condensers in conjunction with coils designed to work together, but this might prove a too-expensive alteration. In your place we should try something simpler, and be satisfied to get the dial difference reduced to a reasonably small degree.

Why not, for instance, change over the present two tuning condensers? By coincidence they may match up quite well when reversed in position, i.e. aerial condenser changed over to the anode circuit, and vice versa.

Failing that, procure another condenser that resembles one of the original ones, and try matching those two. It should be possible to reduce the present wide difference quite easily, for it is unusual to find such a big discrepancy where the recommended capacities have been fitted.

POWER-GRID DETECTION FOR EXTRA VOLUME?

D. L. (Gillingham, Kent).—"As I cannot afford new valves or greater high tension I wondered if I could get the extra volume by changing over grid-leak detector of usual type to power-grid detector.

"If this can be done without much difficulty, please give the connections."

You are under a misapprehension about power-grid detection if you expect it will result in greater volume. It does not produce any such effect.

As a matter of fact, the term "power-grid detection" is not a suitable one, like so many others that we have grown accustomed to. The distinguishing feature of this class of rectification, as compared with that of the ordinary grid-leak-and-condenser arrangement, is that it is capable of satisfactorily handling a large input, and so of providing a comparatively large low-frequency (detected) output for operating the last stage without intermediate low-frequency amplification.

Incidentally, the connections are the same as for the ordinary grid-leak-and-condenser arrangement,

the difference between the two systems lying in the values of the leak and condenser and of the high tension applied.

USING UP THE OLD HIGH-TENSION BATTERY.

W. W. C. (Sheringham).—"Now that we are listening again more regularly and for long hours at a time again, I want to ask a question that I meant to raise last time I wrote. It is about using up the old H.T. battery when a new one is bought.

"Having proved what a big difference a new battery makes to the quality, I should like to be able to throw the old one away as soon as the new one is fitted. But owing to salary reductions that is out of the question if I can save a bit by using the remaining volts.

"I know I have read that there is a right and a wrong way of doing this. And I feel sure it is wrong to connect the negative of one battery to the positive of the other, as is sometimes done.

"But what is the right way? My set has one screened-grid valve, detector and pentode, the battery terminals being as marked on the sketch."*

* [NOTE.—Sketch not reproduced.—ED.]

You are right in assuming that it is wrong to connect one battery in series with the other. This results in the old fault reappearing in the new high-tension supply.

The fault in question is high internal resistance. As an old battery's voltage drops its resistance goes up, and usually this results in back-coupling troubles

between the output and preceding stages which are supplied from that battery.

If one battery is joined in series with the other their resistances are placed in series, and the tendency to trouble is inevitable. The alternative is to use the old (high-internal-resistance) battery as a separate H.T. supply to one of the stages that requires but little current, where its high resistance will be little detriment.

In your case you have a separate H.T. tapping to the detector. And as this valve will only take about a couple of milliamperes at the most, the old battery will probably be able to supply this small current for a long time without any apparent distortion arising.

All you have to do is to connect the new battery in place of the old one, with all the H.T. plugs in their respective positions except the one for the detector (H.T. +2 in your case).

Stand the old battery beside the new one and join its negative socket to the set's H.T. negative terminal also. Then take the detector's H.T. plus plug to the extra battery, instead of to the main (new) battery, and work the set like that.

(Continued on page 372.)

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.

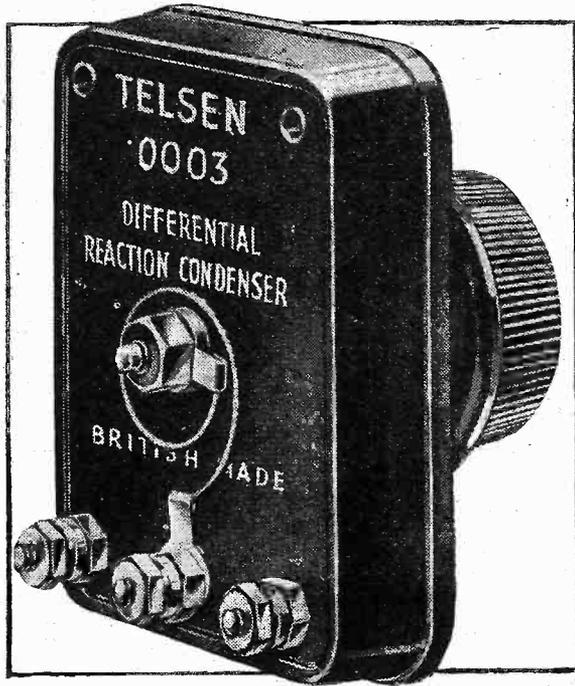
Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

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.

TELSEN DIFFERENTIAL CONDENSER

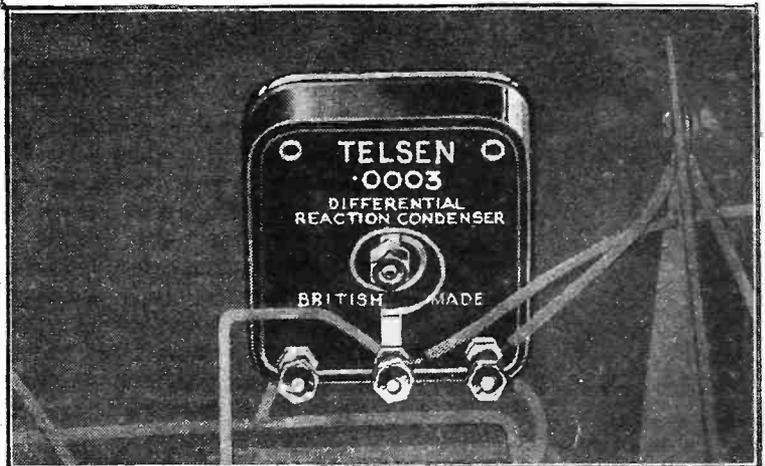
Specified by **MR. JOHN SCOTT-TAGGART**
for the P.W.



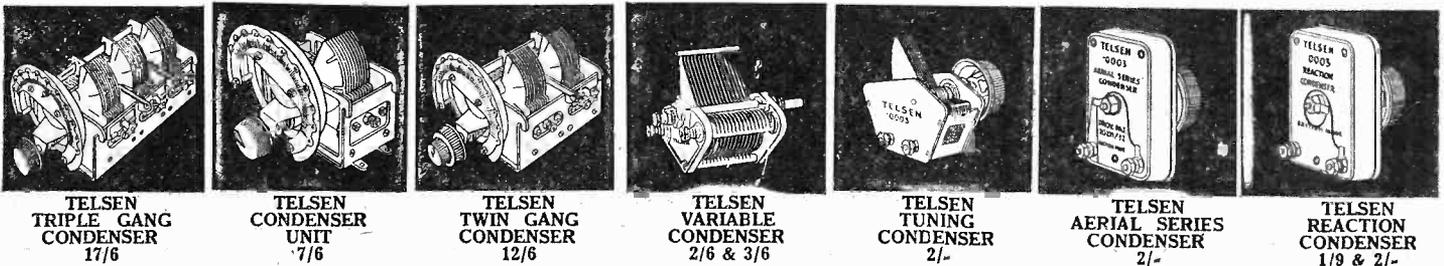
"S.T. 500"

Illustration below shows the position occupied by the new Telsens Differential Condenser in the built-up S.T.500.

