

# The Wireless Constructor

6<sup>d</sup>  
MONTHLY

EDITED BY  
PERCY W. HARRIS. M. I. R. E.

VOL. VI.

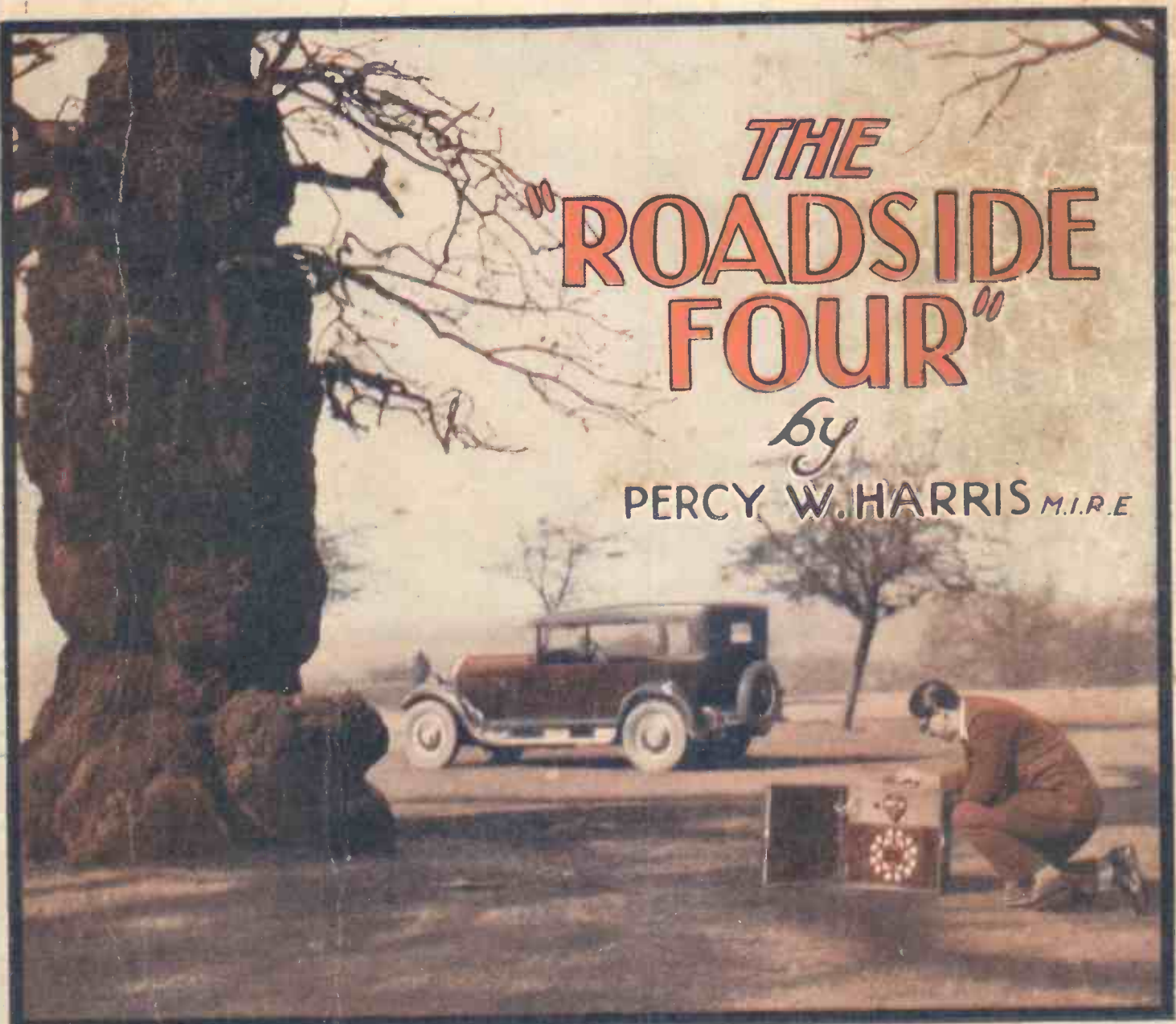
MAY, 1928.

No. 19.

## THE ROADSIDE FOUR

by

PERCY W. HARRIS M. I. R. E.





Always the valve with the wonderful Mullard P.M. Filament — that consumes only 0.075 ampere filament current and that for length of life and purity of reception is unequalled, Always then, the valve for improved radio reception in any receiver. Always Mullard.

# Mullard

**THE · MASTER · VALVE**

ADVT. THE MULLARD WIRELESS SERVICE CO., LTD., MULLARD HOUSE, DENMARK ST., LONDON, W.C.2.

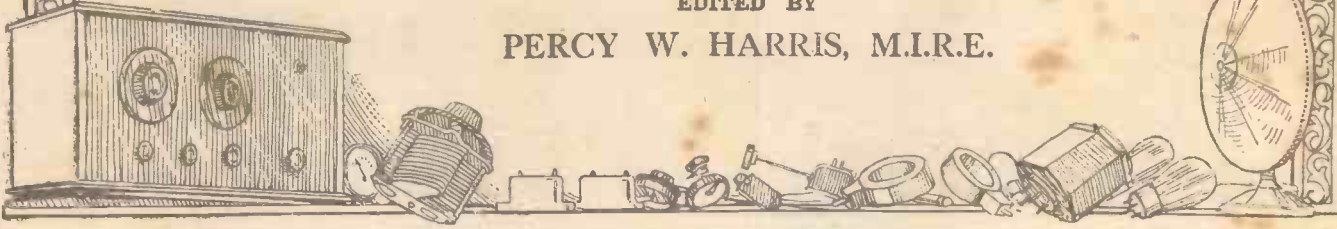
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*As some of the arrangements and specialities described in this Journal may be the subject of Letters Patent, the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.*

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PERCY W. HARRIS, M.I.R.E.



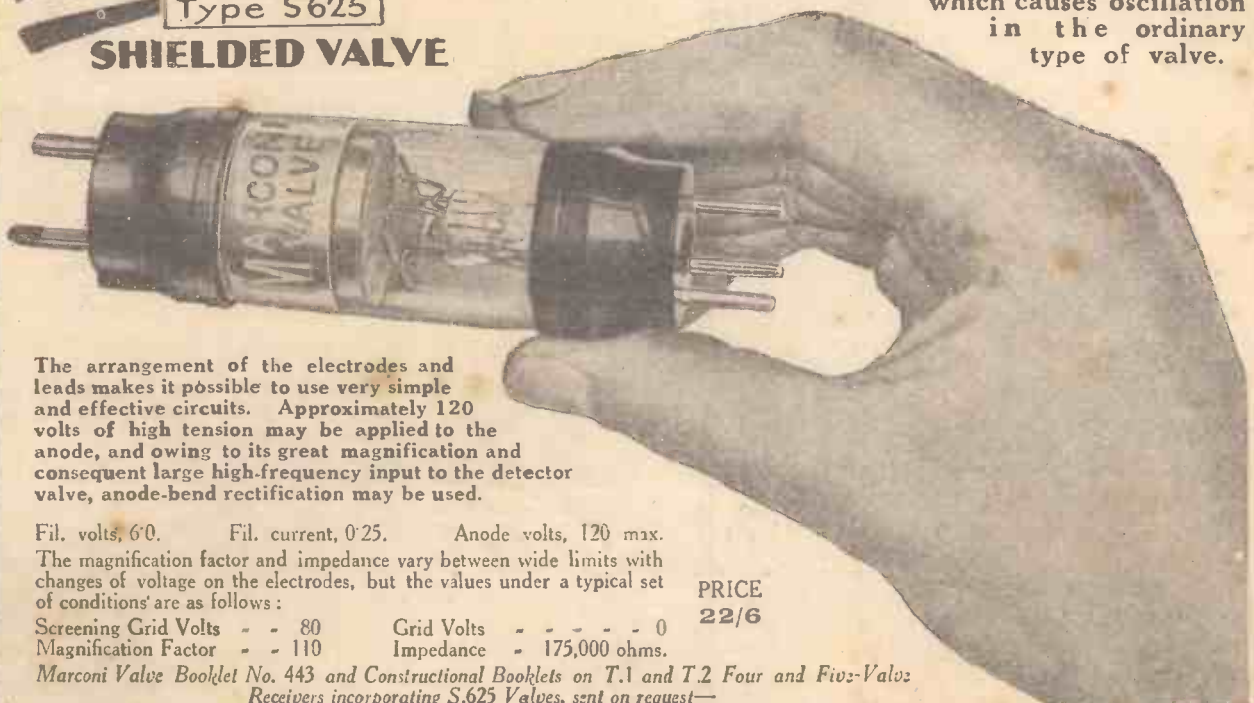
## Marconi

Type S625

### SHIELDED VALVE

Gives an amplification of 30 to 50 per stage, with absolute efficiency and complete stability over a wide band of wave-lengths.

The second grid of Type S.625 overcomes the capacity effects between grid and plate, thus preventing the "feed back" of energy which causes oscillation in the ordinary type of valve.



The arrangement of the electrodes and leads makes it possible to use very simple and effective circuits. Approximately 120 volts of high tension may be applied to the anode, and owing to its great magnification and consequent large high-frequency input to the detector valve, anode-bend rectification may be used.

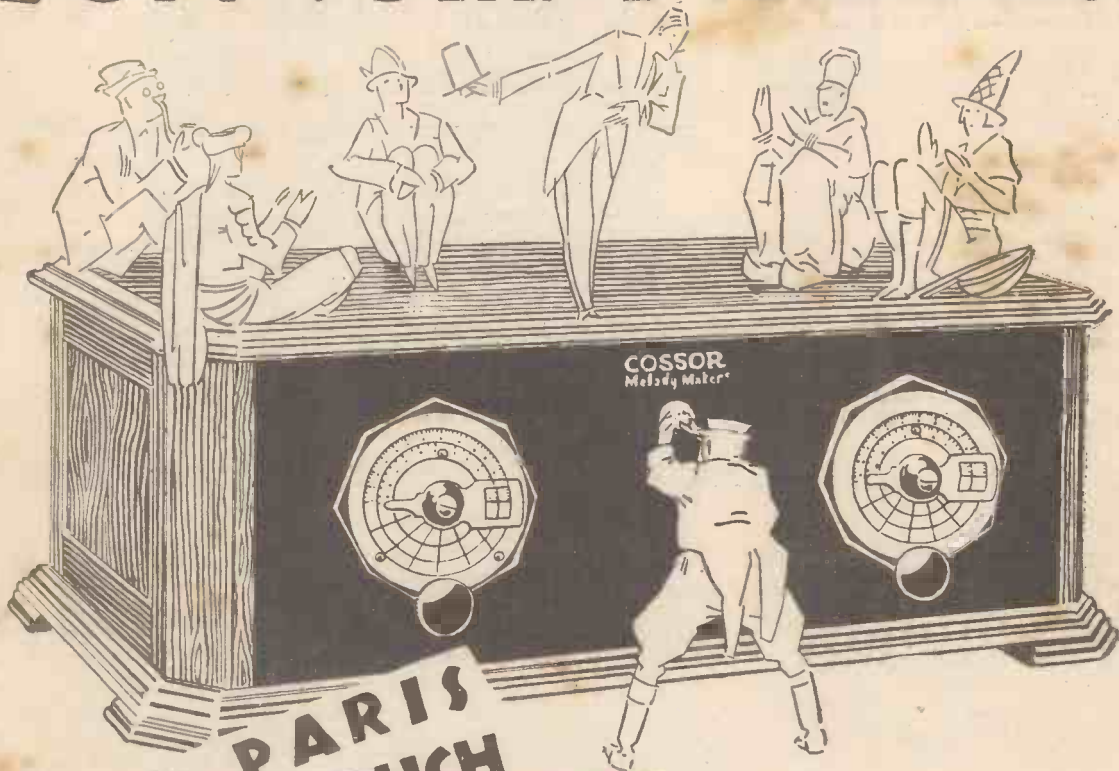
Fil. volts, 60. Fil. current, 0.25. Anode volts, 120 max.  
 The magnification factor and impedance vary between wide limits with changes of voltage on the electrodes, but the values under a typical set of conditions are as follows:

Screening Grid Volts . . . . .	80	Grid Volts . . . . .	0
Magnification Factor . . . . .	110	Impedance . . . . .	175,000 ohms.

PRICE  
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Marconi Valve Booklet No. 443 and Constructional Booklets on T.1 and T.2 Four and Five-Valve Receivers incorporating S.625 Valves, sent on request—  
 (Dept. P) THE MARCONIPHONE COMPANY, LTD., 210-212, Tottenham Court Road, W.1

# "BON SOIR, MESSIEURS"



**RADIO PARIS  
AT THE TOUCH  
OF A SWITCH**

**S**WITCH on—so! Radio Paris at your command! Turn the dial—German, Dutch, Swiss, Italian and Spanish broadcasting as you will. That's how easy Radio is with the wonderful Cossor "Melody Maker."

All over the country thousands have built this famous Set—thousands who know nothing about Radio. You can build it—even if you've never seen a Wireless Set before. Not an atom of Radio knowledge is needed to follow the simple instructions in the chart, "How to build the Cossor 'Melody Maker,'" free from your Dealer. It's as simple as Meccano. There's nothing to hinder you. No puzzlesome blueprint. No soldering to thwart you. Just follow the instructions and in a few hours you'll build a Set that is better than many factory-built Receiver's costing twice the price.

Don't be tied to one broadcasting station. Build a Cossor "Melody Maker" and take your pick of Europe's best. Ask your Dealer for the free chart or send a P.C. to A.C. Cossor, Ltd., Highbury Grove, London, N.5.

**ON THE  
WONDERFUL**

# COSSOR

## "Melody Maker"

Advt. A. C. Cossor Ltd.  
Highbury Grove, N.5

# The WIRELESS CONSTRUCTOR



Published by the Amalgamated Press, Fleetway House, Farringdon Street, E.C.4.

## THE EDITOR'S CHAT

Percy W. Harris, M.I.R.E., the Editor of the "Wireless Constructor," discusses the knotty and topical question of Television.

IN view of the newspaper publicity that has been given to certain television experiments, and the statements that have been made that amateurs can now build their own television receivers, it is only natural that many readers should ask when the WIRELESS CONSTRUCTOR is going to publish designs for television receivers. The answer is quite simple. The WIRELESS CONSTRUCTOR will publish such designs just as soon as—

(1) The practical difficulties of television have been overcome by the inventors themselves, and

(2) There are any practical broadcast television signals to be picked up.

### "Extremely Unlikely"

We yield to no one in our admiration of the persistence of the many inventors who have done so much work to reach the present stage of television, and we wish them all success in their future experiments, but we would earnestly recommend them to try and place a curb on the activities of their friends who so lightheartedly suggest that television is now a practical proposition, and that in a very short time we shall "see by wireless" in our homes. Television, by wire or by wireless, is in a very early laboratory stage, and will not emerge from it until a number of very intricate problems have been solved. The solution of these problems is not yet in sight.

Mr. John L. Baird in this country, the Bell Telephone Laboratories in the United States, and a number of inventors in France, Germany and elsewhere, have all been working for

years on television. By far the best demonstrations yet given have been those of the Bell Telephone Laboratories, a branch of the American Telephone and Telegraph Company, and an extremely wealthy organisation with unrivalled scientific facilities. It is to the credit of this organisation that it has described in detail the apparatus it used and has

discussed quite fully the difficulties both overcome and to be overcome, in contrast to the veil of mystery which seems to surround the practical details of the British experiments. After pointing out that the wireless transmission of television signals requires a much wider band of wavelengths than that used for broadcasting, it states unhesitatingly that

### A Very Loud Loud-Speaker



This super-loud-speaker, which was recently brought over from the Continent, operates on the "moving-coil" principle. It is driven by a 1,500-volt generator and makes a greater noise than the Albert Hall organ. In the open country it can be heard over a distance of five miles.

## The Editor's Chat—continued

"the frequently predicted introduction of television as an adjunct to radio broadcasting without extensive changes in existing arrangements is extremely unlikely."

### The Present Position

All inventors are at present using the same basic idea, namely, the complete "exploration" of the image about sixteen times per second; the translation of the light and shade of the points explored into electric currents which faithfully follow, in variations of intensity, these variations of light and shade; and, finally, the production at the receiving end of a moving spot of light which varies sympathetically in its intensity with the light and shade at the transmitting end. Just how all this is done is explained in an article in the present issue.

Such then is the present position of television. It is nonsense to suggest that we have approached within measurable distance of the time when, even by buying the most expensive apparatus, we shall be able to see by wireless such events as theatrical performances, football matches, horse races, or political meetings.

### The £1,000 Challenge

It is not yet possible to reproduce such things even in the most perfectly equipped laboratory, much less by a general broadcast service, and it is not the policy of the WIRELESS CONSTRUCTOR to encourage its readers to spend ten or fifteen pounds merely to demonstrate to themselves the "principles of television." They can get just as informative a demonstration of the "principles" by swinging a red-hot stick in a dark room.

When television has reached a stage that makes it worth while for the home constructor to try his hand at it, the WIRELESS CONSTRUCTOR will provide its readers with simple, practical designs, just as it has always done with apparatus for the broadcast reception of telephony.

### A FIRST-CLASS "FOUR"

Do you want a first-class design for a highly sensitive four-valve receiver with the following features:

- (1) Perfect Quality.
- (2) High Selectivity.
- (3) Three or four valves at will.
- (4) First-class appearance.
- (5) Wide range of alternatives in components.
- (6) Wonderful distance-getting properties with remarkable purity on the local.

And all for a cost of under nine pounds, including a handsome cabinet, but excluding valves?

If so, go to your newsagent and ask him for the WIRELESS CONSTRUCTOR ENVELOPE NUMBER TWO, containing Mr. Percy W. Harris's "CONCERT FOUR." This envelope contains not only full constructional details, with diagrams and many photographs reproduced on high-grade paper, but a FULL-SIZE BLUEPRINT which alone is worth the modest price of ONE SHILLING AND SIXPENCE charged for the whole envelope.

For PURITY, RANGE AND ECONOMY BUILD THE "CONCERT FOUR."

Meanwhile, it is interesting to note that our contemporaries, "Popular Wireless" and "Modern Wireless," have issued a friendly £1,000 challenge to Mr. John L. Baird and his company to televise images of certain objects such as a clock dial, simple geometrical forms and recognisable human faces, before a committee of

competent observers and scientists. This challenge, made in all friendliness and with the object of clarifying the position, has not been accepted. In the circumstances Mr. Baird and his associates must not complain if their sweeping claims of success, so frequently made, are received with a certain amount of scepticism.

\*\*\*\*\*  
**A READER'S RESULTS**  
*The following interesting letter shows that the "Hale" is still hale and hearty.*  
 \*\*\*\*\*

Sir,—Thanks to the "Hale" circuit and your exposition thereof from time to time, I was able to enjoy hours of W G Y's Saturday evening programme on 379 metres, using a one-valve hook-up.

So good was it that, despite atmospherics, the Morse which is always with us here, and "long" fading, I was able to send W G Y a detailed account of that part of the programme I timed and wrote down.

May I take this opportunity of thanking you for the great and frequent help you have given to us all, from the early days down to the present, in WIRELESS CONSTRUCTOR and "Popular Wireless" (where, of course, I first met the "Hale" circuit).

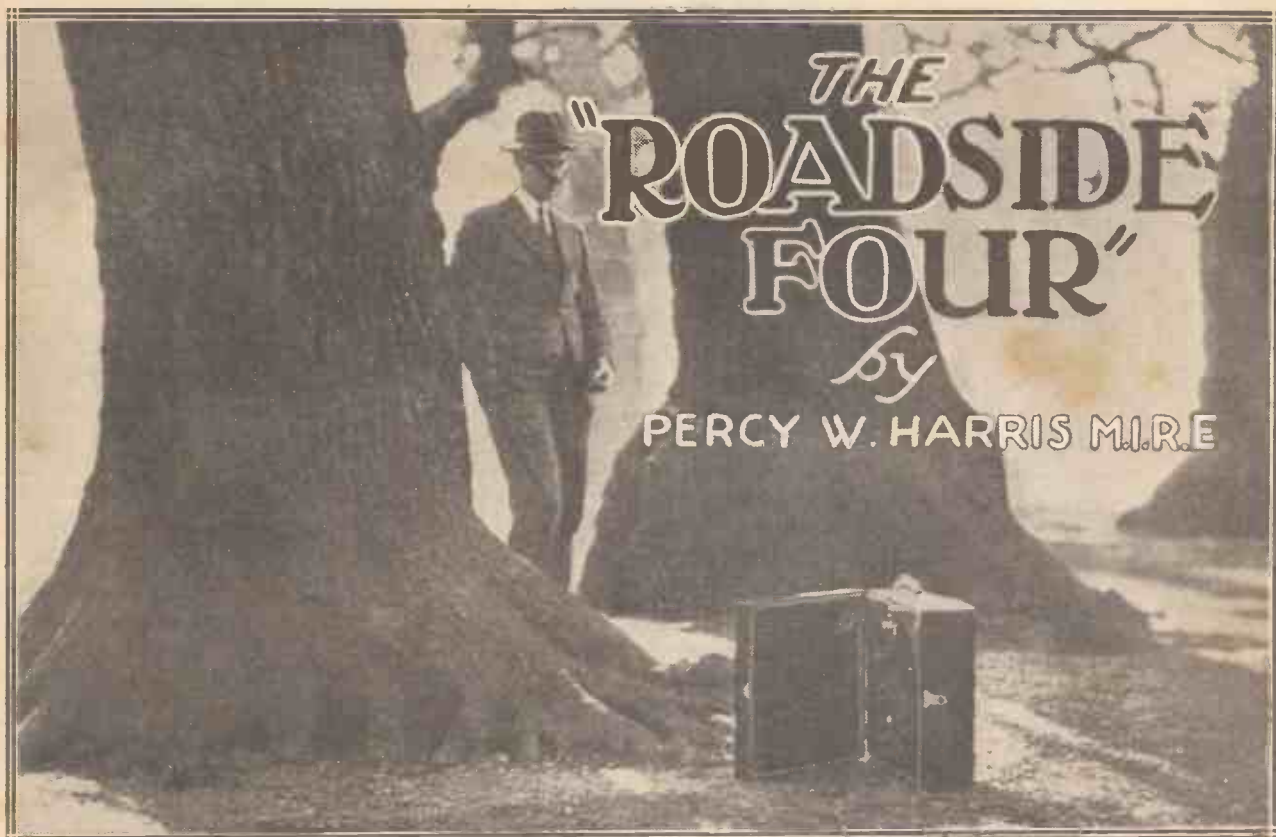
I hope you have not yet found the final development of this fine circuit, and hope to see many more articles from your pen on it, including its short-wave possibilities, which I remember Captain Round hinting at.

Wishing your efforts and journals every success.

Appreciatively yours,  
 Sussex. W. M. CARR.



Great historical event: Discovery of the "moving-coil" loud speaker.



THERE are many jokes about portable sets. The cartoonist has made great sport of the poor user struggling with a huge case which he can hardly lift, and has often poked fun at the manly strength required to shift some of the receivers which pass under the name. Yet ask your wireless dealer which kind of factory-built receiver has had both the largest sale and the greatest popularity during the last twelve months. He will tell you at once—the “portable.”