MR. JOHN SCOTT-TAGGART'S choice of the new Telsens Differential Condenser is an eloquent tribute to its lasting efficiency. Any possibility of deviation from the stated capacity is prevented by the entire elimination of end-play (positive contact being made by a flexible pig-tail) the effective life of the component being enormously increased, and the occurrence of 'rustling' noises due to grit being prevented, by the dust-proof bakelite case which now encloses the entire unit. Yet, in spite of these valuable improvements, there has been no increase in price **2/-**
(Capacities .0003, .00015, .0001)



TELSEN COVER EVERY CONDENSER REQUIREMENT



TELSEN TRIPLE GANG CONDENSER 17/6

TELSEN CONDENSER UNIT 7/6

TELSEN TWIN GANG CONDENSER 12/6

TELSEN VARIABLE CONDENSER 2/6 & 3/6

TELSEN TUNING CONDENSER 2/-

TELSEN AERIAL SERIES CONDENSER 2/-

TELSEN REACTION CONDENSER 1/9 & 2/-

TELSEN FOR EVERYTHING IN RADIO

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

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 370.)

Probably it will carry on satisfactorily in this way for months until another main battery is required. When this occurs the same procedure can be adopted, and the "detector" battery can be thrown away after giving its extra service.

WHEN LONG H.F. LEADS ARE UNAVOIDABLE.

G. V. R. (Brechtin).—"The point I want to raise is an unusual one, concerning the wiring of a high-frequency stage. I am fully aware that with tuned circuit leads, etc., it is most important to keep all the wiring short and direct. But this is a case where some of the leads *must* be longer than is usual or desirable. And the question is which?"

"The trouble arises because the cabinet in which this set is being built is an expensive one, and there is *too much* room in it. The result is that the high-frequency valve holder will be about 16 inches or more away from the panel on which the tuning condenser for that stage is mounted.

"What I want to know is whether the H.F. coil unit (for this condenser to tune) is better placed close to the valve or to the tuning condenser.

"In the former case, there will have to be long leads from condenser to coil, but the coil can be very close to the valve holder with short grid lead.

"If, instead, I put the coil unit near to the panel on which its condenser is fixed there will have to be a long lead to grid and a fairly long one to filament.

"Which is likely to prove the better arrangement?"

We favour the coil being placed close to its condenser. You will then have a compact oscillatory

circuit, and the only disadvantage will be the long leads connecting this to the rest of the set.

If you arrange the coil and condenser far apart you will have a cumbersome oscillatory circuit which is probably much more liable to unwanted interactions than the alternative arrangement.

EASY METHODS OF CONTROLLING THE VOLUME.

R. T. B. (Strood, Kent).—"Now the dark nights are falling early, the volume is too big from many of the stations, and I want an *easy* method of controlling it.

"Could I use a small preset condenser instead of the one marked '0001, which is

You could employ a variable condenser in place of the '0001, and, although the alterations for that are very simple indeed, it would probably prove quite satisfactory. Special types of series-aerial condensers are available, with very low minimum capacity, and these are the types from which you should make your selection.

(The method has the additional advantage of increasing selectivity when the volume is decreased, which is generally desirable when a simple set is concerned.)

Alternatively the potentiometer can be used in the following manner:

Connect the flex lead, which normally goes to the coil tapping, to the centre (slider) terminal of the potentiometer instead of to the '0001-mfd. condenser.

The remaining potentiometer terminals are now joined to the respective ends of the tuning coil—i.e. one terminal to that end of the coil which goes to the fixed vanes of the tuning condenser, and the other terminal to that end of the coil which goes to the condensers, moving vanes, earth, etc.

Volume can then be controlled by the rotation of the potentiometer knob.

THE ANSWERS

TO THE QUESTIONS GIVEN ON PAGE 370 ARE GIVEN BELOW.

- (1) Immediately below London Regional is Graz, Austria, on 352.1 metres. The wavelength above London Regional's is now occupied by Tiraspol, Russia (358 metres), whilst Stuitgar (Muhlecker), Germany, is a little higher up on 360.5 metres.
- (2) The ordinary small dry-cell unit has a voltage of 1.5.
- (3) The effective capacity of condensers in series is always less than the smallest of the individual capacities. The combination in question would therefore have a capacity of less than '0003-mfd.

DID YOU KNOW THEM ALL?

between the aerial terminal and the coil tapping lead?

"Or would a potentiometer be any good? I have one left over which is in good condition, and I think it is 50,000 ohms. But I don't want any big alterations to the inside of the set."

FITTING AUTOMATIC TONE BALANCE TO THE "APEX."

A. C. N. (Northampton).—"Before I get busy on the new set I want to put A.T.B. into the good old 'Apex.' What are the connections for using the 'Airsprite' reaction condenser, audioformer, and '01-mfd. fixed condenser?"

The transformer will replace your present transformer, and can be connected up in exactly the same manner since the terminals are marked the same in both cases.

The special "Airsprite" type reaction condenser will replace the present reaction condenser. The wire from the terminal of the H.F. choke, which formerly went to the F. terminal of the reaction condenser, will now be connected to the moving-vanes terminal instead.

The lead from No. 9 of the anode coil should be joined to F1 of the reaction condenser—that is, to that set of the fixed plates to which no shorting strip is attached.

F2 will then be joined to one terminal of the '01-mfd. fixed condenser. The other side of this condenser will be joined to the negative filament of V3, and the '0002-mfd. fixed condenser will be removed to complete the modification.



S P E C I F I E D

S . T . 5 0 0 .

In signifying his approval of the W.B. "Microloode" speaker for the "S.T.500," Mr. John Scott-Taggart endorses the opinion of all other leading technicians this year.

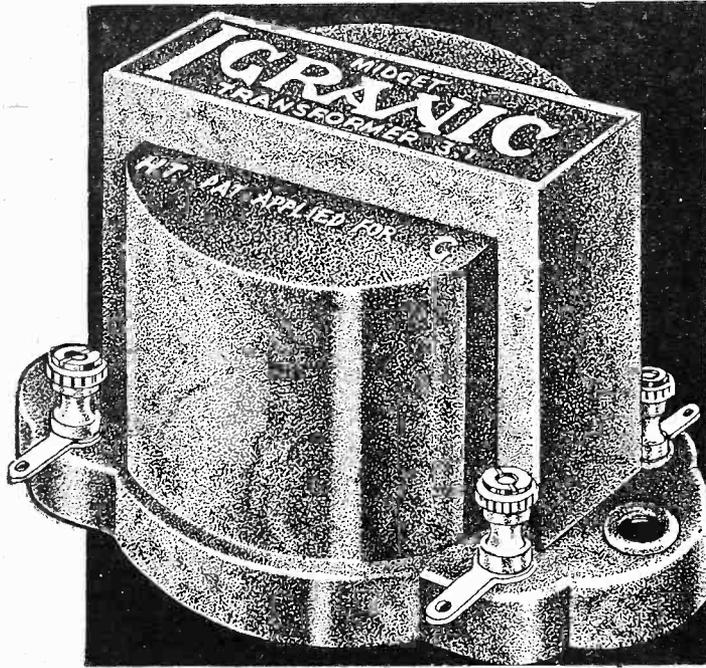
Outstanding sensitivity and wonderfully crisp "attack," due to the unique "Mansfield" magnetic system; even balance of reproduction, due to the patent "Microloode" feature, and the accurate matching it provides; until you hear one you cannot appreciate the difference this speaker makes. "Microloode Model" P.M.6 - 39/6

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"Igranic Enthusiast," Leyland, Lancs.

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Write for fully illustrated Catalogue No. R.214 of Igranic Quality Components

Igranic Electric Co. Ltd., 149, Queen Victoria St., E.C.4.

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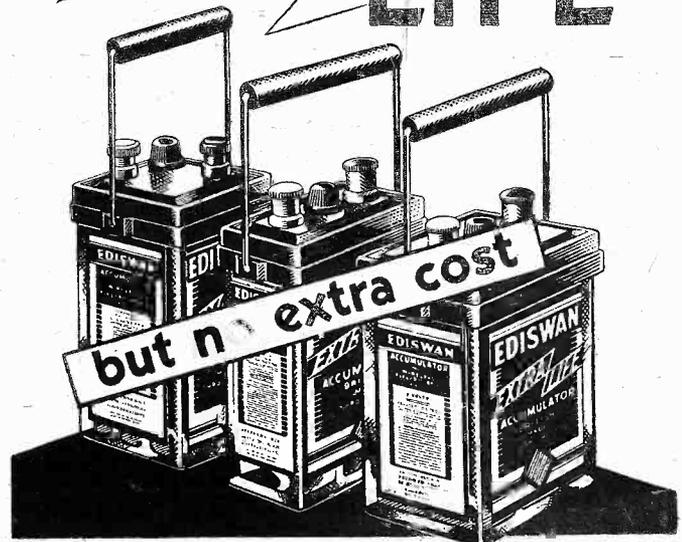
CVS-55



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B.275

S.T.500 NOTES

Converting S.T.300 Aerial Coils
—Using Class B Speakers—Grid-
Bias Adjustments.

THE Colvern type of S.T.300 aerial coil may be converted by yourself into an "S.T.500" aerial coil as follows: 14½ turns of 36 S.W.G. single-silk-covered wire form a new winding between the medium-wave and long-wave windings. This single hank is wound in the same position on the former of this aerial coil as is the reaction winding on the anode-coil former—i.e. in a slot exactly the same distance above the long-wave winding slots.

The new winding starts from No. 1 terminal, and is wound in a clockwise direction looking from the top of the coil, and ends at No. 6 terminal. The direction of the winding is vitally important, of course, as it is a reaction coil.

The above instructions for adding the aerial-reaction winding apply only to the Colvern S.T.300 aerial coil.

I strongly advise the purchase of a Class B moving-coil speaker unless you already have an excellent speaker. The reason is that the output currents should not have to go through two transformers unnecessarily. The Class B speaker will probably, as in the Blue Spot type, be provided with terminals for ordinary power-valve output as well.

If you buy such a speaker you do not

buy the output choke, and elsewhere in this issue the new connections to L.S. + and L.S. — are given.

Next week I am giving a small reproduction of the blue print as altered and also a modification of the Rapid Guide to provide for this.

82 STATIONS

Next week Mr. Scott-Taggart will give the dial readings of 70 medium-wave and 12 long-wave stations received on the S.T.500.

Once you have the "S.T.500" working try altering various voltages. The bias of the L.P.2 driver valve G.B.—1 can be tried at $-4\frac{1}{2}$ volts, while the G.B.—2 of the B.21 can be given -3 volts.

AN AMATEUR LOOKS BACK

(Continued from page 352.)

S O S was the signal I heard, and I was so excited that I had difficulty in copying the Morse message. The message ran: "S O S URGENT CID ON ROCKS OFF TARIFA."

Many other messages were picked up, and the last I heard on this occasion was one from the Fishguard station G R L, at

12.56 a.m.—"S O S NOW CLEAR, S O S NOW CLEAR." So I went to bed, and in the local press next day was a piece of news stating that the British steamer "Cid" was on the rocks off Tarifa.

I was anxious to get down to the short waves, and so a special coil was made and connected up. At 11.25 p.m. I picked up that famous American station K D K A on 100 metres and "Morning, Noon and Night" by Suppé was played by the Westinghouse Band, and came through very well, using only one valve and headphones.

The reception was so good I listened until 2 a.m.

All-Night Sitzings.

A new two-valve receiver was designed and built early in 1925, and amateurs in all parts of the world were heard, especially during the night of August 15th-16th, 1925, when I sat up all night listening. Amateurs in Holland, Denmark, Italy and America were picked up on a wavelength of 40 metres.

I was trying out a new microphone on Sunday, March 28th, 1926, and made contact with an amateur, G G F, of Leicester, on 180 metres. We had quite a long talk with each other, and this was my record distance so far, as regards transmitting speech.

In order to give the new short-wave receiver a good test I sat up all night again on the 29th May, 1926. I put on the headphones at midnight and did not take them off again until eight o'clock in the morning. Several pages in my log book were filled, and amateurs from many parts of the globe

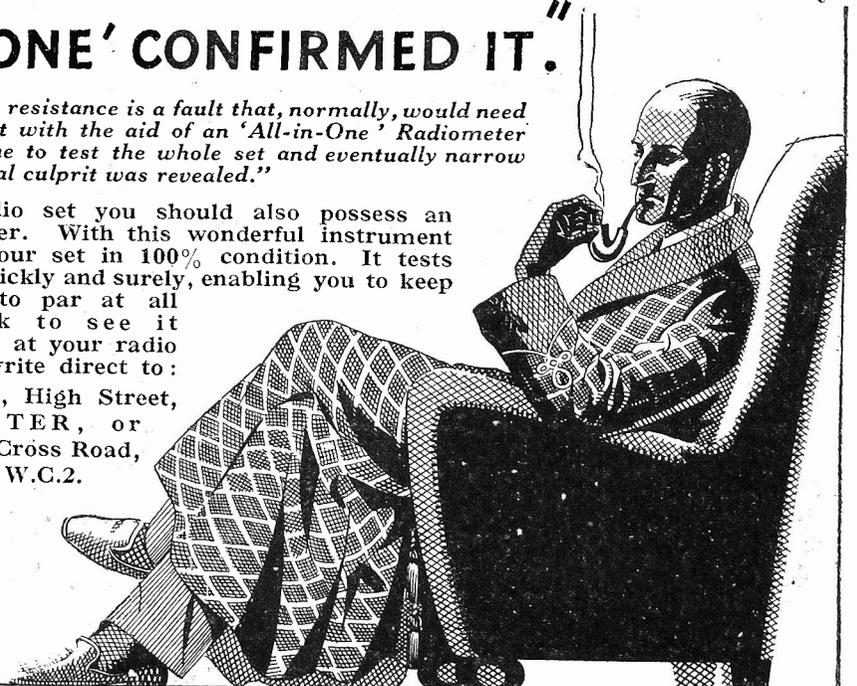
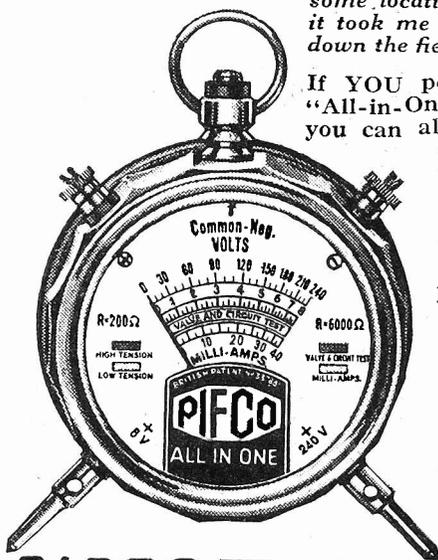
(Continued on page 376.)