### Extremely Popular

The reason for this popularity is not far to seek. Portable sets are completely self-contained, with aerial (in the form of a frame), high-tension and accumulator all in one compact case which can be moved from one side of the room to the other, from room to room, and from house to house, with no more trouble than is required to move the average loaded suitcase.

It is just the transportability and general convenience of such receivers which make them popular, not just the fact that they can be used in the open-air. If any proof of this is required it will be found in the large sales of portable sets during the past winter when, heaven knows, the conditions for outdoor reception were

too hopeless to contemplate. At the same time, it is very pleasant on a spring day, or a summer evening, to be able to take a set off the table, slip it into the “dicky” or the back of the car and listen to the broadcast programme in one’s favourite beauty

Although primarily designed for use in the open air, “The Roadside Four” is just as satisfactory for home use. The invalid in the sick-room and the motorist spending a lonely evening at a roadside inn will find this set equally welcome.

spot; again, if the set is really portable and is not too bulky, one does not grudge the space among the holiday luggage, for it is a magic box which will cheerily disperse the awful monotony of a wet day in seaside apartments.

One more advantage is worth mentioning. Who has not, somewhere in the family circle, a sick or elderly relative who would appreciate an evening visit with a really good portable capable of doing justice to the excellent quality now given by all our stations?

You see I have already occupied half a page extolling the virtues of a good portable, and you will naturally realise that I should not waste good space in so doing if I had

not a really good design to present to readers this month. We have not published many portable designs in the WIRELESS CONSTRUCTOR for the reason that such a receiver must stand up to rigorous tests before publication, and it has not been easy to find a design which combined genuine portability with simplicity of handling, adequate performance and really first-class quality of reproduction. Fortunately, the new Harris circuit has enabled a receiver to be produced, and it is now presented to readers of the WIRELESS CONSTRUCTOR with the full confidence derived from months of practical tests, at home, on the road, and even in the railway train.

### Thoroughly Tested

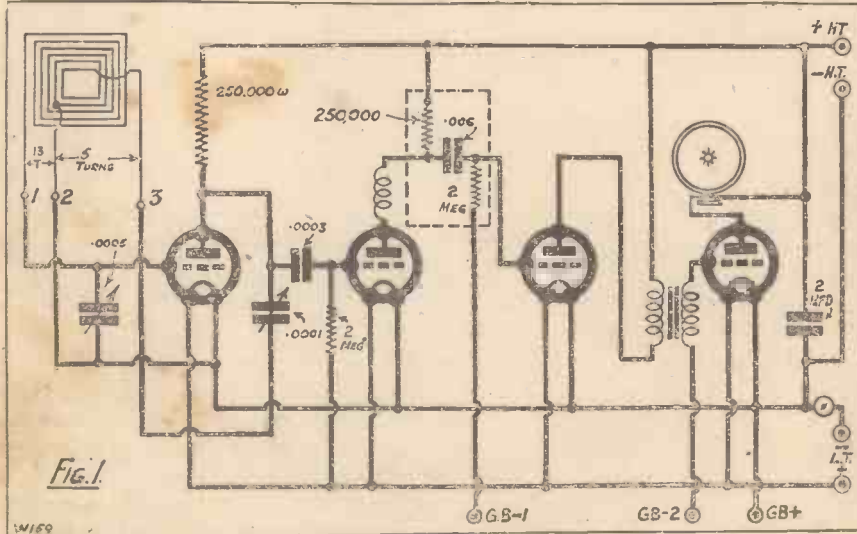
The “Roadside Four” has been seen and tested by dozens of competent critics and experienced wireless men, and they have all been delighted with its performance, its simplicity and practical portability. Your first glance at the magazine this month will have shown you a great deal about it, for there are numerous photographs and drawings which you doubtless perused before reading the text. Like most good things, it is simple, but unless you actually try it, you will scarcely credit the performance it is able to give.

## The "Roadside Four"—continued

At the end of last year, when sitting down to plan a portable set for this summer, I set in front of myself certain requirements which were by no

5. High first cost.  
I therefore said to myself that no portable should be published in *The WIRELESS CONSTRUCTOR* which did

some high-frequency amplification was essential, and, of course, the bulk of the set had to be kept down, as well as the weight.



means easy to meet. A considerable experience of portable sets has told me that most of them suffered from one or more of the following defects.

### Where Many Fail

1. Poor quality owing to inadequate high-tension supply.
2. Extremely short periods for which the set could be run without recharging or replenishing the battery supply.
3. Inadequate volume without overloading the output valve. (This is closely connected to fault No. 1.)
4. Lack of any "reserve" in distance-getting powers and severe limitation of range.

not comply with certain rigid requirements in the way of high quality, distortionless volume, simplicity of handling, and, above all, reasonably long periods between replenishments of batteries.

So far as theory was concerned, one had to choose a circuit which would give proper reproduction on a small frame aerial built into the lid of the cabinet. While the super-heterodyne is practically ideal in this regard, its first cost is bound to be high, while the high and low-tension consumptions are heavier than I considered desirable for this summer's portable. To give adequate range, or, rather, that reserve which I consider so necessary,

### Plenty of H.T.

In the matter of high-tension supply I was determined that nothing less than 90 or 100 volts would be satisfactory, for without this voltage it was impossible to obtain the grid-swing on the output valve necessary to give really good volume without distortion. Considerations of portability and weight made it necessary to choose 2-volt valves, which, fortunately, are greatly superior to those available even twelve months ago. With 90 or 100 volts high-tension one can use about 9 volts grid bias on the modern 2-volt output valve, and this will give really excellent production without distortion.

Starting then with the decision to use 2-volt valves and 100 volts high-tension, together with an unspillable accumulator, the next point was "How many valves?" If too many valves are used the accumulator requires far too frequent re-charging. If too few valves are used one can obtain neither volume nor distance. Two stages of note magnification are essential for loud-speaker work in a portable set; one must have a detector, while one stage of high-frequency brings the figure to four.

### The Harris Circuit

Four valves were therefore decided upon, reaction being used to add further to the sensitivity of the set. The Harris Constant Reaction Circuit seemed ideally suitable for this set,

### WHAT YOU WILL NEED

- 1 Portable cabinet with an interior measurement of 16 in. x 16 in. x 5 in., with a lid 2 in. deep internally. Interior wood fittings according to dimensions given in the drawings (these are supplied with Cameo cabinet).
- 1 Amplion cone assembly, type A.C.13, oak.
- 1 On-and-off switch.
- 1 Ebonite panel measuring 16 in. x 5½ in. x ¼ in. (Ebonart).
- 2 Brackets for same (Magnum).
- 1 Variable condenser, .0005 mfd. (Bowyer-Lowe Popular).
- 1 Vernier dial for same (Polar, Raymond).
- 3 Clix plug sockets.
- 3 Clix plugs for same.

- 1 .0001-mfd. variable condenser (Cyldon Bebe).
- 1 Small knob for same.
- 1 Pair grid-battery clips.
- 1 Clix spade terminal (red).
- 1 Clix spade terminal (black).
- 2 Clix wander plugs (red).
- 3 Clix wander plugs (black).
- 1 2-mfd. Mansbridge type condenser (Dubilier, Lissen, Mullard, etc.).
- 4 Anti-phonics valve sockets (Pye).
- 2 Grid-leak holders (Dubilier Dumet-ohm).
- 1 R.C.C. unit (Lissen). (The resistances supplied in the R.C. unit should be 2 megohms for the leak and ¼ megohm for the anode.)
- 1 Combinator (Lissen).
- 1 Fixed condenser, .0003 mfd. (Lissen).
- 1 L.F. transformer (Mullard).

- 1 Radic-frequency choke (Climax, Igranic, or similar compact type).
  - 2 Grid leaks, ¼ megohm (Dubilier, Lissen, Mullard, etc.).
  - 1 Grid leak, 2 megohm (see above).
  - 1 Ripault high-tension battery, CM 99 volts. At 100 hours a month, this battery should last between three and four months.
  - 1 Oldham 2-volt accumulator, type GL4. This has a 14-ampere-hour-actual capacity, and as the set takes .45 of an ampere, one charge will give about 20 hours' continual use. This means 10 days at 3 hours.
  - 1 9-volt grid-bias battery (Lissen).
- Glazite wire for wiring up, and a few feet of flexible rubber-covered wire for the flex leads.

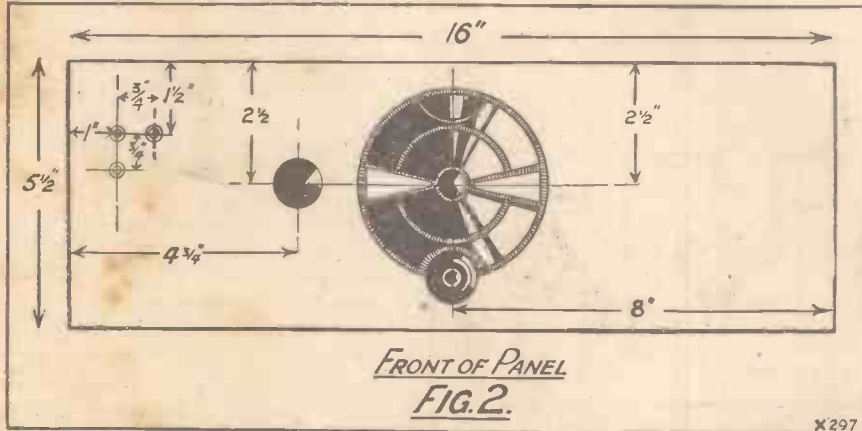


## The "Roadside Four"—continued

for the components required are few, the space occupied by the parts small, and by using in the note-magnifying end one resistance and one trans-

by the makers. The high-tension consumption of the "Roadside Four" is 7 milliamperes, and as this is the maximum discharge rating of the

A definite make of battery coming within very close limits of size had to be chosen, for the casing must be made to fit this one particular battery. The ingenious reader, by departing from dimensions given, may be able to include other makes of batteries, but if the receiver is built according to the measurements given here, the Ripault of the type indicated *must* be used.



### The Cone Loud Speaker

Similarly the dimensions are made to fit the Amplion cone assembly, type A.C.13, oak. The cabinet with wooden former for the frame aerial is a standard Camco portable. The interior wooden framework can easily be built by the home constructor himself, and for this reason full dimensions and working drawing are given, but if the Camco cabinet is obtained (other makers also supply the same size which is suitable for this set), the makers have undertaken to supply the inner wooden framework complete to the specification in this article.

At the same time, any reader who is handy at carpentry should be able to make up the whole cabinet together with the wooden framework, so there is plenty of room for ingenuity. I made the original interior framework from odd wood.

former-coupled stage, both space and weight were easily kept down. During my experiments the new Mullard transformer came along, and as a new principle has been adopted in building this transformer, enabling excellent quality to be obtained with remarkably small weight, its inclusion in the "Roadside Four" was decided upon as soon as it had undergone tests to prove it was really a first-class component.

In a portable of this nature the choice of components is more than ordinarily important, for space, weight and disposition of parts have all to be considered. In order that first-class quality should be obtained I decided to use a cone type of loud speaker, and the Amplion cone assembly, specially designed for portable sets, was soon selected. A good unspillable accumulator of adequate capacity appeared in the Oldham, type OL4, and the particular shape and compactness, together with the very high efficiency of the Ripault 99-volt high-tension battery, type CM, made the selection of this an easy matter.

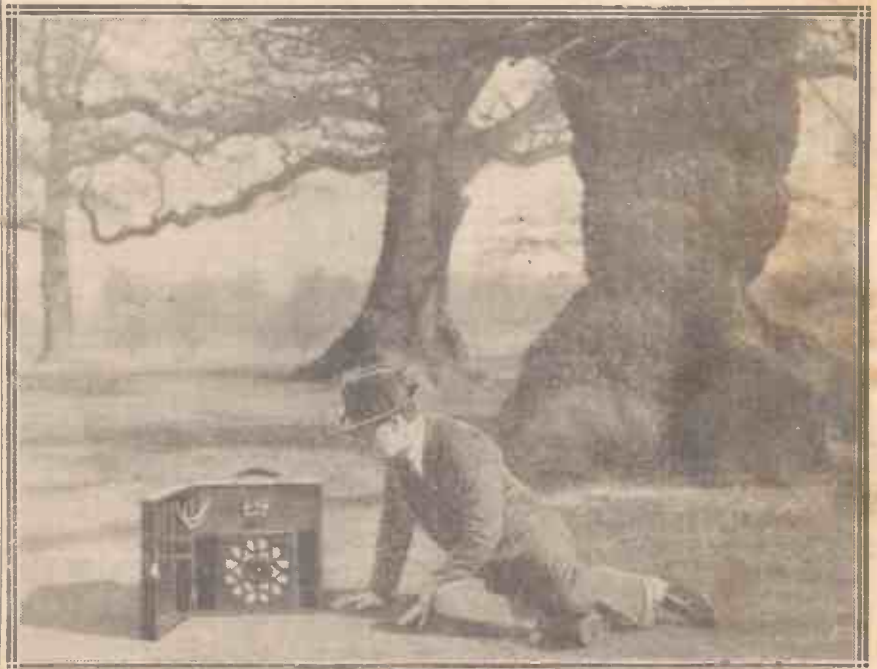
### Small Anode Current

Many portable sets attain their portability by a sacrifice of high-tension size, either in capacity or in voltage, and I was most particularly desirous of choosing a battery of sufficient voltage to give me what I wanted together with an adequate capacity to enable the set to be run without discharging the battery over and above the figure recommended

particular Ripault battery chosen, the user has the satisfaction of knowing that he is running it on a load which the battery is really designed to stand.

### An Important Point

Unfortunately there is no standardisation of size or shape in high-tension batteries, and I would like to point out at this juncture that the choice of the particular battery in this receiver must not be taken as a reflection upon the quality of other makers' batteries.



Mr. Percy Harris testing the "Roadside Four" under the conditions for which it was designed. As a holiday companion the set is ideal.

# The "Roadside Four"—continued

The frame aerial is wound on a wooden former which fixes snugly inside the lid and is connected to the receiver itself by three Clix plug

that described this month, so that the stations in the 5 X X range can be received.

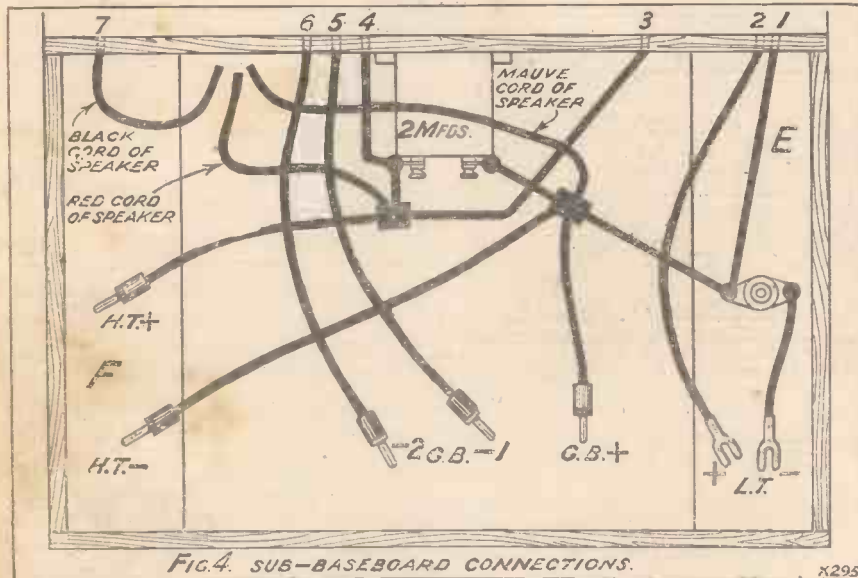
Most readers, however, will be

simply by changing the frame, and no other alterations are needed in the set, for there are no other coils to be changed. It is one of the features of this set that there are no coils whatever within the receiver, the frame being the sole coil used.

## How Circuit Developed

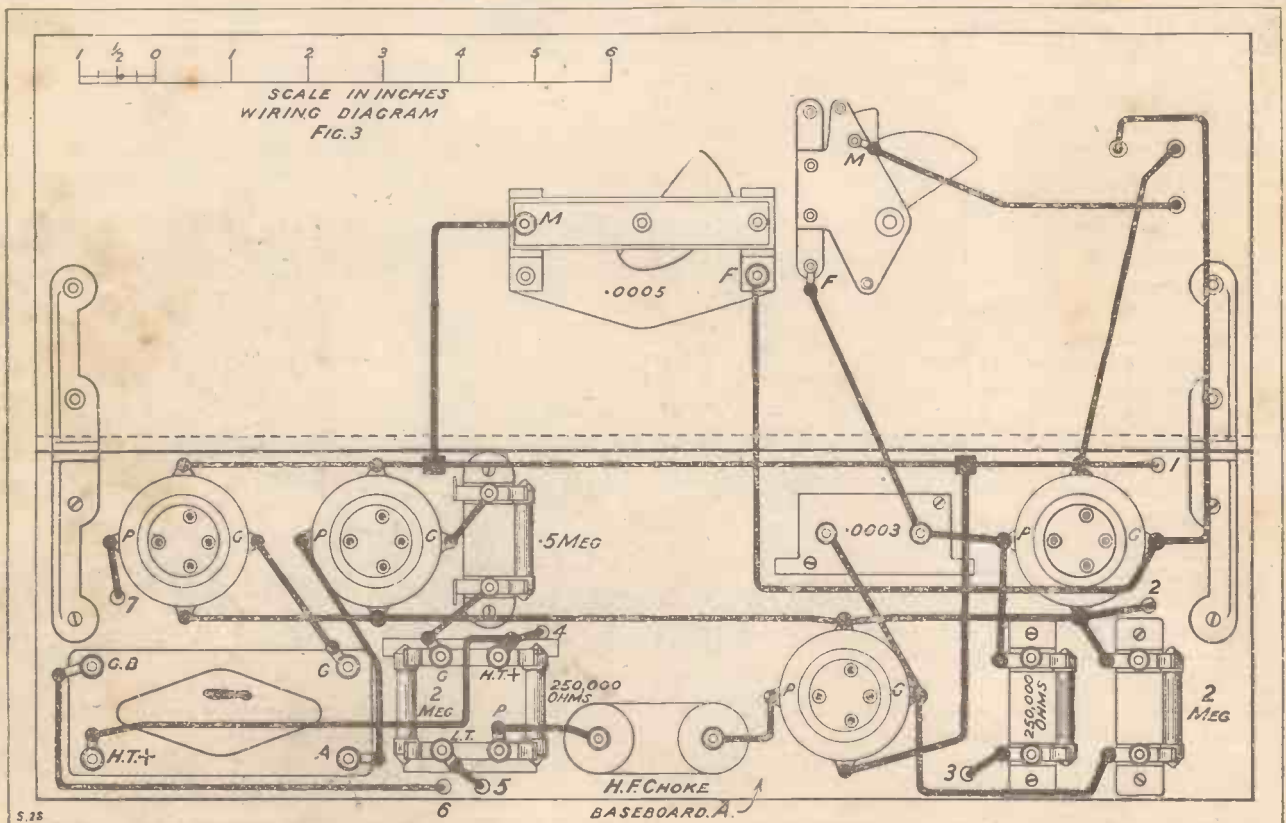
Before proceeding with the constructional work, I must tell you some of the interesting features of the circuit which were discovered during the preliminary experimental work. Readers of the article describing "The Business Man's Four" will be acquainted with the general principles of the Harris circuit, which uses a resistance stage of high-frequency amplification and a double reaction effect, on the detector circuit and on the high-frequency circuit, giving constant reaction over the whole range. The great importance of spacing of parts is emphasised once again in this article, and it will be remembered that "The Business Man's Four" was a well-spaced receiver, occupying a fairly large cabinet.

In its first experimental form "The Roadside Four" used a circuit made



sockets. This month I am giving particulars of a frame for the ordinary wave-length band, but tests are now being completed on a separate frame which can be substituted at will for

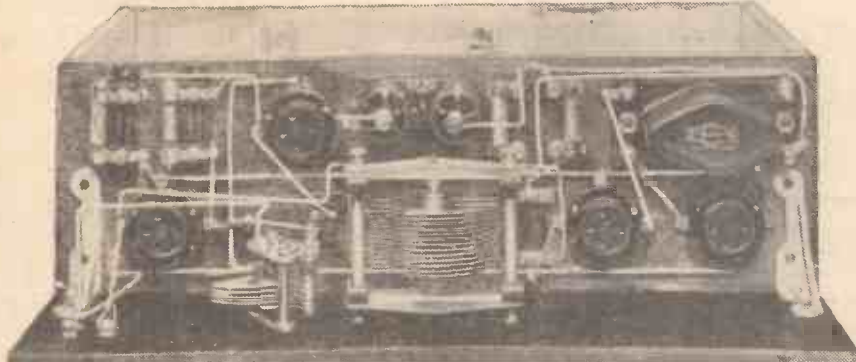
content to use the set on the ordinary band, which includes 5 G B and their nearest station. It is satisfactory to note that the change from the lower band to the 5 X X range is made



## The "Roadside Four"—continued

up identically with that in "The Business Man's Four," but, of course, in a much more confined space. It was found, however, that when the

Any slight lack of balance is easily adjusted on the Reinartz condenser, which is brought out to a small knob on the front of the panel, but in



A plan view of the components on the top shelf of the set, showing how compactly everything is arranged. The wiring is not at all difficult to carry out.

reaction was critically set any movement of the frame so close to the receiver itself occasioned variations which, while slight, were occasionally sufficient to make the set go into oscillation, or, in the other direction, to take the receiver too far away from the most sensitive point. When one is using reaction with a frame aerial there is an enormous increase in sensitivity in the last critical setting, so it was decided to make the first, or Reinartz, condenser setting adjustable from the front by means of a small knob.

### One Condenser Eliminated

This did not mean that we lost the constant-reaction effect, but that a last critical setting could be made when desired to get a distant station. The constancy of reaction of the set is indicated by the fact that one can turn from London to 5 G B and get both on the speaker without any alteration of the reaction setting. At the same time, by its use it is possible after dark to get quite a number of continental stations quite clearly on the speaker.

We now come to a still more interesting point. It was found that by rearranging the parts as they are shown in the final wiring diagram it was possible to dispense entirely with the condenser used to feed-back from the plate of the detector valve to the grid of the first valve, as the close spacing of parts gave just the amount of feed-back capacity required to balance the reaction effect of the first condenser.

practice it will be found that one rarely touches this knob save for long-distance searching and getting the very last ounce of volume out of the station to which one is listening.

### Results Obtained

For the reason just given, the actual spacing of parts is very important, and if you try to put together this receiver on a different shape of base-board, with an entirely different set of components, you must not expect to get the constancy of reaction which characterises this set.

There being but one tuning control, you will naturally choose a vernier dial of the type with indicating window, so that the actual position

of the station tuned in can be marked once and for all. On my dial I have indicated the following stations permanently: 5 G B, Langenberg, Frankfurt, Stuttgart, Toulouse, London, and Munster, as after dark I have always been able to bring these in on the loud speaker, although, of course, conditions vary from night to night, and sometimes they are much louder than at others. Quite frequently, however, Langenberg, Munster, and Frankfurt have all been heard as loud as anyone could wish for a small room, while at times a number of other stations have been picked up, all, of course, on the loud speaker, for there is no means of attaching headphones to this set.