"Intricate deduction, Watson, BUT THE 'ALL-IN-ONE' CONFIRMED IT."

"A broken-down grid bias resistance is a fault that, normally, would need some locating, Doctor, but with the aid of an 'All-in-One' Radiometer it took me very little time to test the whole set and eventually narrow down the field until the real culprit was revealed."

If YOU possess a radio set you should also possess an "All-in-One" Radiometer. With this wonderful instrument you can always keep your set in 100% condition. It tests everything quickly and surely, enabling you to keep the set up to par at all times. Ask to see it demonstrated at your radio dealer's, or write direct to:

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CLASS 'B' constructors can save an extra 30% H.T.

Multitone TRUE TONE CONTROL, in the first L.F. stage, not only ensures good reproduction under all conditions, but also saves an extra 30% H.T. in addition to the saving already made by using Class "B" amplification.

Write to Dept. B for the new Multitone Guide to Class "B" telling you all about the theory of Class "B" together with details of components and circuits.

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Ratio 1/4
(saves an extra 30% H.T.) Price **17/6**

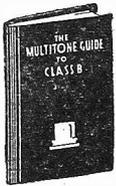
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BEPU DRIVER TRANSFORMER
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High Power Efficiency over 85%. Very low overall secondary resistance 100 ohms. Price **9/6**

PUCHOKE CENTRE-TAPPED CHOKE
For matching any speaker to Class "B" output. Price **9/6**

CLASS "B" CONVERTER UNIT
Those who do not wish to interfere with the wiring of their present set can buy this simple unit. Just plug in adaptor, to last valve stage and enjoy Class "B" advantages. Price **37/6**
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The Ever Ready Co. (Gt. Britain) Ltd., Hercules Place, Holloway, London, N.7.

AN AMATEUR LOOKS BACK

(Continued from page 374.)

were intercepted. Just after 2 a.m. scores of Americans were heard, and at 2.27 a.m. B Z I A D was logged, from Rio de Janiero, Brazil. A good programme was heard from K D K A at 2.35 a.m.

Soon after 7 a.m. an Australian, 2 C M, was heard, this being my greatest long-distance reception.

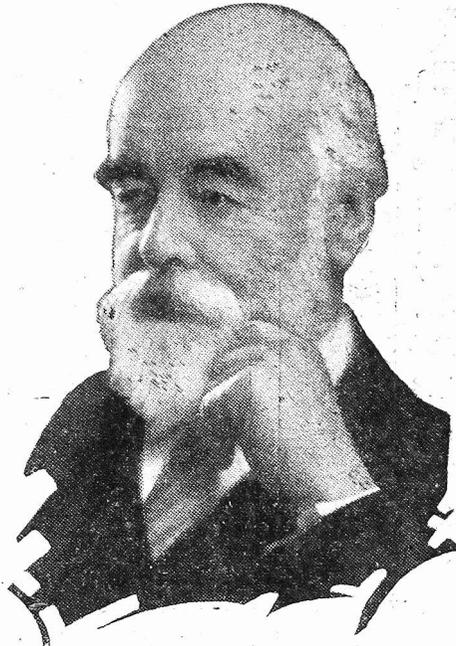
A new transmitter was built early in 1927 for work on 45 metres.

International Communications.

About 10.30 p.m. on April 5th, only two nights later, I heard E C 2 Y D, an amateur in Moravia, Czecho-Slovakia, calling in Morse for anyone to reply. I immediately started up the transmitter and replied to him, finishing up with my call sign 5 O D. Then I listened in, little expecting any luck, and was much surprised to hear him calling 5 O D. I was nearly too excited to work the key, and I guess my Morse must have been rather bad, as I did not think my signals would be heard so far. We carried on communication by the aid of the international code of signals, and though my power was only 2½ watts, I was heard 770 miles away.

Nothing very exciting happened after this, and although many transmissions were carried out by this station (5 O D), interest began to lag, due, largely, to the very decreased activities of the amateur transmitting fraternity as a whole. One could listen on Sunday on the 40-m. band and hear dozens of amateurs, and now it is seldom if one is heard.

SIR OLIVER LODGE'S MESSAGE



Sir Oliver Lodge, to whom "The Manual of Modern Radio" was mentioned, writes to the Editor:

"I KNOW SCOTT-TAGGART. I FEEL SURE THAT ANYTHING HE WRITES WILL BE OF INTEREST TO WIRELESS EXPERIMENTERS."—OLIVER LODGE.

THE LINK BETWEEN

(Continued from page 364.)

prices of components or sets. But still, forewarned is forearmed, and one can never tell!

Loudspeaker Revolution.

There have of late been so many developments in the matter of receiver output schemes that inevitably in the early stages there has been a certain lack of standardisation in components. The change from Class A to Class-B outputs, for example, has generally meant a change in transformer ratios and so forth. So that many constructors have been hesitant about taking full advantage of new developments.

All this has been changed, completely and finally, by the advent this season of the W.B. "Microloade" speakers manufactured by the Whiteley Electrical Company. The new patent system which has been introduced in these loudspeakers enables them to be used with every known variety of output *without the need for new transformers*. The simple switching arrangement allows seventeen different ratios to be obtained, and this is, so far as I am aware, the very first loudspeaker to qualify for the description "completely universal."

It is definitely a revolution in loudspeaker practice, and I strongly advise you to apply, under the "P.W." postcard scheme, for a leaflet giving (No. 59) particulars.

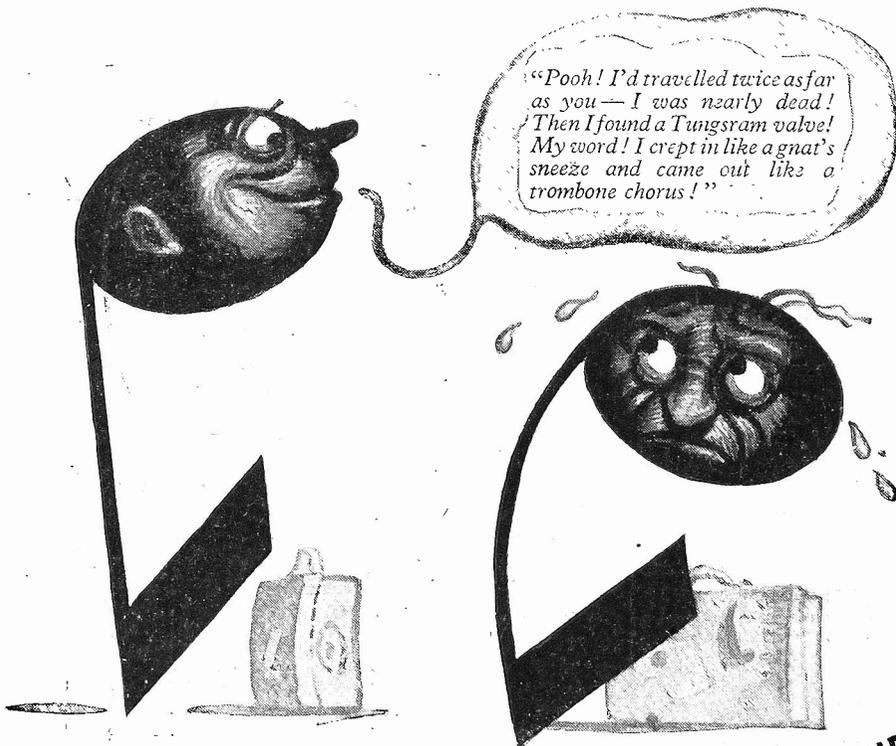
In Contrast.

As a welcome diversion from the more serious aspect of my first paragraph, I am glad to be able to pass on the news of several price reductions in the components manufactured by Ready Radio.

All "P.W." readers will be familiar with the productions of this old-established concern, and so that you may be equally familiar with the new and attractively low prices that have recently been introduced, I propose to make their latest catalogue available under "P.W.'s" postcard literature scheme. (No. 60)

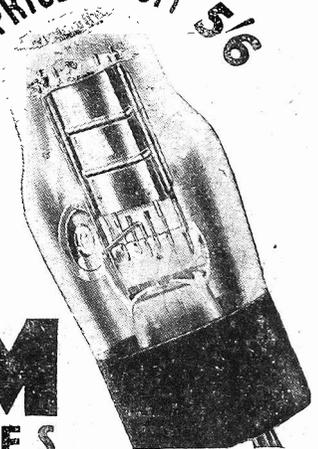
OUR POSTCARD SERVICE

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.



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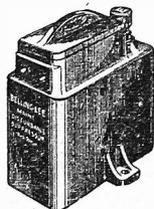


THE TRUTH ABOUT MAINS DISTURBANCE SUPPRESSION

The Position of Belling & Lee Ltd.

A great deal of nonsense has been published about this subject, both in the form of advertisers' announcements and in articles. With their Mains Disturbance Suppressor, Belling & Lee Ltd. are in the position of a dispenser making up a doctor's prescription, the doctor in this instance being the Engineers of the Post Office. After an investigation of 16,000 cases they state that 80-90% of the unwanted Mains noises coming through a Radio Set are due to H.F. disturbance carried by the Mains, re-radiated by the house wiring, and picked up by the aerial system of the receiver.

They state that a condenser unit such as that produced by Belling & Lee Ltd. will considerably reduce or entirely eliminate the disturbance. In about 10%



Mains Disturbance Suppressor No. 1118. each 10/6.

cases additional aids may be required. Such a Mains Suppressor Unit should be fitted at the source of the trouble or next best should be fitted at the listener's Mains switch. No relief can be expected if the Suppressor is fitted to the set. You should certainly fill in the coupon and get a copy of a booklet on this subject.

Its Application to the S.T.500 Circuit.

Many people cannot see how a Mains Disturbance Suppressor can help the Battery Set user. We have already pointed out that the Post Office Engineers are emphatic that the H.F. is mains carried and re-radiated by the house lighting wires and picked up by the aerial system of the receiver. Whether Mains Driven or Battery does not matter.

Be sure and fill in the coupon opposite. It will bring you full details and latest authentic information on Mains Disturbance Suppression.

S.T.500 SPECIFICATION



10 R type terminals at 3d. lettered A, B, LT - LT + HT -, HT +1, HT +2 HT +3, LS -, LS +; 7 Wanderplugs at 1d. lettered HT -, HT +1, HT +2, HT +3, GB +, GB -1, GB -2; 1 Screen Grid Anode Connector at 4d.



Not specified but a useful refinement are 2 Spring Spade terminals at 2d. and twin tap plugs at 1d. each.

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CAMBRIDGE ARTERIAL ROAD, ENFIELD, MIDDX.

NAME

ADDRESS

THE LISTENER'S NOTEBOOK

(Continued from page 344.)

has largely gone. Mabel Constanduros, on the other hand, is always introducing fresh situations—it's always a new book with her. Have you ever analysed any of her lines? Not only are they amusing, but they are also very cleverly written, with the listener always in mind.

This is why she is so easily followed, and her situations so quickly visualised. She always uses the right word; her descriptions are apt; she avoids irrelevancies which only go to confuse the listener. I know no broadcaster who has a better mastery of the technique of broadcasting than she has.

"The Canterbury"—the first of "The Old Music-Halls"—was disappointing. It did scant justice to that famous old ball. The heyday of the Canterbury was too much before my time for me to have a personal experience with which to compare this broadcast version.

But I am quite certain that a performance at the Canterbury wasn't as refined an affair as this broadcast would lead us to suppose it was. These performances must have an audience if the old-time atmosphere is to be recaptured. And a none too well behaved audience at that.

There was a rich variety of songs, ranging from the comic to the sentimental—all tuneful enough to haunt one for days afterwards; but there was little suggestion of the gusto that old-time stars used to put into their efforts. The men were too genteel by half.

THE MIRROR OF THE B.B.C.

(Continued from page 344.)

Meson will be Maurice Avery, Baliol Holloway is to be Hechary Trewhella, and Betty Bolton will fill the rôle of Mrs. Raeburn. The play will occupy nearly two hours.

A Budapest Concert.

Another of the series of "European Concerts" arranged by the different

members of the Union Internationale will be relayed to London Regional listeners on November 4th from Budapest. It begins at 8.40 p.m. and will consist of a serious concert of Hungarian music from Liszt to Bartok.

Those who may prefer to miss it (and there will be some, because serious music, come from where it may, is not everybody's choice) will have an opportunity at 9.15 p.m. the same day of hearing a concert of light Hungarian music played by a Tzigane Orchestra. As this will also come from Budapest it will be the real stuff.

The Lord Mayor's Banquet.

Those who want to hear the Prime Minister's speech at the Lord Mayor's Banquet at the Guildhall on November 9th will be able to listen at home. The B.B.C., the Post Office engineers and their own receiving sets will provide the necessary means.

ARTHUR MEE'S 1000 HEROES

ARTHUR MEE has been looking round the world again, looking back and looking forward, a little impatient of hearing it said that Youth has no chances in these days.

He has looked back to the dark days that have been before and has seen how men

got out of them. He has looked about in every age and every land and has chosen a thousand heroes equal to their situation and told their story in a new 6d. part work called "ARTHUR MEE'S 1000 HEROES."

Some of them were heroic all their lives, facing hard times and overcoming them. Some have made themselves immortal by great deeds which all the world remembers. Some of them are heroes all unknown, some of yesterday, some of our day, some men and women like ourselves.

It is not true that Youth has no chances in these days. What Youth needs is Courage. Here are a thousand heroes who have known dark days and overcome them. They have done incredible things. They have made the world we live in.

Here are a thousand great adventures of Humanity, told in that fine way in which Arthur Mee's stories are always told, glowing with life and feeling and hope and courage. Here is nothing for the pessimist, but here is something for all who are thrilled by the past and believe in the future.

Here are the Greathearts of the world. Here is inspiration for these dark days. Here is the very book the world is waiting for, the very thing Youth needs.