### Wide Reserve of Power

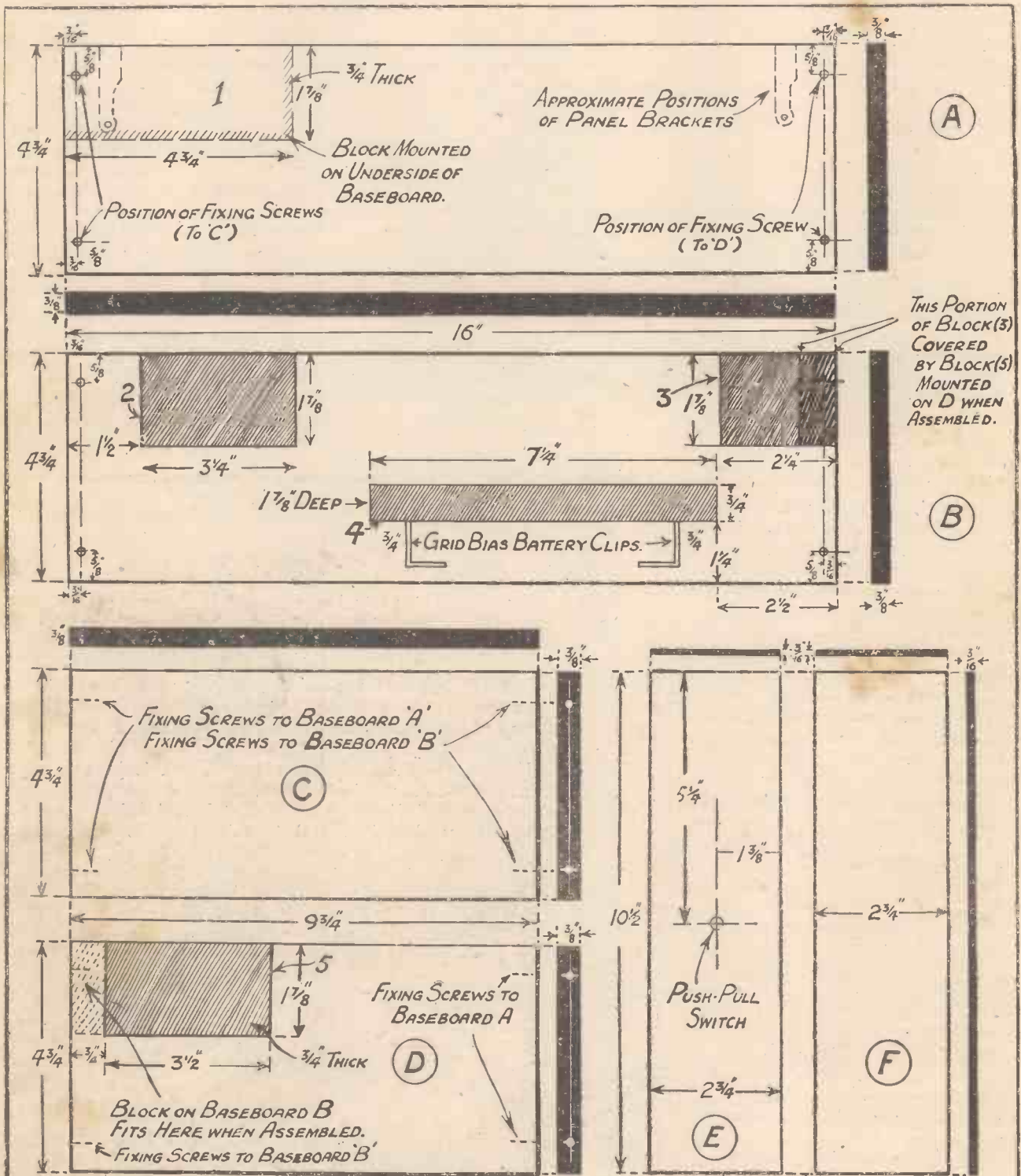
The fact that the receiver will bring in these stations is an indication of its wide reserve of power, for it is primarily intended to receive the nearest station only, together with 5 G B. Tested at 25 miles from London, both that station and 5 G B gave full loud-speaker strength in daylight, while, with careful and critical testing, Langenberg has been found to be just audible in daylight wherever I have tried the set, including tests in the steel-framed building of the Amalgamated Press, Ltd., Fleetway House, Farringdon Street, London, where this journal is published.

It must be pointed out, however, that this daylight reception of



A roadside halt with the "Roadside Four." Listening to a programme from 2LO during a week-end trip.

The "Roadside Four"—continued



DETAILS OF FRAMEWORK.

FIG. 5

## The "Roadside Four"—continued

Langenberg is not properly termed loud-speaker reproduction—one can just hear the words of the announcer, and can recognise what he is saying if one has a knowledge of German, while, of course, music can be heard distinctly. After dark, however, it is quite another story, and one can frequently enjoy the programmes from two or three continental stations. Do not forget, however, that this is not a regular occurrence, for one is very much dependent upon wireless conditions at the time of listening. I have not the slightest doubt that a very large number of readers will be able to log at least a dozen stations as having given loud-speaker reproduction at one time or other on "The Roadside Four" after dark.

### Concerning Construction

So much for performance. Let us get down to the constructional work for which, by this time, you will no doubt be impatient. You saw the list of components. No list of alternatives is given, for in such a receiver as this it is better to adhere to the actual parts named, for reasons already given. In a number of cases, however, (such items as on-and-off switch, vernier dial, valve holders, radio-frequency choke, R.C.C. unit, Mansbridge type condenser), any good recognised types can be used.

I do not advise the use of any other make of variable tuning condenser or reaction condenser, for the actual geometric form and the amount of metal in them have a bearing on the distributed capacity effects. Space considerations rather limit the choice of the low-frequency transformer, as most of the good makes available are rather too large for the baseboard spacing allowed.

### Mounting Components

The constructional work in this receiver is exceptionally easy. After you have either made or obtained the necessary wooden framework, fit the blocks in place for the batteries, as indicated in the drawings and photographs, attach the loud-speaker assembly and stand the framework aside for a moment. Now take your panel and drill it to take the holding screws for the brackets, the three Clix sockets, the two variable condensers, and the vernier dial. Notice in the drawings and photographs

that the panel mounts flush on the top of the wooden frame and does not overlap any part of it.

When you have drilled the panel, mount the components on it and, together with the brackets, stand it temporarily in position on top of the wooden frame. Now set out your various component parts as illustrated, being sure that nothing fouls, and screw the parts into position. Do not yet attach the panel, which can be taken from its temporary position and laid aside for the time being.

You will now need to drill some holes through the top of the frame. Starting from the right and looking at the frame from the back, the first hole will be close to the first valve

socket (between it and the first Dumetohm holder), the next will be close up against the panel (or where the panel will be) and near the right-hand bracket. The third hole will be near the back end of the frame, close to the second Dumetohm holder. The fourth hole will be behind the R.C. unit and between it and the Combinator. The fifth hole will be near the edge of the R.C. unit, and the sixth hole just by the plate tab of the last valve holder.

### The On-Off Switch

Attach the Mansbridge type condenser to the underside of the top of the frame, and wire up as far as you can go without attaching the front panel. A rigid lead is taken from the



The design of the set is so arranged that the batteries can be removed for inspection or renewal in a few moments, without having to fiddle about among a lot of wires and odd components.

## The "Roadside Four"—continued

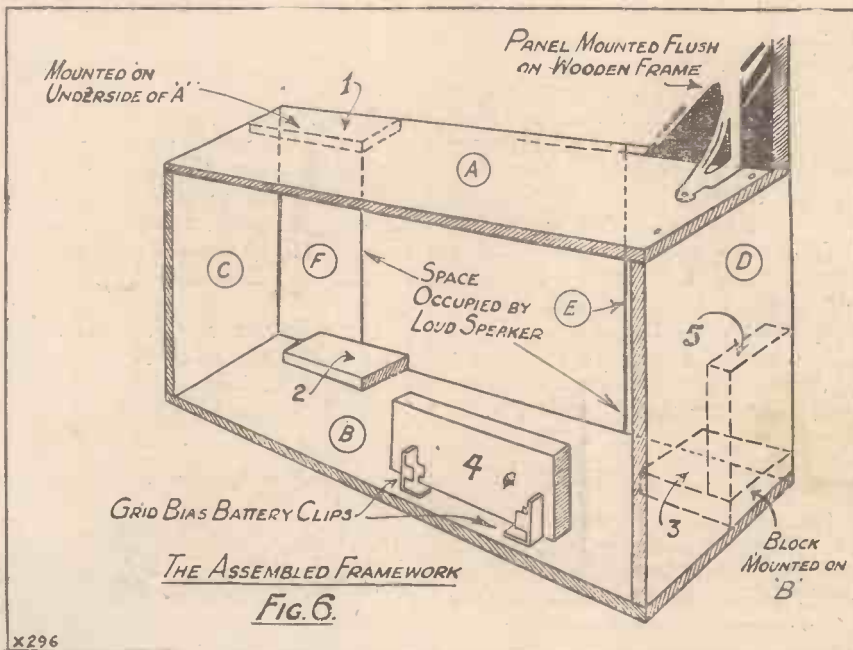
hole close to the panel down to one side of the on-and-off switch, and from there to one side of the Mansbridge type condenser. From the opposite side of the on and-off switch a flexible lead, terminating in a black Clix spade terminal, goes to the accumulator, while the other side of the accumulator is joined by a red Clix spade terminal to a flexible lead which comes up through the baseboard and is joined to the common positive lead which runs to all the valves.

### No Resistors

Notice that no fixed resistors are used in this set. A flexible lead is also taken from the same side of the Mansbridge type condenser as that which is joined to the on-and-off switch, and this flexible lead terminates in a red Clix wander-plug. I recommend the Clix wander-plugs in this set because they are springy and grip into the holes, and are not likely to jump out with vibration. The same point, too, is also connected to a flexible lead terminating in a black Clix wander-plug, which is plugged into the negative socket of the high-tension battery.

By now you will have noticed that the cone loud-speaker assembly has three leads. One is red, the other is

while the purple cord is attached to the framework of the loud speaker for "earthing" purposes. This purple



black, and the third purple. The red and the black are the usual positive and negative leads of the loud speaker,

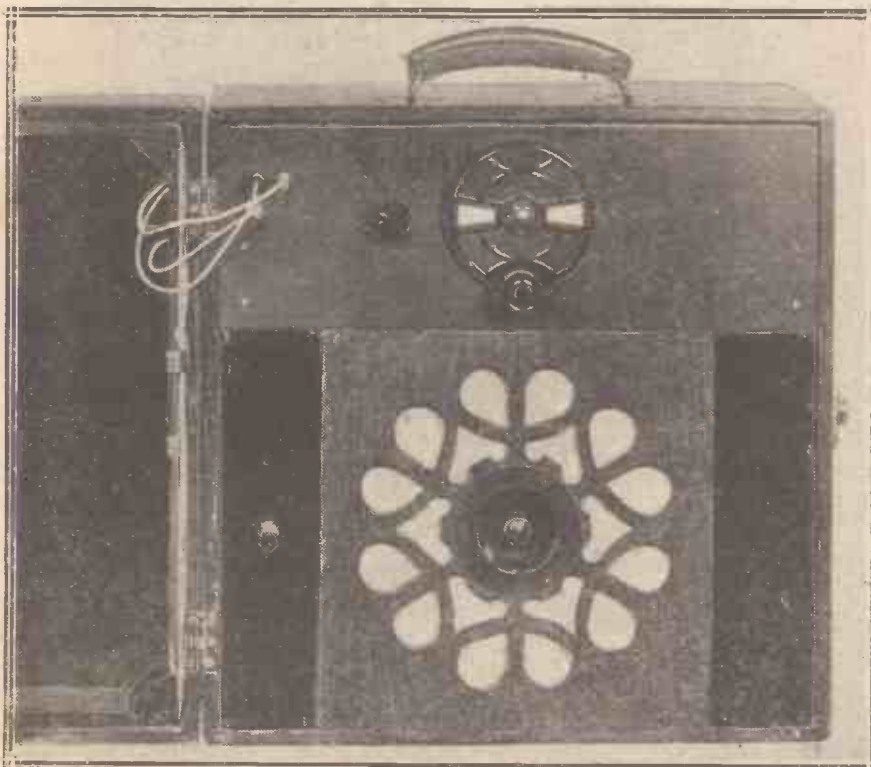
lead is connected to the Mansbridge condenser, as shown, and through this, of course, to the negative L.T. of the battery. This tends to give stability and freedom from howling in a set such as this.

The terminal of the Mansbridge type condenser to which we have not yet referred is connected by a stiff lead to the second Dumetohm holder and to the R.C. unit as well as to the red loud-speaker lead. The only further lead on this side of the Mansbridge type condenser is a flexible lead to a red wander plug making connection to the positive socket (99 volts) on the high-tension battery.

### Completing the Wiring

A pair of flexible leads is also taken through the top of the baseboard to the two black wander-plugs for grid bias negative. One of these leads goes to the grid-bias terminal of the R.C. unit and the other to the grid-bias terminal of the low-frequency transformer. The black loud-speaker lead is taken through the remaining hole in the top of the baseboard to the plate socket of the last valve.

Be particularly careful of the wires used on the high-frequency side and follow the exact layout and, as far as possible, the disposition of the wires as shown in the photographs and



Note the three connecting leads from the frame aerial in the lid, the one tuning dial and the reaction control. The on-off switch is on the vertical panel to the left of the loud speaker.

## The "Roadside Four"—continued

wiring diagrams. Owing to the necessity of showing all the wiring in one plane the wiring diagram does not

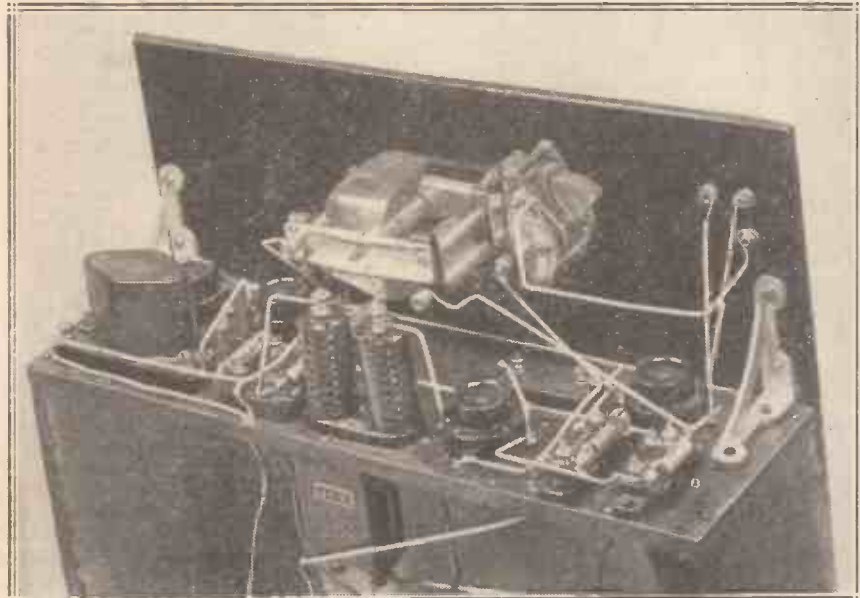
Having regard to the special conditions of this receiver, I would recommend for the first socket either a

Mullard P.M.1 H.F., the Six-Sixty S.S.210 H.F., or the Marconi or Osram H.L.210. For the second socket a Mullard P.M.1A, or S.S.210 R.C.

For the third socket I have had excellent results with all the makes of 2-volt H.F. valves, while in the output any of the makers' 2-volt power output valves work well, but one should choose a valve which has a filament current of not higher than 15 ampere. The Cossor Stentor Two, the Marconi and Osram D.E.P.215, the Mullard P.M.2, and the Six-Sixty 215P are all excellent valves here.

### A Valuable Tip

Occasionally in every make one gets a valve more microphonic than others, and as the valves are so close to the loud speaker, and the cabinet itself forms a resonating chamber, valves which would be quite satisfactory in ordinary types of sets sometimes give trouble in a portable. Fortunately, I have found a cure



*The simplicity of the whole arrangement will appeal to all home-constructors.*

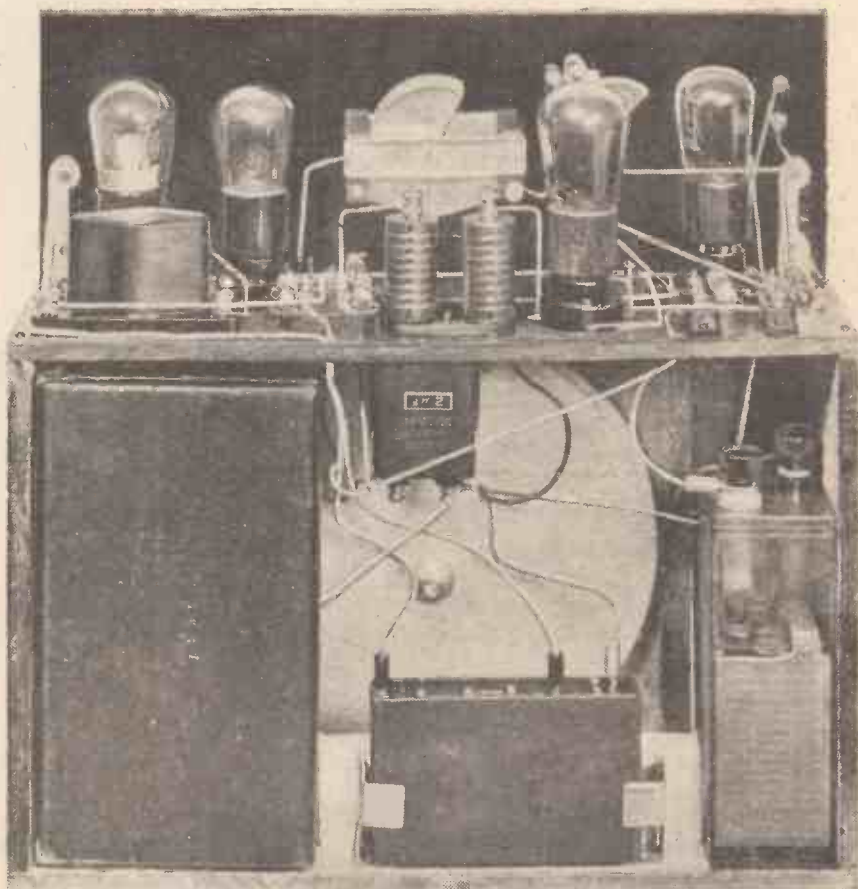
give the exact shape of the wires, and these can be better followed by examination of the photographs.

After everything has been wired up, it is a very simple matter to fit the batteries. Notice that the high-tension battery goes into the case with sockets towards the loud speaker. For this reason the plugs should be inserted in the battery before it is put in the case. Be sure that you connect the accumulator correctly to the positive and negative leads. The red Clix wander-plug of the grid-bias battery is put at the positive side, which in a Lissen battery is marked 9.

### The Choice of Valves

The black wander-plug connected to the grid-bias unit is placed two sockets away from the 9 (6), while the wander-plug connected to the low-frequency transformer can be placed in the extreme negative socket. This gives a grid bias of nine on the power valve and three on the first note-magnifying valve.

The choice of valves is rather important in this set. Two-volt valves are used throughout. The first socket should have preferably an H.F. valve, the second an R.C. valve, the third an H.F. type valve, and the fourth a power output valve. In such a set as this one has to be particularly careful of microphonic effects.



*This photograph gives a clear idea of the layout. Note the positions of the batteries and the loud speaker—all the rest of the set being mounted on the platform.*

## The "Roadside Four"—continued

for practically all the microphonic valves that I have tried, and it is one that I can recommend not only in a portable set but in any set where this trouble arises.

It should be remembered that much of the microphonic valve trouble in a set such as this comes from vibrations that are transmitted

.....  
 " . . . It is very pleasant on a spring day, or a summer evening, to be able to take the set off the table and to listen to the broadcast programme in one's favourite beauty spot."  
 .....

through the air to the glass of the valve. The anti-phonic valve holders are useless for stopping this particular trouble. Where these holders are so useful is in stopping the vibrations through the baseboard and in generally protecting the valve from shock.

The tip is very simple and cheap. Go to the nearest toy shop and buy a penny stick of "Plasticine," which is used for modelling. Take a piece of it and roll it into a ball as big as a halfpenny in diameter. Now place this ball in the palm of the hand and press it with the thumb so as to form a kind of dish. Turn this "dish" upside down on top of the valve, forming a kind of cap, and you will find it will stop the trouble in practically every case.

### Another Remedy

If this does not completely cure the trouble at first trial, increase the size of the Plasticine cap. It is only the first and second valves which are

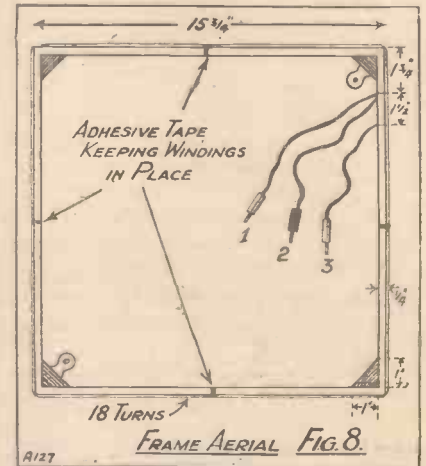
likely to give this trouble, and it only occurs occasionally with certain valves.

It is also useful to glue a strip of cotton wool along the inside back of the cabinet (upper half). This obviates any trouble which might be due to the effect of the sound waves reflected from the walls of the cabinet.

### The Frame Aerial

The only remaining constructional point is the frame aerial. Fortunately this is very simple. Take ordinary single rubber-covered flexible wire and wind on the turns according to the diagram, threading the beginning of the wire through a hole in the frame and terminating it in a plug. After you have wound on the larger number of turns, attach a lead to this point and thread it through a second hole in the frame, terminating it with a second Clix plug. Carry on the winding for the remaining turns, and thread the end through a third hole in the frame, terminating this also with a Clix plug. The beginning of the winding plugs into the socket connected to the grid of the first valve, the conclusion of the larger number of turns (where the tapping is taken off) goes in the socket joined to the filament of the valve, while the end of the winding goes into the socket joined to the '0001 reaction condenser. The turns of wire for the frame can be held in place by binding them to the wooden frame with electricians' sticky tape. The frame is then secured inside the box with a couple of small brass plates.

When all is ready and the batteries are connected up you have only to slide the whole framework into your carrying-case and to plug in the frame aerial leads into the three sockets on the front of the panel.