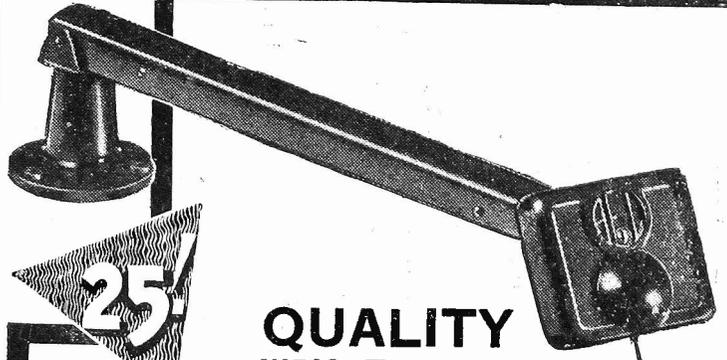
Ask for "ARTHUR MEE'S 1000 HEROES," the new sixpenny in about 50 weekly parts. Part 1 on sale now.

Player's
please
Everyone



NCC 176

BETA PICK-UP



25%

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Bowyer-Lowe Pick-ups range from Pick-up Heads at 19/6 to the wonderful MARK IV Pick-up at 42/-. Each model is supreme in its class. Also vitally necessary to every pick-up is the Bowyer-Lowe Tone and Volume Control with independent controls at 10/- complete.

QUALITY INDICATIVE OF FAR MORE EXPENSIVE MODELS

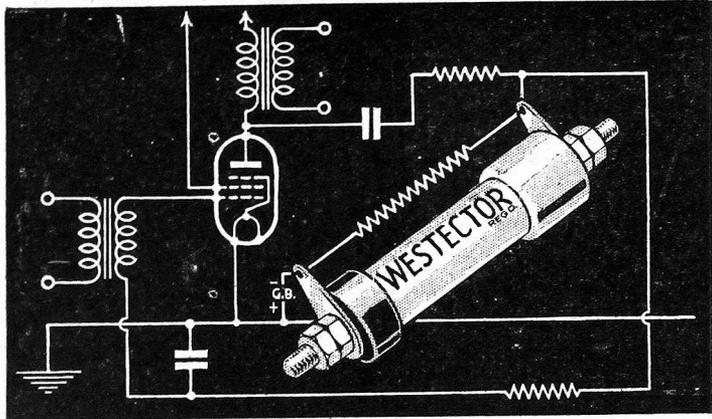
FEATURES of design and performance found in the most expensive pick-ups are incorporated into the Bowyer-Lowe Beta Pick-up to provide a superlative level of performance. Frequency response is from 80 to 5,000 cycles with a rising characteristic to compensate bass notes, while top cut-off reduces needle scratch to a minimum. The balanced head is in mottled bakelite on a freely swinging arm finished Florentine Bronze. Complete with lead and arm-support.

In cases of difficulty send direct. Also for descriptive literature.

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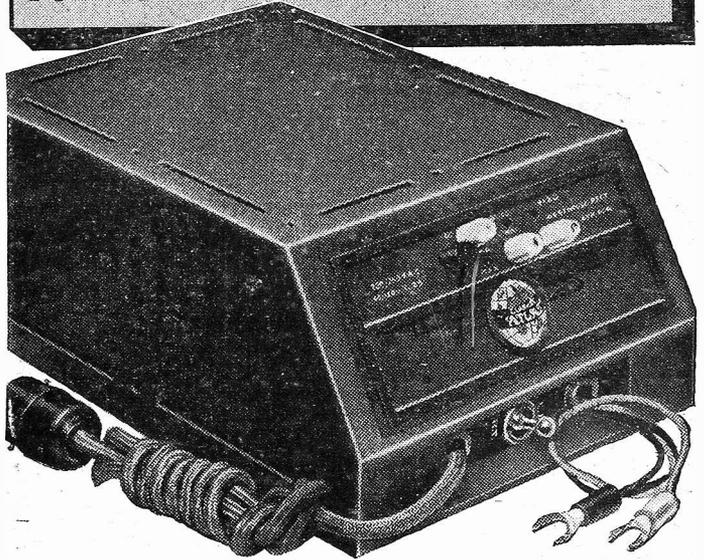
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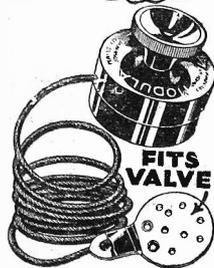
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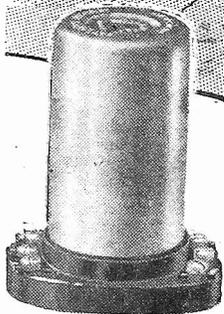
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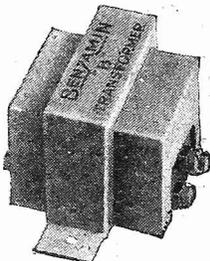


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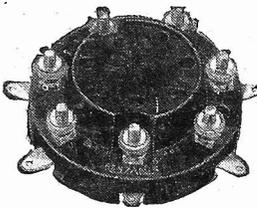
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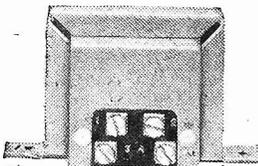
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TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

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

A Class B Peculiarity.

THE introduction of Class B amplification, and quiescent push-pull also, for the matter of that, have, like the majority of inventions, brought with them their own peculiar problems. As you know, Class B has particular advantages where a battery-driven set is concerned, owing to its economy in H.T. current consumption. The fact that it gives such excellent output volume, of course, one of its outstanding advantages.

There must be very large numbers of people, however, who use Q.P.P. or Class B with H.T. supply units, and here there is a peculiarity which sometimes develops into a serious difficulty. In fact, I have had quite a number of cases where readers have been disappointed with Class B, owing to the fact that it gives bad distortion.

Voltage and Current.

If you think about it for a moment you will see why this may happen with an H.T. mains unit, particularly if it is one of somewhat limited output. The H.T. unit differs

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essentially from an H.T. battery, even a dry battery, in that it has a considerable internal resistance; the consequence of this internal resistance is that the output voltage depends very largely upon the current which is drawn from it. If the current is seriously increased the output voltage may drop quite a large amount, and vice versa.

Now, with a push-pull arrangement, whether it be Q.P.P. or Class B, the anode current drawn from the H.T. source will go up enormously when you get a large grid swing. In fact, this is the essence of the efficiency of the system. But with a mains unit in which the voltage varies largely with the current it obviously means that, just at the moment when a large current is drawn, the voltage will go down, so that what is gained on the swings is lost on the roundabouts. It is worse than that really, because it may introduce bad distortion, and this is the reason why, as

(Continued on next page.)

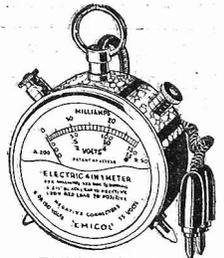
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TECHNICAL NOTES

(Continued from previous page.)

mentioned above, many people using Class B have been disappointed in that way.

Neon Regulator.

There are more ways than one of dealing with this difficulty, but one very simple method is to use a neon regulator which is now made by one of the leading valve manufacturers. The principle is that when the valves draw a large current the neon tube takes a small one, and vice versa, with the result that the total current—that is, the current which is taken by the neon tube, together with that taken by the valves—keeps fairly well to a uniform average and so prevents the output voltage from the unit from varying very seriously.

In fact, in actual practice it is found that, under proper conditions, the variation in output voltage is a very small percentage. If you are using Class B or Q.P.P. with a mains unit and are having trouble with distortion it is worth while to consider the question of one of these neon regulators.

Tapped Chokes.