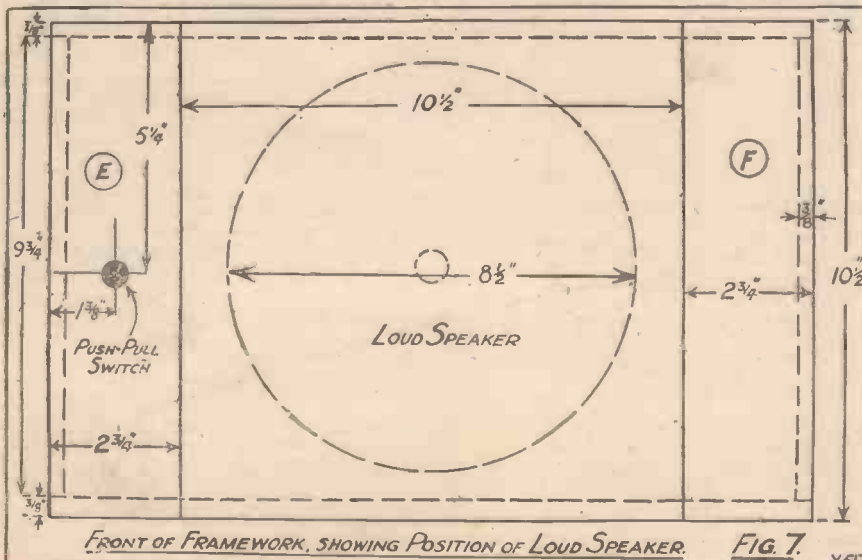


Set the reaction condenser at zero, and then try the reaction effect. A slight rushing sound in the loud speaker will indicate when the set is oscillating. Turn the reaction condenser below the oscillating point and rotate your tuning dial. You will soon pick up your nearest station, and then with a little adjustment of the reaction knob you can bring it in at excellent volume. Now search about and find other stations. If it is after dark, you will be able to pick up carriers of a large number by making the set oscillate slightly.

### Surprising Quality

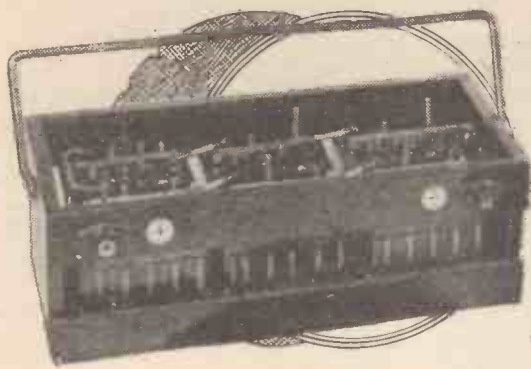
The fact that you are working on a very small frame aerial will prevent trouble from oscillation, but if there are other listeners working very close by you may disturb them. As a matter of fact, once you have set the reaction condenser to a sensitive position, you will be able to do a lot of searching without touching this adjustment and without oscillating. If you only intend to listen to one or two stations you need never touch this knob after its first adjustment.

I am sure you will be astounded at the excellent quality and volume obtainable from your nearest station with this receiver. Reports of the results obtained by readers will be greatly appreciated, for they are of more than ordinary interest with a set such as this.





# The Case for the H.T. Accumulator



Following on Mr. Hallows' article entitled "A Searchlight on the H.T. Battery," a "Wireless Constructor" correspondent puts the case for the accumulator type of anode-current supply.

By a Correspondent.

THE article in the February number of the WIRELESS CONSTRUCTOR, by R. W. Hallows, on high-tension batteries, is very illuminating and throws light on many a failure of reception in volume, clearness or tone. One cannot

when given 21 hours' rest between each 3 hours' discharge—20 to 40 days' work. It is simply foolish to expect a small cell to do work that will call heavily upon the powers of a much larger one. A three-valve set with a loud speaker needs a large dry high-tension battery or a small accumulator battery.

As Mr. Hallows points out, few people buy in milliamps., which, of course, determines the size of the cell, whether it is a dry primary or an accumulator. Nor should any cell be bought on intermittent rating, which is a delusion and a snare.

### An Interesting Contrast

In Figs. 1 and 2 I give the continuous discharge ratings of two popular cells: No. 1, a well-known dry high-tension cell; No. 2, a first-class accumulator cell which is rated at 3 a.h. capacity at a discharge rate of 200 hours. The discharge given by dry cell was 50 hours to 5 volt, experience having shown that a cell run down to 5 volt at this rate rises to 1 volt on standing a few hours.

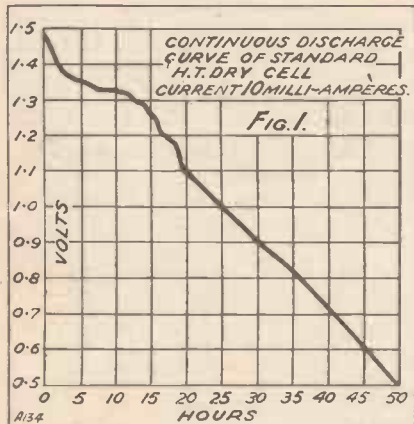
The capacity of the cell under these conditions was 1/2 amp. hour. The accumulator discharged at 15 m.a. gave a capacity of 3 amps. The point to be remarked is that the percentage values of the potential differences at beginning and end of charge in the accumulator was only 10 per cent;

in the dry cell it was 66 per cent. Even with a dry cell of six times the capacity of the standard cell, and which would deliver the m.a. of the accumulator, the difference in potentials between beginning and end of discharge would be 33 per cent.

### Comparative Costs

Further, the discharge curve of the accumulator is practically steady; as Mr. Hallows points out, there is considerable erratic jumping in the potential of a dry cell. When an accumulator is used intermittently, and within its normal discharge rate, the potential curve of short-period discharges are practically horizontal lines—that is, the voltage does not alter during a few hours, which is ideal for reception.

Mr. Hallows' cost figures must be startling to the ordinary amateur. Taking the average of the three types he tested we can say a set using 10 m.a. of high-tension current requires the high-tension dry battery of 60 volts renewing ten times per annum. A first-class 60-volt accumulator, in polished box, of the type I have give the discharge curve of, would, allowing 20 per cent for open-circuit self-discharge, deliver 10 m.a. for 250 hours before the necessity arose for recharging. An accumulator of the same make, but of a more popular crated type, making the same allowance—a very

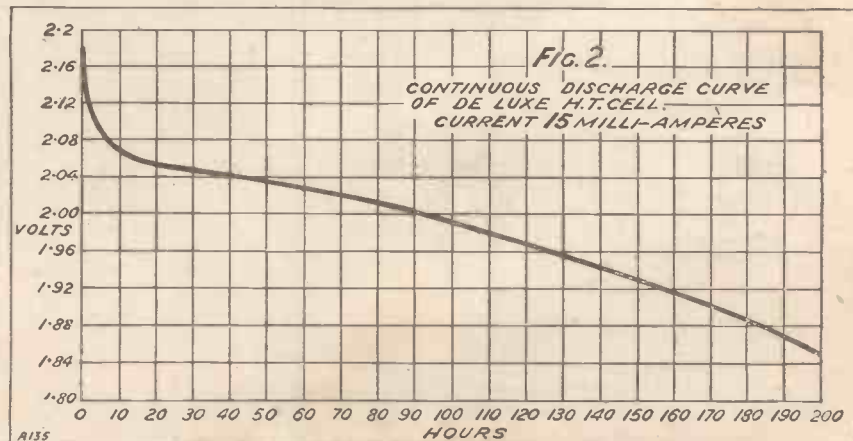


doubt, on reading this article, that the ordinary high-tension battery is shamelessly abused. Mr. Hallows' figures tally with my own, which show the average capacity of the standard dry battery on continuous discharge as 500 milliamps.

Despite these figures, the great majority of amateurs, whatever the number of valves in their sets, and whether they use 'phones or loud speakers, expect the standard 60-volt high-tension dry battery to last six months. The usual boast is, "mine lasted eight months!" I think the outstanding point arising out of Mr. Hallows' article is the fact that the great proportion of amateurs in this country do not receive their broadcasting programmes with that clearness, loudness and purity of tone of which their set is capable.

### A Definite Limitation

The Leclanché type of cell has remarkable recuperative powers, and the work it has to do in wireless is exactly what it is suited for, but the capacity of the standard cell at 10 m.a. discharge is 60 to 120 hours



# The Case for the H.T. Accumulator—continued

high one—for self-discharge, is capable of giving 10 m.a. for 160 hours.

The economic comparison between the three high-tension systems, giving three years' life to the accumulators, is therefore :

QUALITY ACCUMULATOR.		
	£	s. d.
Cost . . . . .	5	15 0
4 Charges per annum =		
12 at 1s. 6d. . . . .	0	18 0
	£6	13 0

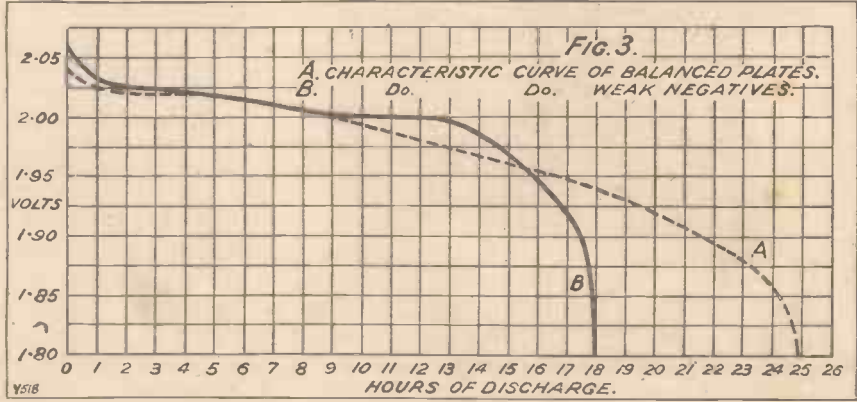
POPULAR ACCUMULATOR.		
	£	s. d.
Cost . . . . .	3	10 0
6 Charges per annum =		
18 at 1s. 6d. . . . .	1	7 0
	£4	17 0

DRY CELLS.		
	£	s. d.
30 Batteries at 10s. . . . .	15	0 0

For clarity and truth of reception there is no comparison between accumulators and dry cells. The great advantage of the accumulator in this respect is due to the steadiness of the voltage and the absence of crackling, which in the dry cell is caused by the creeping and bursting of the bubbles of gas in an almost dry paste held against the carbon electrode.

Of course, like dry cells, accumulators vary very much in performance, but one cannot go very far wrong in buying a battery with a guaranteed rating at a standard continuous discharge. There is, how-

The condition is also easily induced in a normal accumulator where the long first charge is imperfectly carried out. The ordinary negative in a dry or damp state is subject to far more rapid deterioration in the air



ever, one point often overlooked in the manufacture of these small cells for high-tension work, the greater number of which have two plates only, and that is the balancing of the negative and positive plates.

### Capacity Reduced

If this is not done the negative plate gives out before the other, and the cell shows a characteristic sudden voltage drop, the reception when this happens fading rapidly away. Fig. 3 gives curves showing this : A being for balanced plates, and B where the negative is of less capacity than the positive.

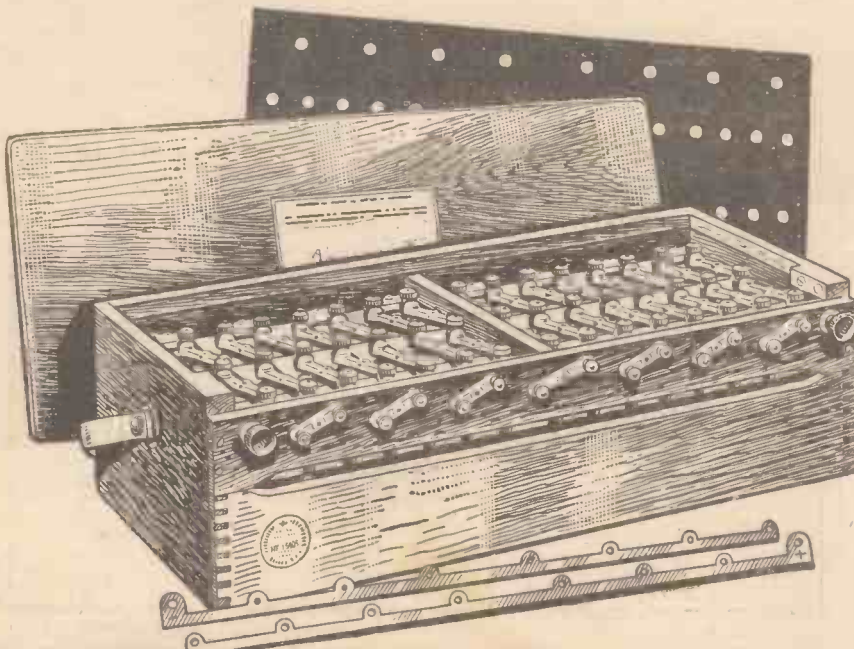
than is the positive, and the oxidation product of the spongy lead formed by this deterioration when immersed in sulphuric acid is immediately fixed as sulphate, thus reducing the capacity of the plate, and in a two-plate cell bringing it below the capacity of the positive end, and, of course, giving a rapid drop in voltage.

This trouble is obviated by the new accumulators with a very short first charge. These are practically fully-charged at the works, and so treated in manufacture that there is no possibility of any oxidation taking place before the acid is put into the cell, therefore they retain to the full the capacity of the balanced negative.

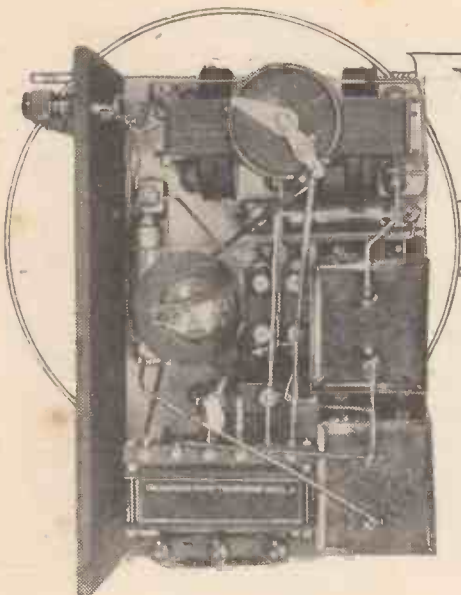
### Little Attention Required

The deterioration of the negative, which calls for a prolonged, careful first charge, without which the cell would never give its full capacity or steady voltage fall, is easily seen. If on adding the sulphuric acid there is a rapid and great drop in the gravity with rise of temperature during the first hour, the negative plate contains much oxidation products. On the other hand, the very short first-charge cells will show very little drop in gravity, sometimes none, and only a few degrees rise in temperature.

The attention an accumulator requires is small. See that it is topped-up regularly with distilled water, or the acid in the cell becomes so strong it chemically attacks the plates, and make sure no cell is ever discharged below 1.85 volts when working.



The "Quality Accumulator" referred to above. By means of the metal strips and the terminals groups of cells can be paralleled to facilitate charging.



# WHAT IS A MAINS UNIT?

The third part of a comprehensive survey of modern battery eliminators and such devices, written in a way that the ordinary constructor should be able to understand. Mr. Harris has spent a considerable amount of time on the subject and the results of his researches are given in this series of articles.

The Editor has carried out some exceedingly interesting experiments in connection with mains units.

By PERCY W. HARRIS,  
M.I.R.E.

IN the last issue we concluded a brief survey of the principles underlying the operation of all mains supply units. We saw how

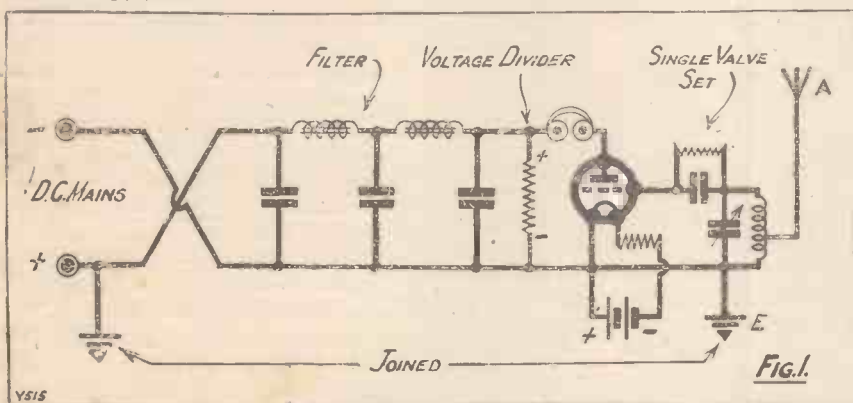
so that readers of the WIRELESS CONSTRUCTOR may have a standard design suitable for supplying the demands of the most "hungry"

porated in any power unit so far manufactured or described.

Those readers who have perused the previous articles in this series will now have realised that a D.C. mains unit is simpler and cheaper to buy than one designed for working on the A.C. mains. The reason is, of course, that we need no rectifier or transformer with the D.C. unit, and because the filter does not have to do quite so much smoothing as with A.C. mains.

## The D.C. Unit

Not every reader who has D.C. mains is in a position to get his supply from this source, for it is impossible to step-up D.C. current through a transformer and we are therefore limited by the maximum voltage of the mains themselves. If these are 100-volt, then something less than a hundred is the maximum we can obtain, for it will be remembered there is a certain voltage drop through the filter itself. Then, again, special precautions have been taken with the D.C. unit, as we are here connected to the mains directly, and not through the medium of a transformer, which is the case with an A.C. unit. This point should be borne in mind during all experiments. Unless special precautions are taken it is very easy to "earth" the mains



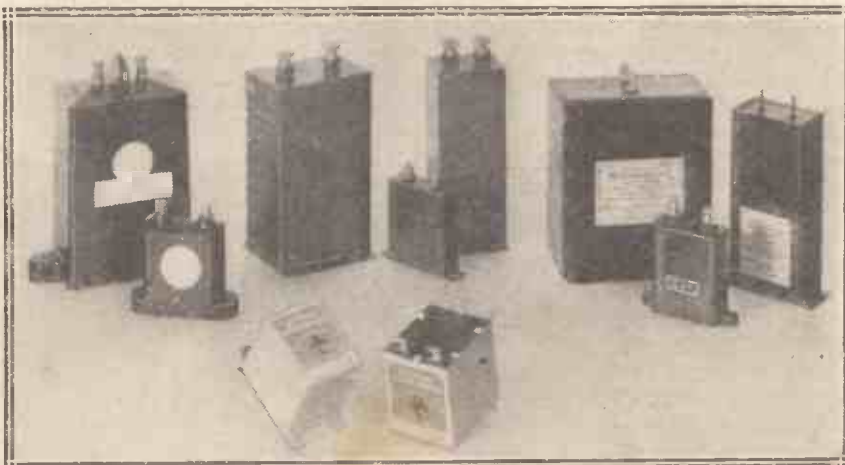
both direct current and alternating current as taken from the mains are unsuitable as a source of supply of high-tension current for our wireless sets; we saw how the irregularities of the direct current could be smoothed out so that this source could supply our needs. We have also seen how alternating current can be turned, first into a pulsating direct current, and then into a smoothed direct current, reaching our valves in a state directly comparable with the current supplied by an H.T. dry battery or accumulator.

amplifier. Incidentally, the WIRELESS CONSTRUCTOR Unit contains certain novelties which, to the best of my knowledge, have not been incor-

## Some Practical Points

In this article I want to deal with some practical points which may afford guidance to the reader who desires to make up his own mains units experimentally. Next month I shall describe the WIRELESS CONSTRUCTOR "Full-Power Mains Unit," which has been built up and thoroughly tested in the laboratory

## CONDENSER COMPARISONS



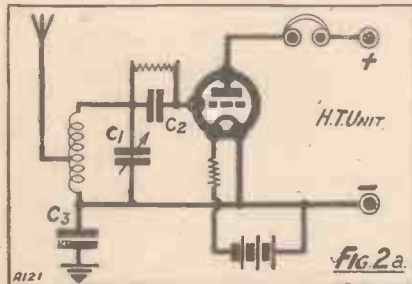
In the back row are a series of high-voltage condensers, and in front of these are condensers of the same makes but of ordinary types. Right in the foreground are two differently designed condensers, both made for mains units.

## What is a Mains Unit?—continued

through your set and to blow the main house fuse. In order that this may be clearly understood, and also to point out the additional danger not often realised, I must refer readers to Figs. 1 and 2.

### That Earth Connection

Fig. 1 is a diagram of a single-valve set with a mains unit, drawn in rather an unconventional way. On the left we have the D.C. mains, the positive



of which is assumed to be earthed. This, by the way, is done at the power station (one or other of the D.C. mains is always earthed). You will see that the positive main goes to the filter, through the chokes, to the voltage divider, and then through the headphones to the plate of a single-valve detector. I have drawn a very simple wireless set here, but my remarks apply equally to any valve set connected thereto.

Now what happens when we connect the mains unit to the set as shown? Immediately we short the mains directly to earth. This will blow the fuses at once, and if, as sometimes happens, very large fuses have been put in and do not blow except for very heavy current, you may do very considerable damage. Starting from the negative D.C. main we see that there is a perfect conducting path through the lower lead of the filter straight to earth, and as the positive main is also earthed, the mains are completely short-circuited!

### A Simple Precaution

The usual precaution taken in such cases is shown in Fig. 2a, where a high-voltage condenser  $C_3$  (which can be either one or two microfarads, of the mains unit type, and not a small condenser such as used for shunting high-tension batteries) is placed in series with the earth lead, insulating the mains from direct contact with the earth. Fig. 2b shows how, by

using an inductive coupling for the receiver, the use of the series condenser in the earth lead can be dispensed with, but most sets have the batteries connected to earth even when the set is inductively coupled. In many cases there is a risk here, for the reader is depending upon the insulation between the primary and secondary windings of the aerial transformer. The series condenser is best used in both cases.

I wish to draw particular attention to Fig. 3. It shows a source of danger which is too little realised when using D.C. mains units. Here we have the same single-valve set, the same circuit and the series condenser in the earth lead as recommended. We have, however, in addition, an aerial earthing switch designed so that the aerial can be earthed during thunderstorms or when the set is left at night.

### Another "Snag"

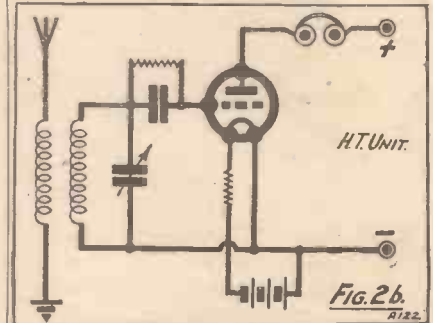
If the aerial is earthed while still connected to the set (which, anyway, is not a method I would recommend) it will be seen that there is a path through the inductance up the aerial lead and down through the switch to earth, giving just the short-circuit we want to avoid. The effect of closing the switch will be to produce a brilliant flash and a burn-out of the aerial tuning inductance if the fuse has not blown at once. I heard of a case where this happened quite recently.



A block condenser for mains units. This condenser gives a very wide choice of capacities.

If an earthing switch is used for the aerial it should be so arranged that the aerial is disconnected from the set before it is connected to earth.

It is sometimes difficult to get rid of an annoying hum, even with the best D.C. mains units, when the earth lead is very long. Always try to make your earth lead as short as possible, or try a second connection.



When making up a D.C. mains unit consisting of three condensers and two chokes with a voltage divider, the first thing you should consider is the voltage of your supply. Assuming that most readers will not require more than 150 volts high-tension, the most fortunate are those who have 220-volt D.C. mains. If they have 220-volt mains, then they can afford to "give away" 70 volts, and it does not greatly matter whether he loses these volts in the chokes or in the voltage divider. Assuming that the reader has a five-valve set using a super-power valve in the last stage, a small power valve in the previous stage, and three valves of the high-frequency type for the detector and high-frequency stages respectively, the high-tension consumption using 150 volts on the plate of the last valve would probably be about 25 milliamperes at the outside.

### The Effect of "Load"

Add another 10 milliamperes to this for the current taken by the voltage divider, and we get a total current drawn through the chokes of something like 35 milliamperes. By the way, the current taken by the voltage divider is very often forgotten by the designer of a mains unit. He thinks that the current taken through his unit is merely that drawn by his set, whereas it may easily be 10 milliamperes more than this due to the load of the voltage divider.

Ohm's law tells us that the resistance through which a current of

## What is a Mains Unit?—continued

35 milliamperes will drop 70 volts is 2,000 ohms. As there are two chokes each of these can be as high as a 1,000 ohms resistance without losing more voltage than we can afford to give away with 220-volt mains.

### An Important Rule

Of course, the more current we draw through the resistance of the choke, the bigger the voltage drop and, correspondingly, the smaller the current the lower the drop. This is why the open-circuit measurement of voltage on a mains unit taken with a voltmeter using very little current is very much higher than the voltage actually given by the unit under the load of the set. Remember that the rule in a mains unit is: The higher the current the lower the voltage. Some mains units drop their voltage very rapidly with the increase of load. It is thus possible to have two mains units showing 200 volts on "no load," although one will give 150 volts with a load of, say, 30 milliamperes, while the other will not give more than 60 or 70 volts at the same load.

### Good Chokes Essential

If, now, you are living in a house which has 100-volt D.C. mains, the maximum voltage will be scarcely enough, and you will want to lose as little as possible. How can you do this? By choosing high-quality chokes of low ohmic resistance. It is possible to get excellent chokes giving all the smoothing

load (including the voltage divider) is not more than 25 milliamperes, for the voltage divider will take less current on 100 volts than on 220 volts, and, furthermore, your valve will not take so much current at the lower voltage. With 25 milliamperes the voltage drop through these chokes



An American type of voltage regulator valve.

will be only 6, so the reduction in the high-tension voltage is not a very serious matter. Be sure, then, if you are running from 100-volt mains to buy chokes which not only really choke but also have a low ohmic resistance. The points you really want to know about when buying a choke for a filter are its real working inductance and its D.C. resistance.

There is many a "20-henry" choke which has an inductance of only 3 or 4 henries under a practical working load, and as this is the only condition under which you will use the choke, such information is vital. The more responsible manufacturers have adequate apparatus for measuring their products, and are not afraid to tell you the inductances of their chokes on such loads as 10, 20 or 30 milliamperes.

### The Voltage Divider

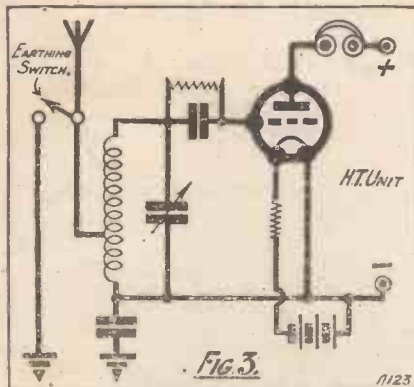
There are several problems connected with the voltage divider. If its resistance is too low it will add very seriously to the total load on, and therefore the drop in voltage through, the filter and the valves in use in the rectifiers, and if it is too high you will get big alterations in voltage with changes in current in your set.

I strongly advise all who experiment with eliminators, or who use them ready-made, either to buy a special voltmeter designed specifically for use with mains units, or else to make up the little unit described in the last issue so as to check the voltages obtained. No serious work on eliminators can be done without a proper voltage-measuring device, and certainly every wireless club should have one as a means of testing eliminators for its members.

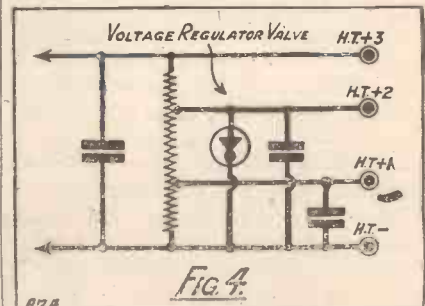
### Watch Those Condensers

Do not forget my warning about proper mains unit condensers, and do not grudge the extra cost of the high voltage types. A broken-down condenser in a mains unit will not only put your unit out of commission but may ruin your valves, transformer and choke, if your "luck is out" that day. Some rectifying valves, if grossly overloaded, as may happen when a condenser breaks down, will lose their power of emission, or go soft. Partial injury to a valve may not demonstrate itself at once, and the set will go on functioning although you will have a much lower output voltage. If you have no means of measuring or testing your unit you may attribute your trouble to many other causes, such as faulty valve in the receiver.

With A.C. mains units we have in addition to those losses already indicated—resistances and chokes—the voltage drop in the valves and in the transformer. The ideal mains unit would give a constant voltage at any



required even in an A.C. unit, with a D.C. resistance of not more than 120 ohms. This gives 240 ohms for two chokes, although in a D.C. mains unit with fairly good mains one choke and two condensers is often enough. Using two chokes we will assume the



load drawn from it, but mains units vary a good deal among themselves in the voltage drop for a given increase of current. If, however, you choose chokes of low ohmic resistance (as already indicated in D.C. filters), if you use a good transformer and valves of adequate capacity, you can

(Continued on page 71.)

# SOME OPEN LETTERS FROM A BROADCAST LISTENER

*We publish below two open letters which a correspondent of ours has asked us to publish in the "Wireless Constructor." As they are matters of general interest we have managed to find a space for them, although we do not necessarily agree with all his views.—THE EDITOR.*

## To Sir John Reith

Director-General,  
The British Broadcasting  
Corporation.

DEAR SIR JOHN REITH,

I see that despite the controversy which persists in raging around your administration of the B.B.C., and despite the persistent criticisms about the quality of the broadcast programmes, the number of receiving licences issued by the Post Office to listeners continues to increase. It is certainly interesting and must give you considerable pleasure to note that during the last three months the number of licences in force has risen at the rate of over a thousand a day, and that by the end of February the total was 2,451,051.

After a considerable mental effort I find that this represents an increase of 33,000 as compared to the January figure, and that since December there have in all been 95,000 new licences issued. So, during the next twelve months, ending March, the British Broadcasting Corporation will receive a bigger grant than they received last year.

I see this figure is placed at £880,000, which exceeds the figure for the current financial year by £75,000. And when the Post Office have deducted the 12½ per cent from the gross income received from wireless listeners, in order to cover the cost of the collection of licence fees, etc., the B.B.C. will receive 90 per cent of the balance as regards the first million licences, 80 per cent of the second, and 70 per cent of the third.

## The Prosecution of "Pirates"

I also see in the newspapers that many critics point to this steady increase in licence fees as an indication of the equally steady growth of the popularity of broadcasting, and it certainly does seem a very good answer to those critics who maintain that the B.B.C. is losing ground and that interest in broadcasting is waning. But it is also interesting to note that there have been a thousand prosecutions of "pirates" who have been caught using receiving apparatus and who have not taken out a licence.

I wonder, Sir John, whether you will

agree with me when I suggest that a good many people have consciences, and, having noticed in the papers that pirates have been dealt with rather summarily, and certainly rather sharply when caught, the moral effect has been all to the good as regards inducing them to come into line with their more honest brethren? The argument is psychologically sound; whether it is mathematically sound it is difficult to say.

## Two Pertinent Queries

However, the results must be very gratifying to yourself, inasmuch as the revenue at your disposal seems to be increasing steadily. But this increased revenue certainly entitles listeners to say: "Well, now, what about better quality in the programmes, and what about the Regional Scheme?"

These two pertinent queries undoubtedly constitute the basis of 95 per cent of the average criticisms received by the B.B.C., and although

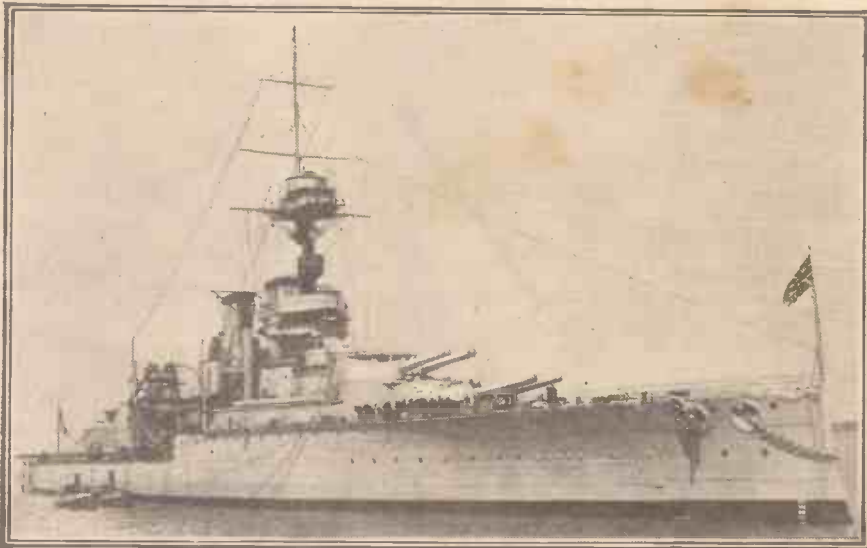
efficiently controlled, and which you still maintain in a state of almost mechanical perfection.

The Regional Scheme, Sir John, has been mooted now for a considerable time, but the only practical evidence which has yet been offered to the public is represented by 5 G B. It is admitted that in dealing with the Post Office you have a task which the President of the League of Nations might very easily shrink from undertaking, but it being equally well known that you have qualities which Mussolini himself might envy, it was hoped that before now something definite might have been done with regard to the progress of the Regional Scheme.

## A Dilly-Dally Attitude

Persistent attempts on the part of pressmen to obtain information with regard to the progress of the scheme are always met with the reply that the Post Office has not yet given permission for the scheme to be proceeded with. If the Post Office is

## A WIRELESS-CONTROLLED WARSHIP



*H.M.S. Centurion, formerly a battleship, has now been converted into a wireless-directed target-ship. Without a single soul on board she can be maneuvered by radio at the will of the wireless officer on board a distant warship.*

the estimable lady who graces your Board in the person of Mrs. Snowden recently remarked that the B.B.C. has to suffer fools gladly, I am sure that you always feel concerned when justifiable criticisms are levelled at the organisation which you have so

going to continue this dilly-dally attitude, would it not be better to drop the scheme altogether? Surely public feeling would soon make the Post Office realise that bureaucracy can be carried too far?

*(Continued on page 72.)*

# TELEVISION PROBLEMS

*So much has been said about Television that constructors will be glad to read below this authoritative and interesting article. It tells where we stand to-day, and the prospects of progress in the future, pointing out how great are the difficulties that beset the television investigator.*

From a Special Correspondent.



THE object of any television system is to reproduce a changing scene or moving object located at a distant point, and to do so simultaneously with the actual event and in a form recognizable by the eye.

To carry this out successfully involves a very high speed of operation in breaking-up the picture to be transmitted into a number of separate light-and-shade elements at the transmitting end. The same problem arises, of course, in reception, because the received signals must be "re-assembled," or thrown together, in proper sequence upon the viewing screen at precisely the same speed.

Exactly what is involved will perhaps best be appreciated by considering the manner in which still-life pictures are at present transmitted over telegraph lines and through the ether.

## Splitting the Picture

Taking a photograph, say, 7 in. by 5 in., it is first split up in rapid succession into the equivalent of 350,000 signal elements, or 10,000 per square inch. This is equivalent to a 100-line screen in process printing, and gives a very clear definition when reproduced in the form of so many signal "dots" of varying density at the receiving station.

Unfortunately the quickest time in which such a photograph can be transmitted is approximately ten minutes.

Television, which, as stated above, involves the reproduction of an animated or moving scene, depends essentially upon the cinematographic effect, where successive images are thrown so rapidly upon a screen that the eye is unable to follow each

picture separately, but merges them one into another so that they "persist," and appear to move swiftly in the fashion of the original.

## Tremendous Speed Necessary

In order to secure this result pleasantly and without "flicker," it is necessary to repeat each representation at least sixteen times in each second. Referring back to the case of still-life photographic transmission it will be seen that the speed of transmission must be increased nearly 10,000 times if the same clearness of definition is to be attained in television. Actually a still greater speed would be necessary in practice, but this figure of sixteen per second may be taken as a convenient basis of discussion.

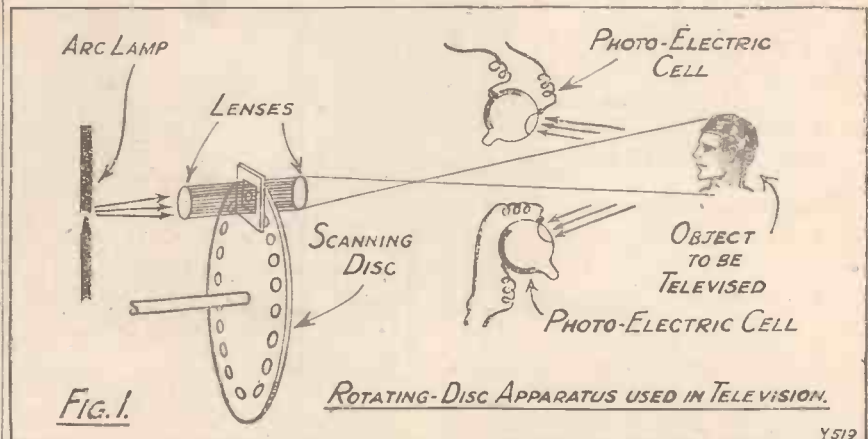
Such speeds are, at present, quite outside the limits of mechanical

arises of sending 2,500 separate picture signals in one-sixteenth of a second, or 40,000 distinct impulses per second for each square inch of picture transmitted.

However, the Bell Telephone Laboratories did, in fact, succeed early last year in televising on this basis the recognizable features of a speaker over a distance of 22 miles through the ether. By using a connecting wire between transmitter and receiver, the distance covered was increased to 250 miles. The size of the transmitted picture was 2 in. by 2½ in.

## Methods of "Scanning"

Various methods of "scanning," or analysing, the picture into its component light-and-shade elements have been proposed from time to time. Probably the simplest is that of the



apparatus. The maximum that has been done in this direction is to transmit a moving picture on the basis of a 50-line screen, which although coarse-grained is still recognizable. Even here the problem

rotating disc with spirally arranged holes, which was first proposed as far back as 1884 by a German inventor named Nipkow.

When such a disc is rotated, as shown in Fig. 1, the ray of light from

## Television Problems—continued

an arc lamp or other source, preferably focussed by means of lenses, is swept in a spiral track over the object to be televised, the track being completed once for every complete revolution of the obturator disc. Each hole in the disc accounts for one particular light or shade element along the track, and transmits it as a separate electric signal.

### Question of Illumination

The conversion from light and shade into electric current of corresponding intensity is effected by means of the photo-electric cells, which receive a separate light impulse every time the ray succeeds in passing through a hole, to strike against the object, and to be reflected back again.

Here a distinction must be drawn between the results that can be obtained by using reflected light, and those possible when the light from the source falls directly upon the selenium or photo-electric cell. In the latter case, the cells are situated behind the illuminated object, and only shadow or silhouette effects are possible.

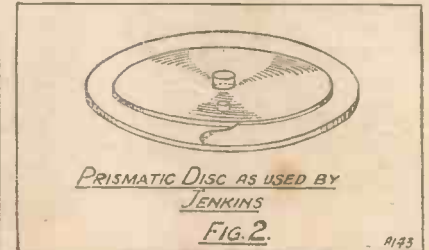
current, either over a line or in the modulator of a wireless transmitting set. It would obviously be a great advantage from this point of view if direct light could be used, but then the object can only be received as a shadow, or in outline. It is quite impossible, for instance, to transmit a recognisable full-face image in this way.

On the other hand, if reflected light is used, and this is the only method which can give satisfactory "radio vision," the intensity of light available falls off to a value several thousand times less than that of the direct ray.

### High Amplification Required

Accordingly one is faced with the dilemma that either the illuminating source must be so powerful that it practically scorches the victim to be televised, or else, if a bearable light is used, the effect on the selenium cell must be magnified several thousand times by means of thermionic amplifiers. In the latter case it is extremely difficult to prevent the inherent "valve noises," which are always present in any multi-valve

overcome it by using infra-red rays, i.e. light rays of longer wave-length than those in the visible spectrum, so that the person to be televised sits in practical darkness. This has been termed Noctovision.



The fact that selenium will respond to infra-red rays, as well as to ordinary light, has, of course, been well-known for many years. Pontois was probably the first to point this out as far back as 1890.

Noctovision cannot solve the difficulty as regards the use of reflected light. It may give relief to the person being televised, but it cannot increase the intensity of the reflected light thrown on to the sensitive cell, nor remove the necessity for subsequent enormous amplification before the resulting currents can be used for direct signalling.

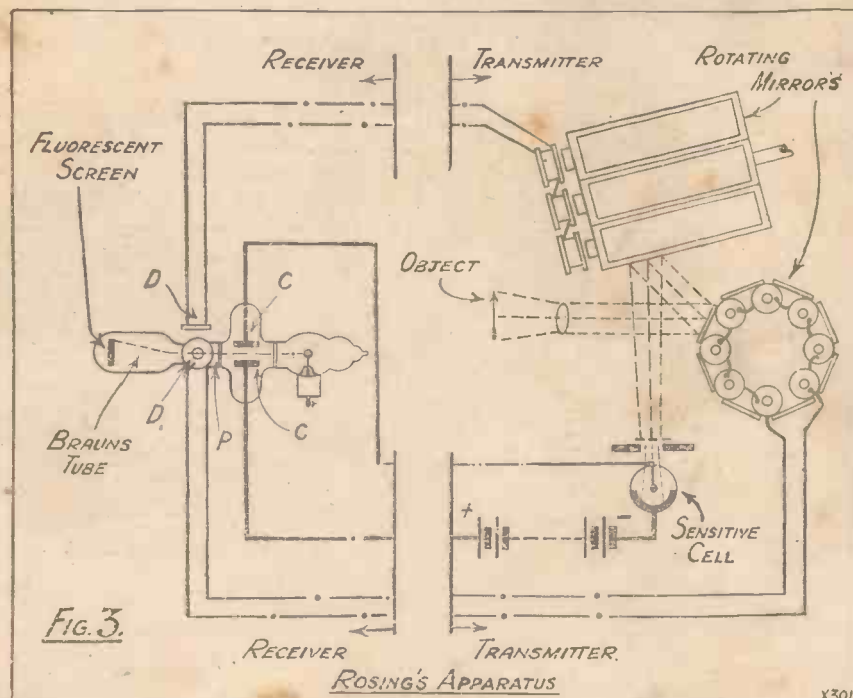
The problem at the transmitting end then amounts to rotating the spirally-pierced obturating discs at such a rate that each square inch of surface is split up into 40,000 separate signals. With an object 3 in. by 3 in. this involves sending 360,000 separate signals per second.

### Other Methods

This represents so formidable an undertaking that inventors have sought in many directions for some practical means of achieving the required result. Jenkins, for instance, has suggested the use of a solid glass disc of prismatic section, as shown in Fig. 2, as an alternative to the disc of Fig. 1, partly in order to overcome the difficulty of maintaining the various inset spiral lenses in an absolutely constant plane when the disc is rotating at high speed.

On the other hand, Alexanderson employs seven separate light sources instead of one, so as to increase the intensity of illumination. He uses a rotating drum, on the periphery of which are mounted a series of twenty-four separate mirrors, set

(Continued on page 68)



The response of any known form of sensitive cell to an incident beam of light is relatively feeble, and it must be amplified by means of valves before it can serve as a signalling

set, from seriously "masking" or interfering with the actual picture signals.

Mr. Baird has met with this difficulty, and apparently proposes to



## Using the Thirty-One Tested Circuits.

*In this article, the third of a new series, the Editor discusses practical points relating to the "Thirty-One Tested Circuits" Gift Book, presented free with the "Wireless Constructor" for February, 1929.*

### Tested Two-Valvers

THE circuits D1, D2, D3 and D4, in "Thirty-one Tested Circuits," presented free with the WIRELESS CONSTRUCTOR for February, have much of interest. The choice between them will depend upon the listener's requirements. D1 and D3 are detector circuits with reaction, followed by one stage of note magnification, and, as such, are suitable for loud-speaker work within a limited distance of a broadcasting station, while D2 and D4 consist of a high-frequency stage followed by a detector. Neither of these will work a loud speaker adequately, even close to a broadcasting station, but are very appreciably superior to the circuits D1 and D3 when the listener desires to use headphones and to listen to distant stations.

Dealing with D1 and D3 first, it will be seen that the note-magnifying valve in each case is transformer coupled to the detector valve. When only one stage of note magnification is used transformer-coupling is strongly recommended, for this gives a very high magnification.

#### "Local" Loud Speaker Sets

In D1 the output terminals are marked for "telephones," and in D3 for "loud speaker," but either telephones or loud speaker can be used in both cases equally successfully. On the local station, of course, the telephones will give far too loud results, but on distant stations the telephones are required owing to the relative weakness of the signals received.

D1 shows what is commonly called Reinartz reaction with a tapped-aerial coupling arrangement, while D3 shows the aerial coil as a separate winding, and reaction is obtained in this case by the swinging-coil method. Personally, I prefer the D1 circuit to the D3, for although when skilfully handled equally loud signals can be obtained with either, the control of the D1 circuit is far easier and the receiver occupies slightly less space.

On the other hand, D3 is the cheaper circuit to make up, as there

is only one variable condenser and we have not to pay for a radio-frequency choke, which is essential in the D1 circuit. It is quite possible to use the tapped-aerial coil in the circuit D3 in place of the two coils shown in D1, and this will still further reduce the cost of D3.

#### Curing Reaction "Floppiness"

The successful operation of both D1 and D3 depends upon a very smooth reaction effect. If reaction is "floppy" in either case the reason is probably due to (1) too big a coil  $L_2$  in D1, or  $L_3$  in D3; (2) too low a value of grid

find a point where you get the loudest signals and still obtain smooth reaction. You can then keep this as your standard voltage on H.T.1.

H.T. positive 2 should be always as high as you can get up to a maximum voltage specified by the maker of the valve, for the higher you make the voltage on this valve the more grid bias you must use, and the more grid bias you use the louder the signal you can reproduce without distortion. At the same time, if the maximum strength of signal you can get, owing to distance from a station, is not very loud, you will not gain a great deal by

### PLAYING CHESS BY RADIO



*Recently a Washington team played chess by radio with chess champions of a Chicago club. The winners of the radio tournament of which this match is a part are to play a London team by radio.*

leak; or (3) wrong value of high-tension. It is just as well to begin your experiments using about 36 or 40 volts on the detector (H.T. positive 1), and if you obtain perfectly smooth reaction go on increasing it, carefully testing the effect of each change. You will easily

going up in high-tension voltage beyond, say, 60 or 70 volts.

#### For the "Distance Hunter"

Of the circuits D2 and D4, D2 is the cheaper and D4 is the more efficient, for in this circuit reaction on the detector is used, with greatly improved

## Using the Thirty-One Tested Circuits—*continued*

results, both in regard to sensitivity and selectivity. D4 is, in fact, a first-rate circuit for the "distance hunter." D4 is rather a large set when made up in practical form, for there are three large variable condensers,  $C_1$ ,  $C_3$ , and  $C_5$ , all of which must be brought out on the front of the panel for controlling purposes.  $C_2$  is a small neutralising condenser which is kept inside the set and which is adjusted "once and for all." This set is best up in a 16 by 8 in. cabinet, with the three condensers,  $C_1$ ,  $C_3$  and  $C_5$ , equally spaced.