In a choke-capacity output filter it is a good plan to use a tapped choke, because this enables you better to match up impedances. The impedance of the output valve and the impedance external to the valve—that is, the load—should bear a certain relationship to one another for best

NEXT WEEK

JOHN SCOTT-TAGGART

will contribute further details of the

S.T.500

THERE WILL ALSO BE ANOTHER STEP-BY-STEP SUPPLEMENT

For Beginners.

results. If these two impedances are not within measurable distance, so to speak, it is necessary to put in either an output transformer giving the proper ratio or a suitable choke, and, as I say, a tapped choke is best in this case because you can so easily adjust it to the best working conditions.

In fact, adjusting the impedance of the choke has very much the same effect as adjusting the ratio of the transformer. You should have no difficulty in getting a suitable choke for your purpose, as there are plenty of tapped chokes available on the market giving all the required "ratios."

That Core Hum.

By the way, it is surprising what a lot of chokes (and transformers too, for that matter) are so badly assembled that the iron laminations of the core give an audible hum. This is very aggravating, and whilst you can sometimes stop it by tightening up the assembly bolts, there are other cases when it seems quite impossible to do anything with it. I saw one experimenter use a very neat little trick in such a case; he melted some paraffin wax and allowed this to soak in between the laminations, and

when it was "set" it stopped the audible hum completely. Of course, you cannot always use even a little dodge like this because the core is not always easy to "get at."

How Things Change!

Isn't it extraordinary the way things move in wireless, first this way and then that, and then back again to where they started? Firstly we had the two-electrode detector, the Adam of all valves, then came the three-electrode valve which would amplify, then the four-electrode valve, and more recently valves with all kinds of electrodes for all kinds of purposes. Who would have thought that we would suddenly go back again to the two-electrode detector? But this is what we have done for many purposes, one of the most recent being the double-diode triode.

Unit Sets.

When broadcasting first started we had sets which consisted of units which could be added together very much like building-bricks in a child's toy. On the face of it this looked like an excellent system, but it was soon found to be troublesome in practice as well as to have important technical drawbacks. Needless to say, with modern highly efficient sets the drawbacks referred to would have been infinitely more pronounced. There was no such thing as incorporating the loudspeaker with the set. For one thing, loudspeakers of those days were not at all adapted to be conveniently housed with the set, whilst for another thing sets had not then taken unto themselves cabinets suitable for housing anything very particular.

The Craze for Compactness.

As set design developed it became all the fashion to incorporate everything possible within the cabinet, and this soon led to the popularity of the radiogram, with the radio set, gramophone and loudspeaker all in one cabinet. This again brought with it its own problems, not the least of which was the microphonic effect of the loudspeaker on the valves.

A Compromise.

I suppose it would be heresy to-day to suggest that this passion for compactness may go too far. The difficulties met with in putting the loudspeaker in the cabinet have not, in my opinion, been completely overcome, and I think many of you will agree with me that the present-day outfit is really something in the nature of a compromise. A powerful mains-excited moving-coil speaker—none of your permanent-magnet speakers, however efficient they may be, within their limitations, but the real thing, with plenty of juice in the field winding—wants a bit of housing, and for practical purposes is a bit of a "bull in a china shop" inside a radiogram.

I know that mains-excited speakers are so used and with quite a good deal of success, but the point I am making is that there are definite limitations imposed by this condition of compactness. I am thinking of a favourite moving-coil speaker of my own—one of the big fellows that you don't often see nowadays—which I have housed in a special cabinet, built for the purpose, and which it would be pretty well impossible to fit into any likely-looking radiogram cabinet.

(Continued on next page.)

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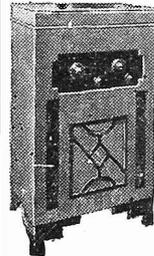
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TECHNICAL NOTES

(Continued from previous page.)

Why Not Separate Cabinets?

The only real solution in a case of this sort is to do as I have done, and that is to have the set and the speaker entirely separate. But it would be funny if there came a swing of the pendulum in this opposite direction, and if we found manufacturers proclaiming the advantages of their separated sets and speakers, and the disadvantages of the all-in-one system! At any rate, if it *does* come it will, in my view, be quite a good move, at least in a considerable number of cases, and it will be just one more of the many paradoxes which we have met with in the last few years of radio development.

Shock Excitation.

Often enough readers ask me why it is that they get a station—a high-power station—at all parts of the tuning dial, whatever type of circuit they use. This is generally due to shock excitation, which means that the impulses are so powerful that they are actually operating on the coil itself as an aerial, and are practically incapable of being tuned.

You may do something towards getting over the trouble by putting screens over your coils (if the coils are adapted for the

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purpose); but if this does not give you what you want, the best thing is to scrap the coils and replace them with properly screened ones.

Heterodyning.

Owing to the large number of stations now operating within the medium broadcasting band, you often get a couple of stations causing a heterodyne whistle; this happens sometimes even if the stations do not actually interfere with one another in the ordinary way.

You can get over this, as a rule, by means of one or other of the types of tone control which I have dealt with in these Notes previously.

If this is not convenient, however, you can use a little intermediate circuit sometimes called a heterodyne stopper.

A Stopper Circuit.

The heterodyne stopper circuit consists essentially of a couple of condensers and a high-frequency choke, the condensers of a

(Continued on next page.)

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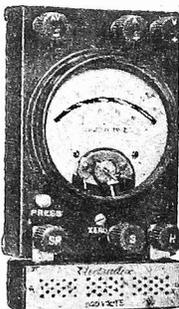


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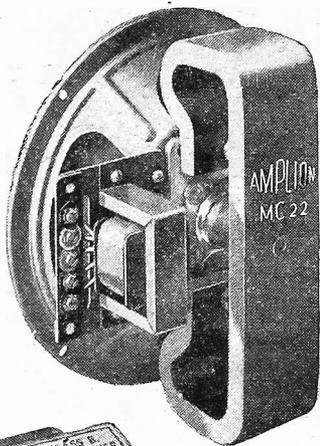
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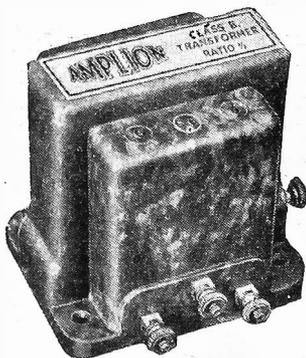
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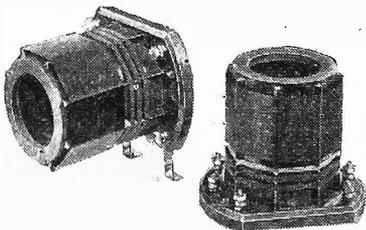


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TECHNICAL NOTES

(Continued from previous page.)

value of, say, .005, whilst the choke should be of fairly high impedance. A choke which is ordinarily used with a screened-grid valve will be suitable for the purpose, and incidentally the impedance of the choke determines to some extent the capacity of the condensers. Anyway, it is quite a simple matter to try different values around that which I have indicated.

The high-frequency choke I referred to is nothing to do with the H.F. choke used with the anode of the detector valve. The choke of this heterodyne stopper circuit is included between the H.F. choke of the detector anode and the primary of the L. F. transformer, whilst the two condensers are connected together in series and shunted across the heterodyne choke. The point between the two condensers should be connected to H.T. negative.