### Interaction and Parasitics

I would recommend in both D2 and D4 the use of a vertical metal screen

measuring about 8 in. long by 6 in. high, so placed that all the apparatus up to  $C_2$  is on the left of the screen and that after  $C_2$  on the right. Unless you take some precautions such as this (binocular coils can be used for  $L_1$  and  $L_2$  and  $L_3$  and  $L_4$  without screening) you may get interaction and not be able to neutralise the set properly. The purpose of the resistance  $R_1$  is to damp out parasitic oscillations which frequently occur in a circuit such as this owing to the fact that one half of  $L_2$  is in the grid circuit and the other in the plate circuit.

If 2-volt valves are used it will generally be found that the positive tapping for H.T. is best connected to

point 3 on the H.F. transformer, while if 6-volt valves of the high-frequency type are used, then probably the tapping 4 will be the better. This, however, is best tried for any valves used. The selectivity of the tapping 4 will be better than that of tapping 3, but signal strength will perhaps be better on 3 than on 4.

### A Cheaper Set

Sometimes results are so much better on one than on the other that there is no possible doubt of which to use, but with some types of valves it may be a "toss up" which you will decide upon. In such cases the better selectivity will always be obtained on tapping 4.

There is a slight hand-capacity effect on condenser  $C_1$ , but it is generally less if the moving plates of  $C_1$  are connected to the lower end of the inductance  $L_2$ .

Circuit D2, as previously suggested, is cheaper to construct, as we have no reaction condenser or radio-frequency choke to buy. The absence of the reaction condenser makes it possible to build up the set more compactly, but, as indicated, we lose something in sensitivity and selectivity by its absence. Here, again, we must guard against undesirable reaction effects, either by using binocular or other fieldless coils as suggested, or by the interposition of a screen as indicated for circuit D4.

### Concerning H.F. Chokes

Circuit D2 can be made more sensitive and selective by using the scheme for the detector valve shown in circuit D4, and indeed there are many possible methods of combining D4 and, rather, D2, or, rather, parts of these circuits. For example, D4 can be made smaller and cheaper by omitting the reaction condenser and by making the second half the same as the second half of the circuit D2.

It is essential for the proper functioning of circuits D1 and D4 that efficient radio-frequency chokes should be used. Some radio-frequency chokes are quite satisfactory on the 200 to 600-metre band, but are hopeless on the Daventry range. You will be quite safe in choosing any chokes which have been incorporated in a set in the WIRELESS CONSTRUCTOR, as all such chokes have been tested and found satisfactory on both wave-length ranges.

## RADIO AT THE AIR PORT



One of the features of the great new Croydon aerodrome building assemblies is the wonderful modern radio equipment. On the control tower can be seen the aeriavls used for direction finding, but the transmitters are at Mitcham. An intricate system of remote control is utilised.



# HAPPENINGS AT SAVOY HILL



By OUR SPECIAL COMMISSIONER

## Work at Potters Bar

IT is reassuring to learn that work has actually begun on the new twin-wave transmitter at Potters Bar. Post Office repression effectually prevented any publicity of this arrangement until it "leaked" by the proverbial mischance. Now that bricks and mortar are about, listeners will hope that no further time is lost. Captain Eckersley and his colleagues can be trusted to make the maximum possible speed because they fully realise that they are fighting against time. The commissioning of the London twin-wave transmitter before the end of 1928 would be a very fine technical achievement: but I fear it will not be realised.

## The Wireless Trade and the B.B.C.

Relations between the Wireless Trade and the B.B.C. are experiencing one of their periodical flutters of excitement. There are strong rumours that one particularly enterprising concern has gone to the B.B.C. and offered to embody and produce any specification which the B.B.C. engineers might recommend for standard mass-production listening apparatus.

The B.B.C. had been waiting for just such an opportunity ever since 1924, but previously the trade had kept entirely aloof. If there is anything substantial in the present rumours, their materialisation may not only reap a rich harvest for the commercial interest involved, but it may also disturb the equanimity of the newly-formed R.M.A.

## To Entertain or to Educate

The report of Sir Henry Hadow's Committee, just published, is a portentous and ominous document. Sir Henry and his able educational coadjutors have been pondering broadcast education for about eighteen months. However one may differ from their conclusions, no one will be so ungracious as to grudge praise

for the thoroughness in which an admittedly great task has been successfully tackled.

The report is a masterly document of its kind. Indeed, its very excellence renders it all the more sinister. On analysis, this document is a charter for the reconstruction of broadcasting. Mrs. Snowden is reported to have declared that in her opinion it would be better for the B.B.C. to be associated with the Ministry of Education than with the Post Office.

The Hadow Committee re-affirms her view. If the recommendations of that Committee were to be made effective, entertainment would give

## CHARLOT'S HOUR



Mr. Andre Charlot, whose new series of broadcasts from 2 LO is proving a popular feature.

way to "uplift," and broadcasting would become the toy of a few educational and religious cranks. There is one crumb of comfort, however, in the knowledge that Savoy Hill has reserved its judgment executively. No doubt, Sir John Reith and his staff are observing the flight of the kite.

## The Talk of Competition

The conflict with the Variety industry about the broadcasting of the Command Performance has caused fresh discussion of the possibility of either breaking down the B.B.C. monopoly or of arranging something nearly equivalent to free competition.

Sir Oswald Stoll has again taken the lead and is increasingly hostile to Savoy Hill.

## End of Monopoly ?

His solution would be to deprive the B.B.C. of all the lighter part of their entertainment, which would then be handled by the music halls, acting as a separate authority. Other people, not identified with entertainment, are advancing the idea that competition in broadcasting is the only solution of the difficult problem of the satisfactory inclusion of frankly controversial matter.

The latter argue that the B.B.C. should sell, say, six hours a week to private concerns, who would be entitled to do what they liked with the time that they had bought. It would be presumed, of course, that they would have to pay the same attention to the laws of libel and slander as newspapers do. A third body of opinion now discussing the possibility of competitive broadcasting is identified with the Anglo-Catholic movement, which would like to have its own medium for reaching the public.

And, finally, there is talk in the Labour Party of the desirability of copying American practice by establishing a purely propagandist Labour Broadcasting Station. With so much restiveness about, and the Corporation not yet eighteen months old, one wonders whether the monopoly will run the whole eight and a half remaining years of the licence.

## A Brilliant Discovery

Radio drama produces few original composers, authors, or executants. Therefore, when a bright star emerges it attracts all the more notice. The present discovery is reported from the north, where Mr. John Watts, after only a few months as a "junior" at Belfast, has acquired an enviable reputation for his radio dramatic work throughout Northern Ireland as well as in Scotland. Mr. Watts promises to go far in broadcasting.

(Continued on page 64.)

# THE RECORD-BREAKING "THREE"

## MORE WONDERFUL EVIDENCE

### "Alive with Stations!"

SIR,—I have been a reader of the WIRELESS CONSTRUCTOR since it first came out and I have built many of your one-, two- and three-valve sets, but I must say that I have never had the success with any that I have just had with the "Radiano Three." It is absolutely wonderful; the set seems alive with stations on every half degree on the dial.

On January 14th, at 7 p.m., I tuned 36 stations in on the loud speaker at full strength, and at ten past twelve I got my first Yankee station—W G Y, Schenectady. I sat up till 3 a.m. and got seven more, two of which I heard the call-sign—W T A M and W P G. All these came in at excellent loud-speaker strength and I didn't take the trouble to find out the others except by booking the readings, as I thought I could get them any other time; but I have been mistaken, for I haven't had any since.

Many more stations could be heard quite well at good volume on the 'phones. When I first tried it out I was quite shocked as I couldn't tell which was the local station. Anyway, the one I thought was the Local turned out to be Radio Toulouse!

Yours faithfully,  
W. EVANS.

Liverpool.

### "Radiano Mad!"

SIR,—Just one more "Radiano" success. How's this?

Brussels	2 L O (Local)
5 G B	Barcelona
Berlin	Koenigsberg
Langenberg	Breslau
Oslo (weak)	Dublin
Rome	Milan
Frankfurt	Newcastle
Madrid	Belfast
Hamburg	Nurnberg
Toulouse	Dortmund
Stuttgart	Cassel
Madrid	

and two or three unidentified, so far!

With the "Radiano" H.F. unit, coupled up with the "Radiano Three," all the above stations received on L.S., with an indoor aerial, ten miles from 2 L O.

I have also constructed the "Radiano" Silencer, and, when used with main set, was amazed to find that the loss in signal strength, generally believed to be serious when any sort of wave-trap is used, was almost negligible!

A friend of mine, an amateur transmitter, has had a thorough overhaul of my outfit and was much surprised to find that what he believed to be "fairy tales" regarding the "Radiano" series proved to be just as I had timidly stated.

But, he blames the aerial, and says that a set that can bring in

### READ THESE LETTERS!

There have been dozens of designs for three-valve sets published in the last year or two, but none has achieved the remarkable success of the "RADIANO THREE." The letters on the page are all unsolicited testimonials from enthusiastic readers, and are typical of hundreds that reach the Editor from all parts of the country.

The "Radiano Three" was published first in the "Wireless Constructor," but copies of the issue containing this famous article are no longer obtainable at any price. In order to satisfy the insistent demand of new readers, the complete design of the "Radiano Three," with numerous illustrations on high-grade paper, FULL-SIZE BLUEPRINT, theoretical diagram, drilling chart and full constructional details, is now obtainable FROM ANY NEWSAGENT OR BOOKSTALL in envelope form.

ASK YOUR NEWSAGENT FOR THE WIRELESS CONSTRUCTOR ENVELOPE NUMBER ONE—THE RADIANO THREE—PRICE ONE SHILLING AND SIXPENCE.

twenty stations on the L.S. (he tuned in fourteen himself!) deserves a better aerial, and that it's a sin to use it as I do!

Yours to a grid leak,  
A. J. KEEFE.

Woolwich, S.E.18.

P.S.—Had W G Y on "Radiano" short-wave set, first time! "Radiano" mad? I should say so!

### "Absolutely Perfect"

SIR,—I feel I must write and compliment you on the splendid circuit—the "Radiano Three." I have added the H.F. amp. and find this

the best circuit I have ever tried out. I might add that I have taken two tappings from the primary of the second transformer to two extra terminals, and use the 'phones, which I find absolutely perfect on the first valve or the second.

I should like to see the "Radiano Four" all on the same panel. When shall we have this?

Yours faithfully,  
C. J. H.

Dollis Hill, N.W.10.

EDITOR'S NOTE.—The "Radiano Four" is now in preparation and test in the WIRELESS CONSTRUCTOR laboratory.

### "I Think It Is Marvellous!"

SIR,—I feel I must write to let you know how pleased I am because I made the "Radiano" Three. I must confess I have not kept strictly to your specification. I have substituted two Lissen transformers. The coils I use are "Edison Bell" 60X, Tunewell 50 and 150 ordinary. The valves I am using at present are three "Triotron" general-purpose, and my aerial is only about 14 ft. high, and surrounded by others.

But that does not appear to make a great lot of difference, as I can get a great number of the foreign stations. My log up to the present is as follows, but I have not yet confined myself to identification.

A few at random, all at good loud-speaker strength, sufficient enough to fill a large room to almost breaking point: London, Daventry (5 G B), Dublin, Liverpool, Newcastle, Frankfurt-am-Main (Germany), Oslo, Langenberg, Paris.

I can get plenty more, but have not yet troubled to identify them. I can cut out London to a very distant faintness in about two or three degrees either side. I might add that I am only using 2-volt valves, and my condensers are "Ormond" .0005 and .00035, 5s. and 5s. 6d., with two "Ormond" slow-motion dials. I think it is marvellous.

Yours faithfully,  
F. J. COLEMAN.

East Ham, E.6.



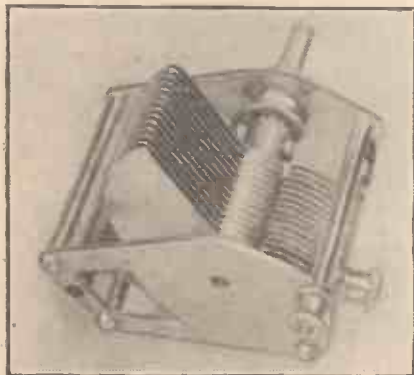
### A Compact and Efficient Condenser

FROM MESSRS. Wingrove & Rogers, makers of the Polar components, we have received a "Polar all-brass No. 3" condenser. It is an efficient variable condenser having several features noteworthy in a low-priced component, for all plates and washers are of brass, and a positive connection is made between the moving plates and the frame by means of an insulated pigtail, while the movement is particularly smooth, being fitted with ball bearings at one end and single hardened-steel ball at the other. No vernier is fitted, as it is intended that the condenser should be used with one of the many excellent separate vernier dials now available.

#### Low-Loss Design

A valuable feature is the exceedingly compact nature of the condenser, for a pair of them can be mounted on a panel as close as two 4-in. dials will allow. It is also one of the few condensers which will satisfactorily fit inside the standard screening boxes used in the "Straight-Line Four." The measured capacity of the .0005 mfd. (the model submitted for test) was .00058 and the minimum .000022, an excellent tuning ratio for all practical purposes.

High-frequency tests indicated that this is a genuine low-loss condenser,



The all-brass low-loss "Polar" condenser referred to above.

and an examination of the design shows that the solid insulating material has been reduced to a minimum and is so placed that it is out of the concentrated electrostatic field. At 8s. 6d. for a .0005-mfd. condenser, and 8s. for the .0003-mfd., the condenser represents remarkably good value.

### The Tungstone High-Tension Accumulator

The Tungstone 96-volt high-tension de luxe is a very fine example of a first-class high-tension accumulator. With a capacity of three ampere hours actual (a figure we can confirm, having tested it on discharge), with every cell a complete separate unit in

#### A MONTHLY REVIEW OF TESTED APPARATUS

(NOTE: All apparatus reviewed in this section each month has been tested in the Editor's private laboratory, under his own personal supervision.)

glass, with rubber bands around each 2-volt cell, and with individual plates removable if required, the battery possesses a really workmanlike appearance. In addition to this, each cell is separately tapped, an ebonite indicating plate slides over the top of the battery and all the cells are mounted in a handsome cabinet with cellulose unscratchable finish and rubber feet. Inside this cabinet all units stand on a rubber mat and the 12-volt sections can be taken out separately. When the lid is on the cabinet the battery can be tapped off at 12-volt sections from the ebonite plate on the front, while any voltage from 2 up to the full 96 can be obtained by a wander plug inserted in the top of the battery.

Only two plates are used in each cell, one positive and one negative, and following modern practice in good high-tension accumulators, there are no wood separators. The makers claim that the plates are correctly proportioned to give an even discharge,

and actual tests on the battery show that it will give its rated output in a uniform manner which is to be expected from a first-class job. At the invitation of the makers, we have submitted this battery to very heavy discharges, and it has given unflinching service throughout.

Many wireless enthusiasts recognise the advantages of the high-tension accumulator, but refrain from purchasing such a convenient accessory owing to a perfectly justifiable distrust of many battery charging stations. The average high-tension accumulator is ruined if charged above a certain rate, and many battery charging stations pay no regard to the maker's specified rate and charge H.T. accumulators as quickly as possible, thus ruining the plates and buckling them.

#### Simplified Charging

While the manufacturers of the battery claim that it can be charged at a far higher rate than the average high-tension accumulator, they have completely removed the charging problem in many cases by providing a very ingenious scheme in which all the 12-volt sections can be quickly placed in parallel and charged by means of an ordinary battery charger



This Celestion loud speaker, reviewed on the next page, retails at £7 10s.

## What's New —continued

such as is used for the low-tension accumulator. When connected up in this way—and the change from the series to the parallel connection is but the work of a few moments—the battery is charged at the rate of 2.4 to 3 amps. for the 96-volt size.

### Some Special Features

To test the practicability of the scheme we discharged the accumulator, connected it according to the maker's instructions, and joined it to the charger that is used in the laboratory for charging low-tension accumulators. The battery was then left until the plates were seen to be gassing freely and the voltage of paralleled sections reached fifteen. The whole battery can be charged in this way overnight, and, if one has mains in the house, the same battery charger will serve both for low-tension and high-tension charging—a very important advantage.

There are several other features about this battery which appeal to us, not the least being the provision of really adequate filling plugs and the fact that the makers provide with the battery a special filler of the syringe type which will completely fill a cell at one stroke. Naturally a battery of first-class construction, and possessing the refinements and advantages we have described, can-



The Lotus switch is a good, sound piece of work, and costs only 1s. 6d.

not be sold for the price of some of the small sealed-up accumulators, the contents of which it is impossible to gather from an external inspection, and ten guineas for a 96-volt high-tension accumulator may be regarded as a high figure. Against this should be placed the fact that everything is of first-class quality throughout, the

battery is of genuine large capacity, while the cabinet itself and special fittings are by no means cheap. In our opinion, the price charged is by no means high for what is provided, and, properly looked after, the battery should give perfectly uniform service for several years. It should not be forgotten that not only can individual cells be replaced, but individual plates can be taken out and replaced should trouble develop in any one of them, as every part of the battery is sold separately by the makers at quite reasonable prices.

### A Handsome Loud Speaker

The Celestion loud speaker, a photograph of which is given above, has long been recognised as in the very front rank of British loud speakers. The model submitted to us for test and shown herewith well maintains the reputation of this firm. The reproduction is clear and the lower tones are particularly pleasing, while the high notes are not sacrificed, as is the case with some models of loud speakers, but are adequately reproduced to give the necessary definition or sharpness, without which no loud speaker can be really natural in tone. The Celestion Company have always maintained a good reputation for their cabinet work, and this model (C.12) in mahogany is a particularly well-finished production. It is a pleasure to handle such a fine piece of cabinet work, quite apart from the merits of the loud speaker itself. The Celestion does not attempt to compete with the cheap loud speakers, and the price of £7 10s. cannot be called low, but for this figure the makers certainly provide a really good loud speaker in beautifully finished cabinet work.

### A Good Switch

Messrs. Garnett, Whiteley & Co., Ltd., makers of the well-known "Lotus" components, have sent us for review a new battery switch with terminals. It is a soundly made little component, the frame being of moulded bakelite and the contact springs strong, making good contact with the centre spindle, which is of insulating material, terminating in a metal knob which forms the conducting bridge between two contacts. Terminals are fitted, but no soldering lugs. Had the springs been prolonged slightly, these themselves

could be used as soldering lugs, and we can certainly recommend the makers to make this slight alteration, which would add still further to the value of the excellent component. A point that appeals to us is that a pair of washers is provided so that it can be adjusted to either a thick or a thin panel. The actuating knob is neatly finished; a small point, but one well worth looking after. A poorly moulded knob tends to spoil the appearance, and this Lotus knob is



Hydra condensers are specially suitable for high-voltage work in mains units.

of a much higher finish than is usual on such a switch. The price of this component is 1s. 6d.

### Hydra Condensers

The growing popularity of mains units has brought into prominence the need for thoroughly reliable high-voltage condensers for use in these units. The ordinary type of Mansbridge condenser as used for shunting high-tension batteries is quite unsuitable for use in mains units, as the high voltage to which the condensers are continuously submitted, and the large surges which cause the impressed voltage to rise to many times its normal value, are greater than the ordinary types can withstand. Messrs. Louis Holzman have submitted to us several samples of the Hydra condenser, specially designed for high-voltage work in mains units. These are much more compact than the usual type of mains unit condenser, and have passed with credit all the tests to which they have been

## What's New—continued

submitted. They can be recommended with every confidence for use in mains units.

The method of manufacture of these condensers is somewhat different from the Mansbridge type, as specially prepared paper and aluminium foil is used. The insulation value of these condensers is particularly high. In one of the high-voltage type we tested, a charge was given to the condenser overnight, and when the terminals were short-circuited about the middle of the next day a brilliant flash showed that the condenser was still quite lively! The Hydra condensers are made in Germany by the biggest German manufacturers of fixed condensers, and are available in this country through Messrs. Louis Holzman. An illustration of a block of condensers designed as a complete unit for a mains unit will be found illustrated on another part of this paper (see the article on Mains Units).

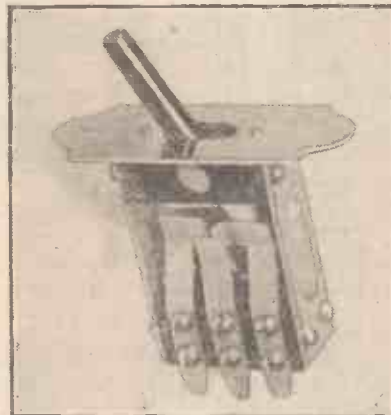
### An Ingenious Switch

Messrs. C. A. Carter & Company have sent us a specimen of the "Carco" two-way double-pole change-over switch for test. The method of actuating this switch is different from normal, and has several interesting points. A pivoted lever made of insulating material projecting through the front of the switch alternately presses the bottom pair and the top pair of contacts against the central springs, there being a definite off position into which the lever clicks. At this point the central pair of contacts is well separated from either pair of end contacts. The switch is very robustly constructed and good sound contact is made at either position. It is supplied in either black or nickel at 5s. 6d.

### Burgess Batteries

One of the largest manufacturers of dry batteries in the world, The Burgess Battery Company, of Madison, Wisconsin, are now placing their radio batteries on the British market through the Rothermel Corporation. Some months ago we received for test three super B batteries rated at 45 volts and designed for very heavy service in multi-valve wireless sets. Exhaustive tests of these batteries have now been completed and the three 45-volt batteries have been used on various loads and their performance recorded, until the voltage of

each now stands at 30. At this figure they are still perfectly silent. For some weeks they were used to run a powerful wireless set using a push-pull amplifier which is normally run from a mains unit. In this service they were called upon to give about 50 milliamperes for many hours each



The "Carco" two-way double-pole switch embodies several novel points in design, and has been widely used by the Air Force.

day and never gave the slightest trouble.

Articles have already appeared in this journal indicating the economy in using the larger size of high-tension battery, and these Burgess 45-volt units of the super B type are capable of supplying the demand of the most extravagant receiver for long periods. They are not cheap—no really satisfactory large-size batteries are!—but to the man with a multi-valve set who calculates his costs of dry batteries by the year, these 45-volt units at 25s. each are a very good investment. It is not,

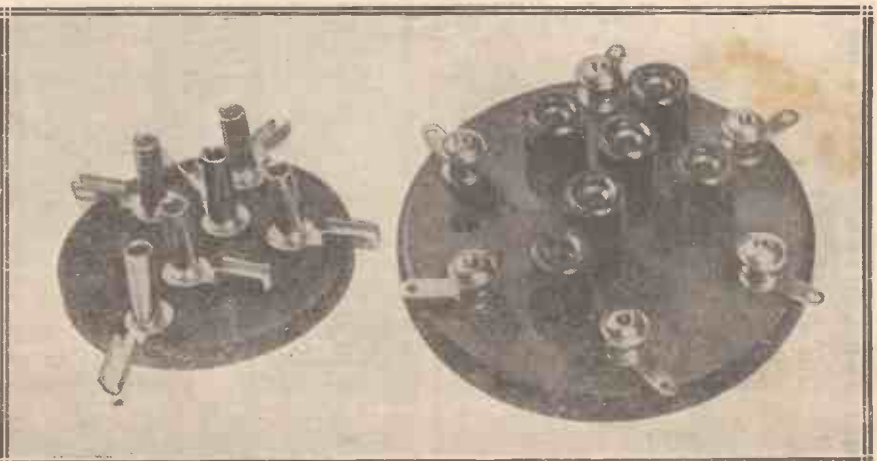
of course, recommended that they should be run so high as the 50 milliamperes mentioned above, for this figure is really beyond the reasonable demands that should be made on any dry battery, however large. They will stand up nobly for months on end to a load of 25 milliamperes, such as a five-valve transformer-coupled set may often take.

### Good Six-Pin Coil Bases

From Messrs. Brown Bros. we have received for test two samples of their Duco, types A and B, six-pin coil bases. Two are shown side by side in the accompanying illustration. Type A, which sells at the moderate price of 2s. 6d., is made up on an ebonite disc, and has six terminals fitted with soldering lugs, each socket separately shrouded in an insulating material to prevent any likelihood of short-circuiting.

The terminals are clearly marked on the base, and connection between the terminals and the sockets themselves are all soldered and substantially made. Submitted to high-frequency tests, this base proved thoroughly satisfactory and can be well recommended to all who require good, substantial six-pin bases of high quality.

Type B is no less efficient electrically, and, in fact, in high-frequency tests had an efficiency fully equal to that of type A. It is made up on a somewhat smaller disc of ebonite with unshrouded sockets and connections made only by means of the soldering lugs, which project far enough from each socket to enable connection to be easily made. At a shilling it is remarkably good value.



Examples of the "Duco" six-pin coil bases, a report on which appears above.



Some typical faults and remedies reviewed.

By P. R. BIRD.

### The Next-Door-Neighbour Problem

WIRELESS law is an art in itself, but a reader who shall be nameless raises a fundamental point that may settle doubts in similar cases.

The position was a fairly simple one. Mr. A., living in one of a row of houses, rented a small shed in an allotment situated quite near his backyard gate. Mr. B., living next door, objected to Mr. A. putting up an aerial between this allotment shed and house because the wire ran over his (Mr. B.'s) back garden.

Mr. A. pointed out that Mr. B. had no aerial himself, and so it didn't matter. But Mr. B. said, aerial or no aerial, he wasn't going to have wires over his garden. And you can guess what happened.

After a heated discussion over the garden wall, Mrs. A. and Mrs. B. came out, and told one another what they thought of this and various other household matters—"loud-speakers-going-late-at-night-when-respectable-people-were-trying-to-get-to-sleep," and "a-loud-speaker-is-music-anyhow-and-that's-more'n-you-can-say-about-a-mangy-dog-howlin'-all-night," and so forth.

To cut a long story short, Mr. A. had to take that aerial down. For as the law stands a man is presumed to own not only his land, but the air above that land, right up and up as far as any of us will ever get! So if you want to run an aerial across the property of somebody else, you must get the owner's permission to do so!

### Intermittent Interference With Quality

Of all the funny faults that puzzle the perspiring trouble-tracker, none is more disturbing than distortion that "comes and goes." Perhaps your own set does not suffer from this particular malady, but as it may get an attack at any time, the experiences of those afflicted will be of interest.

The symptoms are generally something after this fashion:

#### THE TECHNICAL QUERIES DEPARTMENT

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Have you any knotty little radio problems requiring solution?

The WIRELESS CONSTRUCTOR Technical Queries Department has been thoroughly reorganised and is now in a position to give an unrivalled service. The aim of the department is to furnish really helpful advice in connection with any radio problem, theoretical or practical.

Full details, including the revised and, in cases, considerably reduced scale of charges, can be obtained direct from the Technical Queries Department, WIRELESS CONSTRUCTOR, Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: on receipt of this all the necessary literature will be sent to you free and post free, immediately. This application will place you under no obligation whatever. Every reader of the WIRELESS CONSTRUCTOR should have these details by him. An application form is included which will enable you to ask your questions, so that we can deal with them expeditiously and with the minimum of delay. Having this form you will know exactly what information we require to have before us in order to solve your problems.

The set—which may be of any type, working either loud speaker or 'phones—suddenly becomes erratic as to quality. On some nights it is absolutely perfect up till, say, half-past nine, but then it suddenly "goes

off," and speech becomes muzzy, whilst music becomes a misery hardly to be endured.

Then quite suddenly, for no apparent reason, all is well again. For a few nights it may continue clear and good, and then perhaps it starts again, possibly at the beginning of an evening programme. And after its owner has done everything he can without making the slightest improvement he closes down in despair! Generally, to find that next time he switches on the set is in fine tone and voice again. He settles down with a sigh of content to enjoy the programme, but sooner or later this come-and-go distortion starts again!

What is wrong with the set in a case of this kind?

### When Wave-length is Changed

The first hint of the answer is given by noticing what happens if its wave-length is altered. When the quality of the local station suddenly "falls to pieces" in this way, try tuning the set to 5 G B, or to any other programme within its range. If all is well there, you have solved the problem.

For though the quality of 5 G B (or whatever the "alternative" is) may likewise go suddenly, you can always dodge back again to the other programme! Thus proving that your set is all right, but somewhere near your aerial there is a confounded oscillator, who uses far too much reaction to boost his strength of reception.

Often this particular type of oscillator does not give himself away by tuning-howls, but he simply switches on the set and lets it oscillate steadily, spoiling that particular programme for all his neighbours until he closes down. In fairness it must be said he is generally quite ignorant of the trouble he causes, and has no idea that when he "picks up" for the night he restores good reception to all the aerials in his vicinity.

### Improving the Clarity

The remedy in such a case is a large slice of tact. By a helpful and neighbourly interest in his set you may get a look at it, and be able to demonstrate to him that his quality is better with the coils nicely separated. Or that his reaction condenser can with advantage be turned back a little, any slight loss in strength being more than off-set by the gain in quality. Probably he will be as pleased as you are at the improvement, which will clear up not only his own reception, but that of every listener in the vicinity.



# LABORATORY NOTES

By the Editor



ONE of the most difficult tasks which confronts a radio testing laboratory is the comparison of low-frequency transformers with a standard. Unless very great care is taken in all tests, grossly misleading results may be the sole reward for much effort.

A low-frequency transformer consists, of course, of a primary winding, an iron core, and a secondary winding. All three must be right. The ideal transformer would give a perfectly uniform amplification of all the frequencies which go to make up the transmission from a broadcasting station. Let us assume for a moment that we have such a transformer. Would this alone ensure perfect reproduction? By no means!

### Where Loud Speakers Fail

No transformer gives the same reproduction curve with every kind of valve, so that to experience the imagined perfection we would have to select the correct valve for the transformer in question. Secondly, the transformer is used to precede a valve, and in the output circuit of this valve there will be either a further coupling device or a loud

Under this heading the Editor discusses some of the many interesting points revealed during experiments in the "Wireless Constructor" laboratory.

speaker. The makers of some of the best low-frequency transformers and coupling units publish curves showing remarkably uniform amplification, but no single loud-speaker manufacturer has yet had the courage to put out the curve for his loud speaker. A scenic railway in an amusement park designed to have the same contour as the average loud-speaker curve would at once be condemned as unsafe!

Tests in the WIRELESS CONSTRUCTOR laboratories have shown conclusively that there are a number of low-frequency transformers and resistance-capacity-coupled units

which, when used correctly, will give better curves than any loud speaker yet sold. This is one of the many reasons why this journal does not advise its readers that, so far as quality of reproduction is concerned, resistance-capacity coupling is always better than transformer coupling.

### How Transformers Vary

Experimenters who have themselves been in the habit of making comparisons between various low-frequency transformers will be interested in the following facts.

Firstly, if half a dozen transformers are taken and arranged in order of their degree of amplification on, say, a medium frequency with a particular valve, the order of merit may be entirely changed when another type of valve is substituted.

Secondly, the inductance of the primary winding of most makes of transformer could very beneficially be increased.

Thirdly, a transformer can very easily be made with a high turns' ratio by the simple expedient of reducing the number of turns on the primary at a considerable sacrifice of amplification and quality.

### Not a Good Test

Fourthly, the suitability of a transformer for a valve circuit cannot be gauged by testing it as a coupling between a crystal detector and a note-magnifying valve. This latter is one of the few cases where a very high-ratio transformer is really useful, as the primary can be of quite low impedance. For these reasons, the cheap transformers with low-impedance primaries often give practically as good results, following a crystal detector, as the much more expensive varieties.

Experimenters who use the Mansbridge type of condensers for their



Mr. Percy Harris testing the efficiencies of a number of small resistance-capacity-coupling units.

## Laboratory Notes—continued

experiments should be very careful not to damage the casing or the wax filling. The dielectric of this type of condenser is paper, and if it is exposed to the air it will rapidly absorb moisture, and the insulation of the condenser will fall. In two or three cases which have come to the notice of this laboratory, the Mansbridge type of condenser has developed a two- or three-megohm leak a day or two after the paper has been exposed by the breaking away of the casing. In the metal container type this may occur by wrenching, causing the projecting tab which holds the condenser to the base-board to part company with the box at one corner. In the containers made of moulded material a fall may fracture the moulding and expose the paper.

### "Noisy" Grid Leaks

Although the average grid leak now sold is a thoroughly reliable little accessory, especially when purchased from one of the well-known makers with a reputation to maintain, there are occasionally cases where a noisy grid leak causes all kinds of trouble, frequently attributed to other sources,

such as the high-tension battery or accumulator. It is very easy to rig up an arrangement which will test whether your grid leak is noisy. All that is necessary is to connect a grid leak in series with the primary of a low-frequency transformer and a couple of dry cells. The secondary of the transformer should be connected to a valve in the usual way, and preferably this valve should have another low-frequency transformer in its output circuit (giving a two-stage amplifier following the grid leak).

### A Simple Test

For example, a three-megohm grid leak in series with the primary of a transformer and a couple of dry cells, if correctly graded and of good quality, should pass a perfectly steady current of approximately one micro-ampere.

If now we listen at the output end of the amplifier with a pair of telephones we should hear nothing whatever save when the current is started and stopped. If, however, the leak is faulty and "noisy" (which means constantly changing its value), the current passing through the primary

of the transformer will vary with the variations of resistance in the grid leak, and we shall get noises and crackles.

### Care Required

The position of the grid leak in a receiver is such that it never has to carry more than a very small current, as the voltage applied to the grid of a detector valve is probably on the average considerably less than one volt, so it is not fair to test grid leaks, as some people do, with a high-tension battery of 100 volts or so, for a grid leak which may be perfectly satisfactory for all ordinary receiving purposes is often ruined by such a test. Grid leaks are measured in the WIRELESS CONSTRUCTOR laboratory with a voltage applied to their terminals such as that which they are likely to meet with in ordinary practice. Anode resistances and resistance-capacity-coupling units are, of course, tested with much higher voltages.

\*\*\*\*\*  
 \* HOW YOU CAN \*  
 \* SAVE MONEY \*  
 \*\*\*\*\*

**M**ANY home constructors waste a great deal of solder, and it is surprising how far this material will go if care is taken. The writer always uses the lid of a large cocoa-tin to contain his solder and every now and again a quantity is melted off the stick of solder (the most economical way is to buy a large stick of solder and not the thin 1d. or 2d. sizes from the ironmongers). In another tin lid a little flux is kept, and after the iron has been cleaned it is dipped into the flux and solder picked up from the other tin lid. The advantage of having the solder in the lid is that the end of the iron can be rubbed in it and well tinned with great ease.

When a set is dismantled drops of solder can be melted off the ends of terminals and wires into the tin lid and very little solder is wasted. After considerable use a lot of dirt and dust will accumulate in the lid, and when this happens the whole lid should be placed over a gas ring and all the solder melted together. The scum can then be quickly scraped off and the solder poured out on to a stone floor where it will immediately set into a large shiny "blob" which can be transferred to a new tin lid.



At a recent schoolboys' exhibition in London, youngsters gave demonstrations of radio set building. This, as can be imagined, aroused the interest, and no doubt the admiration of the youngsters, a group of whom can be seen above watching the assembly of a three-valver.

# HOW TO USE YOUR GRAMOPHONE

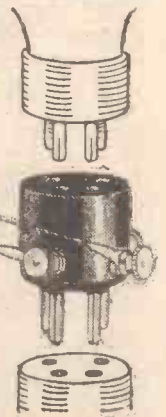


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The Lissen Electrical Pick-up helps your gramophone to reproduce the low notes of the music more perfectly than ever you have heard them — it takes the needle scratch from old records and makes new records last longer.

## LISSEN ELECTRICAL PICK-UP 15'



### INSTRUCTIONS:

Replace your sound box with the Pick-up, connect from Pick-up to Grid Terminal of the Lissen Pick-up Adaptor and to one filament terminal of the Adaptor. Plug the Adaptor with valve fitted in it into the Detector Valve Socket of a two or three valve set.

Full particulars included in every Adaptor Carton. Obtainable at most dealers, but if any difficulty send direct to factory (post free or C.O.D.).

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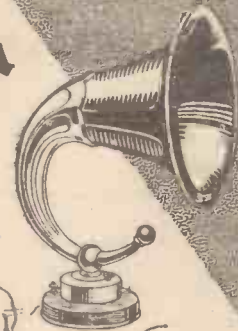
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All over the world, the perfect realism of the "Brown" Loud Speaker is enjoyed by those who enjoy good reception. All over the world the standard of Loud Speaker reproduction is set and maintained by the "Brown."

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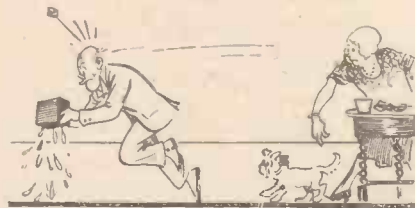
The Loud Speaker on which the sun  
never sets!

Advt. S. G. Brown Ltd., Western Ave., N. Acton, W. 3.



I FOUND the Professor conducting long-distance reception rather under difficulties the other night when I dropped in to see him, since a large bump on the top of his head rendered the wearing of a normal telephone headset impossible. He had got over the difficulty in his usual ingenious way by detaching the receivers from the headbands and fastening them to his ears with sticking plaster.

Striding forward to greet me with outstretched hand he was brought up short by the tautened 'phone cords, and nearly had his ears torn out by the roots.



"The hand that rules the cradle waves the rocks!"

When I had helped him to remove the sticking plaster, we sat down by the fire for one of those chats which are so productive of epoch-making brain-waves.

"But first tell me," I murmured, "how you came by that bump?"

It appeared that the Professor had sought to demonstrate the marvellous qualities of an unspillable accumulator that he had just constructed by turning it upside down upon the drawing-room carpet—with rather disastrous results.

### Cause of Scratch

Mrs. Goop happened to be in the room at the moment engaged in constructing a thingmebob for her tulip bulbs from knobby bits of rock. She is a remarkably good shot at times, and on this occasion she was able to give a practical demonstration of that dear old saying:

"The hand that rules the cradle waves the rocks."

We sat silent for a while. I was just thinking what a rotten time King

Solomon must have had if he ever upset something on his drawing-room carpet, when the Professor suddenly flung a question at me. "What," he asked, "is the cause of scratch?"

I pondered for a moment. "Tickling," I said brightly, "or blackberrying, or spanking pussy."

"No, no, no!" snapped the Professor. "I mean the scratch, or rather the scratching noise that you hear when the gramophone or the pick-up is at work."

### An Easy Cure?

This was rather a poser.

I have always found that when I have a really difficult bit of thinking to do that matters are made easier by closing my eyes and lying well back in my chair. Such is the concentration produced in this way in the jolly old brainbox that I have ever been known to emit absentmindedly noises that might have been mistaken for snores by those who did not know what was taking place.

I had just doz—that is to say, I had just got into my thinking stride, when the Professor dug me sharply in the ribs with the poker.

"I asked you a question," he rasped.

"Hullo! Hullo! Is that you, Professor?" I said, rubbing my eyes.

"Yes—er—quite so," I stammered. "Let me see."

The Professor held up his hand. "Scratching," he said, "is due to three things. We have a hard needle pressed against a hard record by the weight of the pick-up or sound-box."

"Then, surely," I remarked, "the cure should be easy. All that we need is either a rubber needle or a soft record. Weight I regard as entirely unimportant. It should probably be the easiest thing in the world to arrange a spirit-lamp under the turntable to keep the record nice and cushy. Or, again, I see that records are already being made of chocolate; let us immediately patent the Goop-Wayfarer Ice Cream Record. Or we might run quite a number of different

lines, for edible records seem to be coming into fashion."

### Remedies That Failed

The Professor withered me with a glance. He had already tried, he assured me, rubber needles and even rubber records. The trouble about the former was that they produced a slightly muffled tone, whilst the latter were not a sound proposition commercially since it would be so easy for unscrupulous people to purchase little 6-in. affairs and to stretch them to the largest size.

He affirmed that, contrary to my view, scratch was due mainly to the weight of the sound-box affair or the thingmejig. For that reason he was engaged in designing a pick-up of an entirely novel kind. It was to be, he said, rather on the lines of a dirigible airship, only, of course, a little smaller.

### A New Idea

Immediately above the box containing the needle holder and the magnets and things would be a duralumin framework containing a gas-bag divided into several separate compartments in case a leak should occur in any one. This would be filled with hydrogen, and by adding or removing ballast it would clearly be possible to adjust matters so that the needle just lightly brushed the surface of the record and that no scratch of



"The younger members of the family will then willingly undertake the task of disposing of those records that have ceased to serve their original purpose."

any kind could possibly take place.

It would be quite possible, he thought, to utilise for filling the "Floatup," as he called it, the gas delivered by the loud speaker during topical talks. We hope to place this little device on the market as soon as we have perfected a suitable needle

## In Lighter Vein—continued

for use with it. The disposal of worn-out gramophone needles and safety razor blades forms one of the most difficult problems of modern civilised life.

### Edible Records

Carrying the idea of edibility yet a step farther, we hope shortly to be able to produce both needles and razor blades made of hard toffee. The younger members of the family will then willingly undertake the task of disposing of those that have ceased to serve their original purpose.

Meanwhile the Professor has not been satisfied for some time with the standard gramophone motor and turntable. The winding up process, if one uses the instrument a lot, is always apt to produce that distressing malady—sausage-maker's elbow. Secondly, the turntable is invariably horizontal.

This is clearly wrong, for we have seen that weight causes needle scratch, and what can you expect if you flop a horizontal sound-box on to a horizontal record? Then, again, there is the question of speed. The Professor likes his music rather fast, and he can never get the ordinary gramophone to go quickly enough. For these reasons he resolved to turn out something upon entirely original lines.

### Further Developments

His opportunity came whilst Mrs. Goop was away for a week visiting her mother. He erected in the drawing-room a neat little contrivance made of baulks of timber



"Into the cavity Miss Worple poured the greater part of the contents of the pepper pot."

which served to support the frame of an old push-bike, from which he removed the wheels. He replaced the back wheel with a turntable, and with the aid of the three-speed gear and some pretty work with the pedals he was soon able to get his music just as he liked it.

As, however, pedalling was rather hard work he presently substituted a motor-cycle for the push-bike. This was an exceedingly satisfactory ar-

rangement, and he found to his joy that the gentle purring of the exhaust completely covered up all needle scratch.

Then came a marvellous stroke of genius. He fitted the contrivance with a reversing gear, which enabled him to play records backwards. This having been done, he invited Miss Worple, Pimpleson, Tootle, Goshburton-Crump, and all the other deeply artistic souls in Mudbury Wallow to come to a little concert, saying that he would give them some of his own compositions.

### Goop Gets Going

Fearing the worst, but hoping that the refreshments would be good, they turned up *en masse*. Having provided each of them with a kind of stodgy bun that makes conversation impossible for several minutes, the Professor leaped into the saddle and got to work with the kick-starter.

The motor-bike he uses as a record rotator is the kind which invariably fails to respond to the first three kicks, whilst the fourth produces a soul-shattering explosion in the silencer. It was most unfortunate that Tumpy-Wumpy, Miss Worple's Pekinese, should have been sniffing delicately at the spout of the silencer just as the Professor put his weight into it for the fourth time.

He was blown right on to Pimpleson's shoulder, and would probably have gone right through the window had he not, with great presence of mind, secured a firm grip on Pimpleson's ear with what Miss Worple calls his "ickle teethy-weethies." Pimpleson leaped to his feet calling to all and sundry to come and remove the wild beast. Tumpy-Wumpy, however, appeared to have contracted galloping lock-jaw, for no efforts of ours could open his ickle moufy-woufy.

### We Doctor Pimpleson

With great presence of mind I dashed into the dining-room and returned with the pepper pot, which I handed to the distracted Miss Worple. "Shake it over him!" I cried. Miss Worple apparently thought that by "him" I meant Pimpleson. His mouth was open at the moment, for he was in the act of emitting a piercing yell. Into the cavity Miss Worple poured the greater

part of the contents of the pepper pot.

The scene that followed almost beggars description. Every time that Pimpleson sneezed Tumpy-Wumpy shot half-way across the room, stretching the lobe of the ear like the elastic of a catapult. Miss Worple vainly tried to catch her flying pet in mid career.

Things were looking very black when the Professor luckily trod for the eighth time on the kick-starter, and the ensuing report caused Tumpy-Wumpy's lock-jaw to give way to shell-shock.



"Miss Worple soon settled into her stride. Over her face crept an expression of rapture."

Releasing his hold, he fell unconscious on to the carpet, whence he was retrieved by his mistress, who proceeded to administer comfort. The rest of us gave Pimpleson first-aid, and things had just settled down when one mighty kick by the Professor got the engine revving.

### Astounding Results

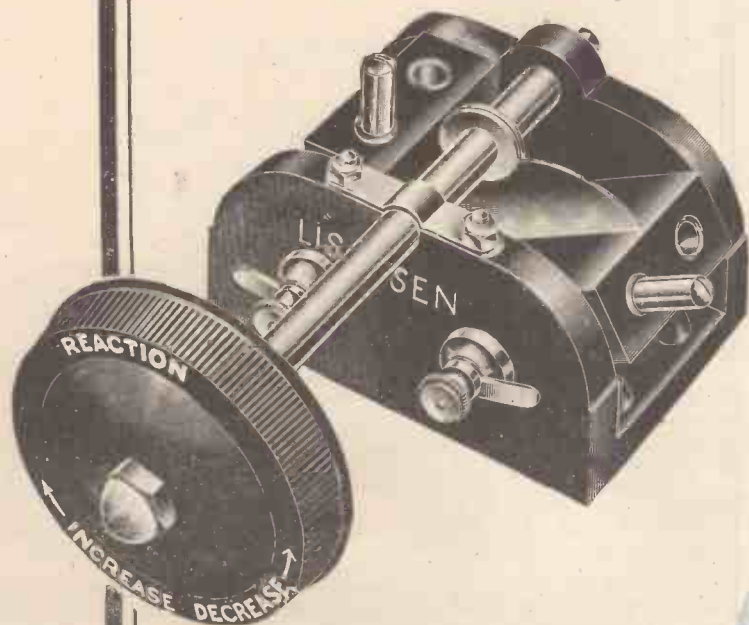
He put on "My Cross-Eyed Sweetie," or something of that kind, with his gears in neutral, and then reversed and let in the clutch, playing the record, of course, from the middle outwards.