Screened-Grid Detector.

We have heard a good deal lately about using a screened-grid valve as a detector, and several readers have asked me what are the advantages of this system and whether it is worth trying. I should explain briefly that the advantage generally claimed for the screened-grid valve as a detector is that the input damping is low but, on the other hand, there is a tendency for the reaction to become rather "ploppy."

Ploppy Reaction.

This disadvantage of "ploppy" reaction can be got over, as a rule, by means of a fine control of the grid bias, using a potentiometer for the purpose. If this doesn't work you can try taking the reaction from the screening grid instead of from the anode. In fact, this latter method is practically certain to succeed if the potentiometer arrangement does not give satisfaction. It is necessary, however, to use exactly the right voltage on the screen grid, and you will then find that you get a very nice, smooth control of the reaction.

SHORT-WAVE NOTES

(Continued from page 348.)

some time or another by the necessity for keeping it clean and for nipping in the bud that distressing habit that it has of "sprouting" loose and straggly leads all over the place.

The poor old transmitting man has to look after his receiver (possibly two), his transmitter, which, if it is of the crystal-controlled variety, will probably need two power supplies, and a monitor or heterodyne wavemeter. In my case you can add to that a broadcast receiver. When I am "off duty" I do like to listen, whether it be to Henry Hall or to a symphony concert (provided, of course, that it is not one of the B.B.C.'s ultra-modern nights)!

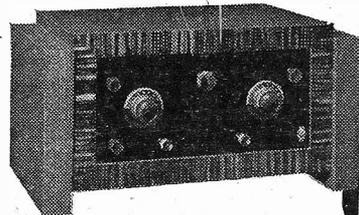
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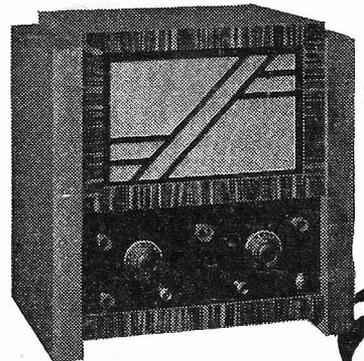
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S.T.500

(Continued from page 343.)

oscillation to a greater or lesser extent, and absolute stability, when obtained, is accompanied by a loss of signal strength. Valves differ very widely in their characteristics—far too widely in my opinion.

We have, however, to budget for things as they are, and a 25 per cent variation either way is commonly experienced. This means that one valve may easily be 50 per cent more efficient than another, and therefore more liable to produce self-oscillation and instability.

Providing for Variables.

Many readers will know that when battery valves were greatly improved in their performance many of the older sets could not be used owing to instability. If valves of a same type by a given manufacturer vary so greatly how much more do different makes of S.G. valve vary?

The set manufacturer issues his receiver adjusted for a given type of valve and even for the actual sample which he sells with the set. No set manufacturer would dream of supplying a receiver without the actual valves carried. We who design for the home constructor, however, must provide for various contingencies. A reader who already has a screened-grid valve is not likely to buy another in order to conform to a designer's recommendation.

In my opinion, a set for the home constructor should have some means of enabling the best results to be obtained from almost any type of S.G. valve. It is absolutely impossible to do this unless some variable control is provided.

Still another variable element in a wireless receiver is the filament voltage and the H.T. A set which will work well with both these at minimum values may be very difficult to operate and liable to instability when the batteries are at full voltage. A set which is designed to work with full voltages will be insensitive when the batteries are below par. But extra controls can accommodate different voltages.

After Years of Experience.

With different valves, different voltages, different aeriels, different districts, different components, the results are bound to be different and bound to be worse on the average. It is little wonder that widely varying reports are often received on what,

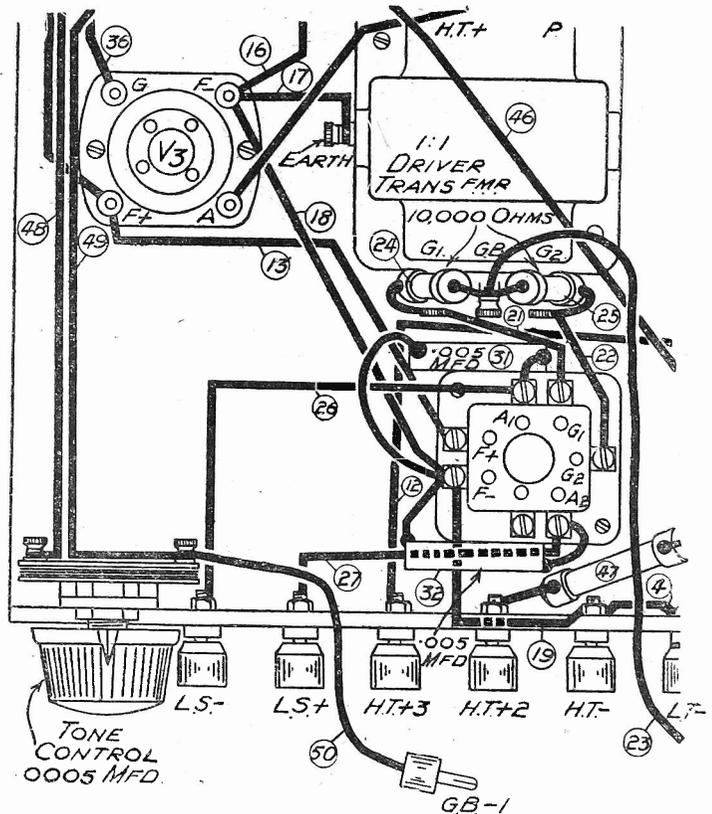
in the original model, was a really good set. Years of experience for designing for the home constructor have taught me that some latitude is essential and that some provision must be made for different conditions of operation.

The Best and Worst of Imitation.

The slavish imitation of the factory-built set is a fatal mistake on the part of designers and would only be justifiable if the designer could service and adjust every set before it was sent out, and ensure that the right valves were in the set. Virtually the receiver would then be a factory-built one.

At the best, the results would equal the factory-built product; at the worst, the result of issuing designs similar to those of a factory set can be disastrous; the widest variations in results are obtained. That poor

FOR A CLASS B SPEAKER



The above is the modification necessary when a Class B speaker is used. Many speakers of the moving-coil type now have extra terminals to enable Class B to be used. There are three such terminals, and the manufacturer tells you which they are: One is connected to the H.T. + 3 on the terminal strip of the "S.T.500." Another of the three terminals is connected to L.S. -, and the third to L.S. +. These latter two terminals on the strip are shown above connected to the anode terminals of the Class B 7-pin valve holder. It will be noticed that the output choke has been removed since it is not needed. The rest of the blue print remains the same, but as a special check I shall reproduce a small edition of the whole blue print as adapted for those buying Class B speakers; a modification of the rapid construction guide will also be given to cover the slight alteration. Practically all constructors, however, will find the above explanation adequate.

results are often obtained is due to the absence of highly technical knowledge, measuring instruments, etc.

Freedom of Home-Construction.

The first requirement of a factory-built set is that it shall be simple in operation, so simple in fact that simple people can work it. No such restrictions apply to the home constructor. The designer, instead of designing down to the lowest common multiple of intelligence, can appeal to the highest common factor of general common sense.

(Next week Mr. Scott-Taggart will contribute a further article on the "S.T.500.")



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