For a moment no one knew quite what to think of the amazing cacophony that filled the room. All looked at Miss Worple, as the highest of the high-brows present, in order that they might take a lead from her. Though a little startled at the opening chords, Miss Worple soon settled into her stride. Over her face crept an expression of rapture.

All the rest tried more or less successfully to follow suit. When the record came to its end, Miss Worple flung her arms round the neck of the embarrassed Professor, telling him that he had surpassed Destripes, Popofski, Katzenjammer, in fact, all of the most eminent of the modern masters.

Tootle, who is a professional musician, is now helping the Professor to prepare his composition for publication.

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Model A. With 2 in. spindle (2 way) .. .. **4/6**

Model B. With 5 in. spindle (2 way) .. .. **5/6**

## LISSEN HEADPHONES

Never before was it thought possible commercially to make headphones so light and at the same time so sensitive. These headphones are so light they may be worn throughout an evening without the wearer realising they are on the head. Cords will not twist or tangle but will always hang straight down no matter how the head may be turned, moved or twisted. The two earpieces are extremely sensitive and both are exactly matched in impedance. They settle at once into comfortable positions and may be secured there by the single movement of a special ball joint .. .. **8/6**



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**LISSEN LEADS IN R.A.**

# WITHIN THE VACUUM

*Volume with purity is not easy to obtain, though much can be done if the valves in your set are carefully chosen. This article shows how you should go about it.*

By KEITH D. ROGERS.



“WHAT do you think of it? Good set, eh? I can hear the local station all over the house.”

You must have heard those and similar phrases many, many times. But how many times have you been able to endorse the proud owner's remarks? How many times have

you been disappointed? You may be disappointed, but the average set is designed for use with valves of the 20,000-ohm impedance type.

The detector stage needs more care because it will depend upon the coupling between this stage and the next as to which type of valve should be used. There is a little difference as to whether a high-gain valve or one with a low-gain factor should be used when the detector stage is followed by resistance-capacity

## Moderate Magnification

For the use of a valve having a magnification factor of not more than 25, and anode resistances of 50,000 ohms. If tremendous anode resistances and high-gain valves are employed, a loss of the high frequencies will be incurred, and the next valve in the 1st L.F. stage—will have to be carefully chosen to avoid overloading on strong signals. I think that in most cases a detector of 20,000 ohms, or perhaps less, say 13,000 or so, will fill the bill admirably.

The 1st L.F. valve should be chosen with a view to whether it has to provide big amplification with a small input, or moderate amplification and supplied with a fairly large grid swing.

Moreover, it must not supply to the next stage, which is probably the last, such a volume that the latter cannot deal with it without being overloaded, for it is here that a large proportion of the distortion which accompanies large volume occurs.

An ordinary power valve in the last stage must not be expected to give very great volume without distortion, it will magnify moderate inputs to a fair degree but will overload and cause distortion when a large input is supplied. For really loud signals the magnification must be carried out gradually in the intermediate stages, and then the last stage must have a super-power valve to feed the energy to the loud speaker.

It must also be realised that placing valves in parallel does not enable them to carry more grid swing without  
(Continued on page 65.)



*A well-erected aerial. It is, however, useless to have a high aerial and a set capable of giving plenty of volume if you sacrifice purity of reproduction in order to attain that volume.*



# RADIOGRAMPHONICS

*A monthly article for the gramophone enthusiast.*

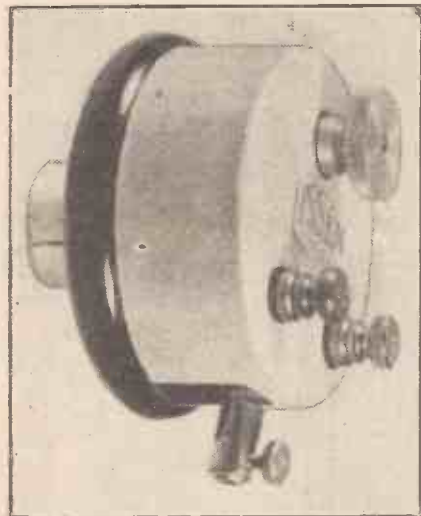
*Pick-ups Tested — The Pick-up in Practice.*

**By A. JOHNSON-RANDALL.**



**W**E stated in our review last month that we had just received one of the new Lissen gramophone pick-ups for test and report. We have now had an opportunity of making a thorough examination of this little component.

The Lissen pick-up is not unlike a telephone carpiece in appearance. It is of the permanent magnet type, the windings being of high resistance. A very stiff armature is pivoted at one



*One of the lowest-priced pick-ups on the market is the Lissen shown above.*

end, and is arranged so that by means of a knurled adjusting screw its distance from the magnet, and consequently its sensitivity, can be adjusted easily and quickly.

It is evident that some care has been expended in the design, and it is apparent that efforts have been made to render the arrangement as free from resonance as is possible. A neat aluminium cover protects the internals and prevents damage to the delicate magnet windings, and the component is quite light in weight.

On test with three stages of resistance-coupled low-frequency amplification, and in conjunction with a moving-coil loud speaker, the pick-up showed good sensitivity and, considering its remarkably low price, namely, 15s., it

is certainly excellent value for money. Those to whom price is a

consideration should certainly secure a practical demonstration of this component, and we can assure them that they will be surprised at the results it gives.

We have also received for test the pick-up made by the General Electric Company, Ltd. Here, again, the device is of the permanent magnet type, the magnet windings themselves being entirely enclosed in a very neat aluminium case, a substantial horseshoe magnet being used to form the framework upon which the component is built-up.

### Very Sensitive

The whole component is extremely rigid, is well finished, and gives one the impression of being very serviceable. On test it was found to be very sensitive, and quite up to the standard of the other pick-ups with which it was compared. There were no noticeable resonance peaks, and both the high and low notes were faithfully reproduced. The device can be well recommended.

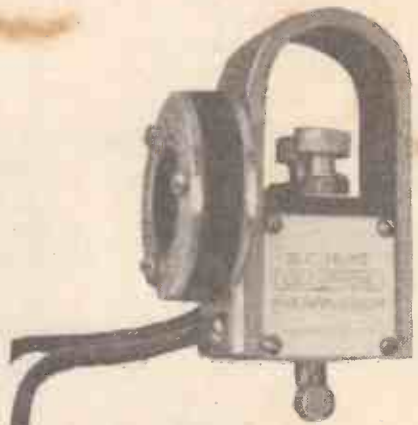
\*\*\*\*\*  
\* **THE PICK-UP IN** \*  
\* **PRACTICE** \*  
\*\*\*\*\*

**E**ACH month brings forth further progress in the art of mechanical reproduction of music. Gramophone manufacturers themselves are conducting experiments in the electrical reproduction of their records. I believe that within a year or so, all of the best quality gramophones will incorporate some form of electrical pick-up and amplifier, instead of the ordinary sound-box.

There is already one excellent example on the market, namely, the

Panatrope, which utilises a valve amplifier and a moving-coil loud-speaker unit. Of course, the Panatrope is rather expensive, but I believe that it will be possible for manufacturers to turn out a first-class gramophone employing a pick-up and some form of "cone" loud-speaking device which will be sold at a reasonable price.

Radio enthusiasts, however, are in a very advantageous position, because they already have their amplifier, batteries, etc., and there is no reason why they should not obtain results just as good as anything the gramo-



*The Geophone pick-up described in this page.*

phone manufacturers can turn out, and, moreover, at a lower cost, because they can utilise their existing radio parts.

Generally speaking, any modern amplifier designed to reproduce the lower frequencies will give excellent results with a pick-up. Most of the up-to-date wireless sets utilise either resistance-capacity coupling or resistance-transformer coupling on the

## Radiogramphonics—continued

low-frequency side, and both arrangements can be used successfully.

The "Business Man's Four," which was described by Mr. Harris in the February issue, can be easily adapted for use with a pick-up. The theoretical diagram has been reproduced for the benefit of those who have constructed this popular receiver, and who are interested in the electrical reproduction of gramophone records.

### A Plug For Pick-Ups

The easiest method is obviously to employ one of the pick-ups which can be plugged straight into the detector socket, such as the Amplion, and others. In this case, no modification would be necessary, the adaptor socket being plugged straight into the second valve holder of the "Business Man's Four."

Alternatively, a plug and jack could be used. The panel could be drilled to take an ordinary open-circuit telephone jack, the two contacts being connected to the grid and negative filament of the detector

grid leak  $R_5$  would have to be removed from its clip, otherwise the grid of the first valve would be at a positive potential. Of course, this could also be carried out by switching, and next month I shall show how a switch could be incorporated in order to change straight over from gramophone to radio and vice versa.

I am of the opinion that one of the simplest and most easily handled amplifiers for gramophone use is a "straight three L.F." resistance-coupled.

It is cheap, and very rarely suffers from that "bugbear," L.F. oscillation.

The values I prefer are as follow: First stage, anode resistance 200,000 ohms; second stage, anode resistance 100,000 ohms; and third stage, also 100,000 ohms. Coupling condensers of .02 mfd. and grid resistances of 1 megohm give very good results.

These values give what may be termed medium amplification, that is to say, the step-up at each stage is not very great, but the quality is

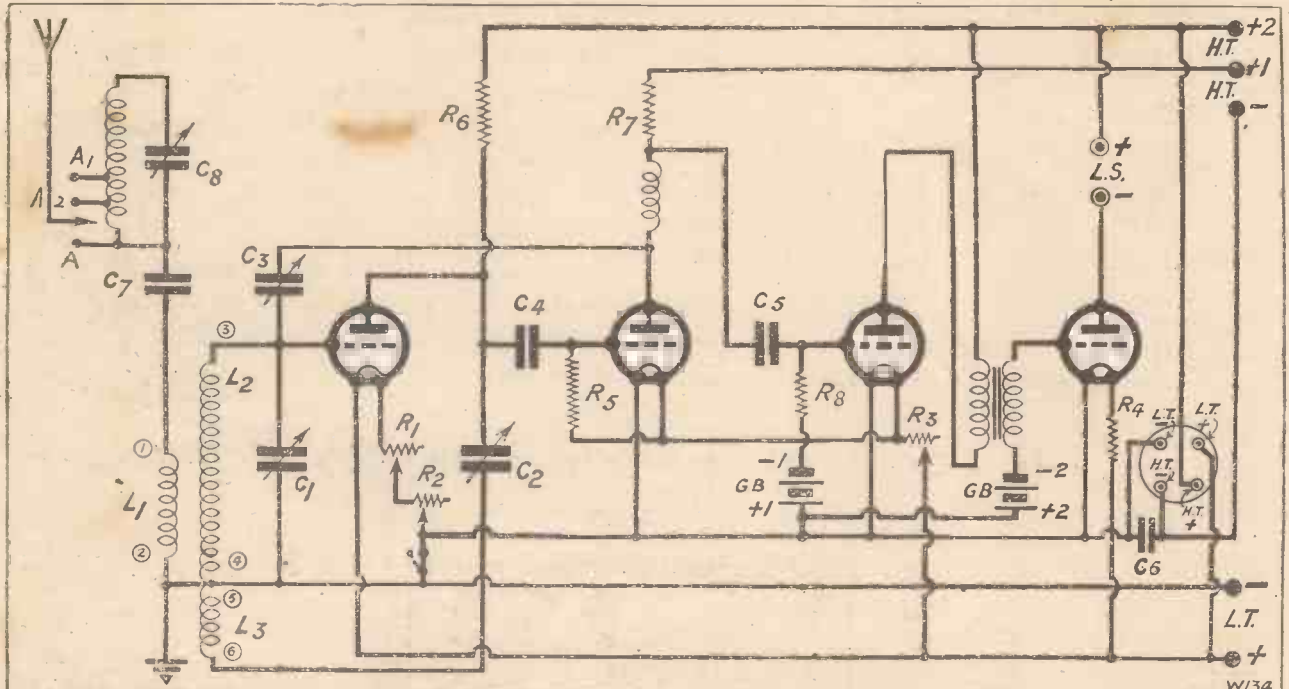
be one of the so-called H.F. type (impedance 20-30,000 ohms, magnification 20), and the second valve may be of similar type, with  $1\frac{1}{2}$ -3 volts grid bias. The next valve can be a small power valve (impedance 8,000-10,000 ohms), and the last valve a super-power.

### Recommended Records

The same H.T. can be employed on all the valves and should not be less than 120 volts.

I have been asked what are the most suitable records for use with a pick-up. In general I think that practically all of those which have been electrically recorded will be quite suitable. I have used the H.M.V., Columbia, and Brunswick with excellent effect.

Organ records come through wonderfully well on a cone loud speaker. None of the moderately priced gramophones seem to render the bass to the same effect, and once a pick-up has been tried in conjunction with a good amplifier one never wishes to return to the ordinary sound-box again.



The theoretical circuit diagram of the "Business Man's Four," the full description of which appeared in the February number of the "Wireless Constructor."

valve. The H.F. valve could be turned out by means of the variable resistance and the pick-up plugged straight into the jack.

One other modification would be necessary, and that is the detector

excellent. Three stages will give plenty of volume with any of the pick-ups I have tried.

The pick-up leads can be connected straight across the grid and negative filament of the first valve, which may

Personally, I use the ordinary steel H.M.V. needle, and I always change it each time a new record is played. If the pick-up is reasonably sensitive a "medium" tone seems to be the best.



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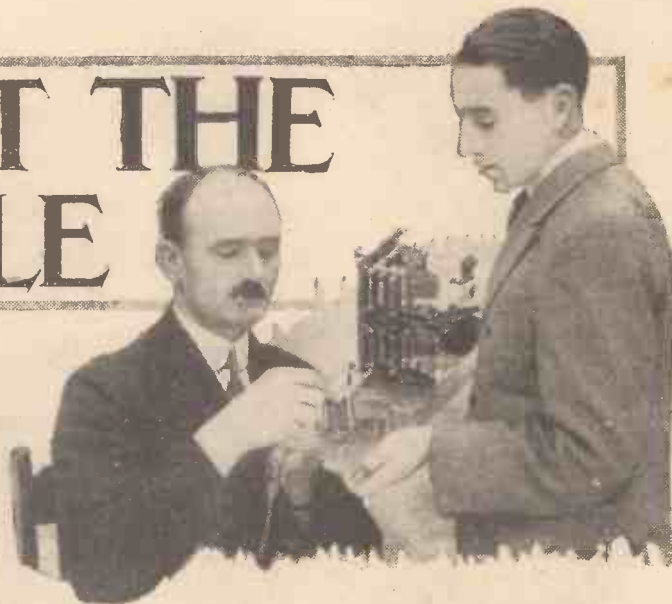
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# CHATS AT THE WORK-TABLE



Many points of practical interest to all radio constructors are dealt with this month, including *The Care of Equipment—Preserving Files and Other Tools—Useful Gadgets, etc., etc.*

By R. W. HALLOWS, M.A.

## The Care of Equipment

In a damp climate such as that in which we rejoice (or the reverse!) good tools are liable to suffer severely unless they are given a certain amount of care. If you possess any such delicate pieces of apparatus as a micrometer, a finely graduated precision rule, a surface

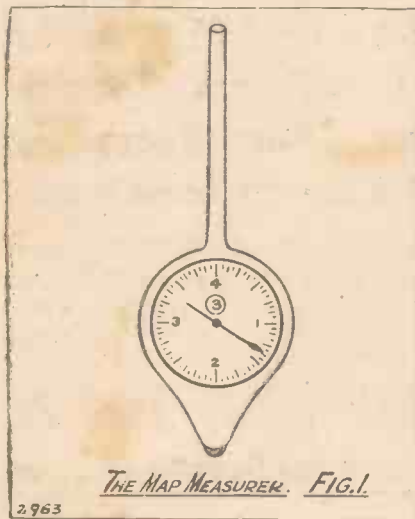


plate or a set of gauges, these should be looked to at frequent intervals, for the slightest trace of rust is apt to detract permanently and seriously from their accuracy.

None of them except the micrometer should be given more than the tiniest trace of grease, but all should be kept in suitable cases in the driest possible cupboards or drawers and wiped over at frequent intervals. For the micrometer and for other delicate instruments with moving parts there is nothing to beat Rangoon oil, which can be obtained from any gunsmith.

If the cases in which they are kept are lined with velvet, plush or some other damp-absorbing material, as is often the case, an occasional drying out in the sun—if there is any sun—or before the fire—if there is not—is advisable. The day will probably come before long when precision instruments are made of rustless steel, and it will then be much easier to keep them in condition. Till then, however, they must be attended to if they are not to be spoilt.

But delicate and expensive tools or instruments are not the only ones that deteriorate under the effects of dampness. It may be said that any tool which has a cutting edge or edges is more or less liable to be affected by the same cause; the finer it is the more likely is it to suffer if neglected.

## Spoilt By Rust

When one comes to think of it, the majority of the tools that the wireless constructor uses, with the exception of pliers, hammers, spanners, and screwdrivers, are employed for cutting. Drills, saws, files, chisels, planes, gouges, and scribers, which make up the larger part of his equipment, are all cutting tools. Probably unless one has seen a finely sharpened edge under the microscope, one does not realise how quickly rust does its fell work.

To the naked eye the business end of a sharp chisel, for instance, looks something like Euclid's definition of a straight line. It appears to be perfectly straight and even; at any rate, if any dents or jags are visible, one feels that it is a case for the whetstone. Under the microscope

the finest edge is shown to be anything but straight or smooth or even. It is composed, in fact, of a series of tiny serrations.

## Thin Edges

The metal of which the little points along the edge are composed is almost incredibly thin, and is therefore easily attacked by rust. When rust has been at work for a day or two these crumble away, leaving the edge—unbelievable as it may seem—too even to be sharp. If you cannot credit what has been said about the serrated edges of fine cutting tools, here is a little experiment that will convince you. Wait until you come across one of those phenomenally sharp razor blades that occasionally turn up. Dry it most carefully, and then examine its edge under a microscope. It will remind you of that of a table knife which has been used for opening tins!



There is only one way of preserving cutting tools from rust, and that is to protect them from the air as much as possible. For this reason they should always be covered with a thin film of grease. For fine tools, such as very small drills, Rangoon or sewing-machine oil will do excellently.

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## Chats at the Work-Table—continued

For larger tools, I can recommend mineral jelly, which may be smeared on every now and then, with a piece of rag. But grease in itself is not sufficient unless it is applied rather too liberally to be pleasant. Drills lightly greased will take no harm if kept either in the handy automatic canisters which are obtainable at reasonable cost, or failing these in cigarette tins. If cigarette tins are used care should be taken to choose those which have no holes punched in them.

### A Valuable Tip

In very damp weather a small handful of the commonest tea may be placed in each tin. Dry tea is one of the most hygroscopic of substances, absorbing all the moisture that it can. By doing so it preserves steel tools surrounded by it, since it takes up the damp that would otherwise reach them. When tea-leaves are used, they should be dried out every now and then.

I learnt this tip a good many years ago from an old campaigner. We were in camp at the time in pouring

### NOW IS THE TIME—



Now is the time to look to your earth connection, a point in your equipment upon which much depends. An earth tube of the type shown in this photo is a good device for all-round efficiency. It should be well driven into moist ground.

wet weather, and the mess cigars were utterly unsmokable owing to their damp condition. He disappeared one afternoon, returning later with several packages of cheap tea. After thoroughly drying out their contents

before the stove, he placed a quantity in each box of cigars. Within twenty-four hours the unsmokables had become smokables once more. Tobacco is strongly hygroscopic, but tea is far more so.

### Preserving Files

Files are rather a problem. If they are used for steel work there is no harm in oiling them, but they are much better "dry" for working ebonite or brass, which are materials that mainly come our way.

A method which I have found pretty satisfactory is not to grease them at all, but to give them at fairly frequent intervals a rub over with a file card or a stiff wire brush. This kills two birds with one stone. All traces of rust are removed and the files are kept free from the deposits which form in them when they are used for work upon such comparatively soft substances. Files may be regarded legitimately as perishable tools which cannot last for ever. After all, they are not very expensive, and it does not greatly matter—in fact, it is often a distinct advantage for our work if they lose something of their initial keenness.

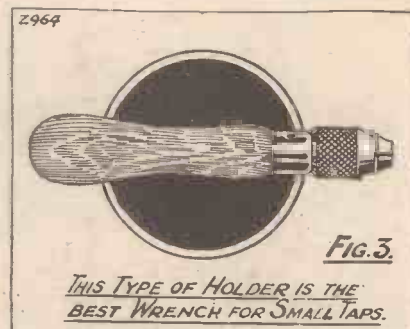
What one does as a rule is to accord them the reverse of promotion as as they become older. When new they may be used for the somewhat strenuous work of doing the first rough shaping, where one wishes to make the maximum cut with a minimum amount of labour. As they grow older and less keen they come in very handily for smoothing off before recourse is had to a fine file for finishing off.

### Put Them Away

The worst possible way of keeping tools of every kind is to leave them lying about higgledy-piggledy on the work bench. Not only are they exposed in this way to the evil effects of damp air, but they are also liable to be chipped or blunted by coming into more or less violent contact with pieces of metal or other tools. Chisels and other wood-cutting tools are best kept, during the damper part of the year, at any rate, in rolls made of washleather or American cloth.

Every workshop should have a cupboard of some kind, and there should be drawers beneath the bench so that tools may be stored in safe places. It is most important to protect saws of

any kind from the effects of rust. For satisfactory working the surfaces of their blades must be perfectly smooth, for otherwise they are apt to bind in a cut with a likelihood of either a bend or a breakage. For this reason both metal saws and wood saws should have their blades lightly wiped over with an oily rag at frequent intervals, and



they should certainly be kept "in grease" when they are not in use.

It must not be forgotten, too, that larger parts of the equipment, such as the vice, the bench drill or the hand drill, require looking after. The jaws of the vice and the threads of its screw both require to be greased every now and then, and the same is true of the chucks, gears, and feed screws of drills.

### A Handy Gadget

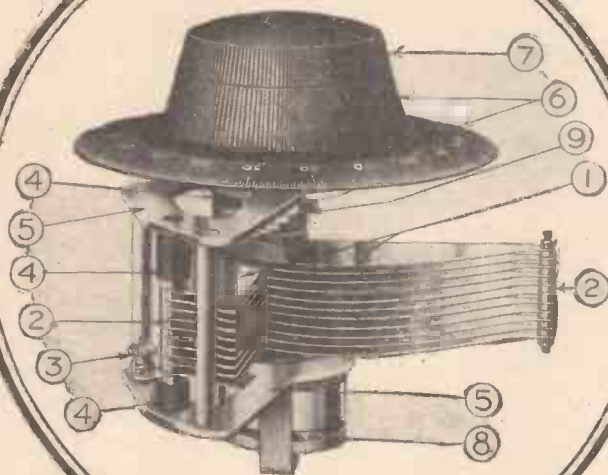
One of the most useful little instruments that I have come across for a long time is the map measurer which is illustrated in Fig. 1. These are obtainable at small cost from shops which deal in measuring instruments, and one can sometimes pick up ex-Army map measures from those who specialise in war surplus stores.

The principle of the instrument is similar to that of the taximeter. At its lower end is a small toothed wheel which engages with gears within the case. These drive the needle, whose point travels round the graduated dial. The most useful type for the wireless man is that graduated in inches. The dial itself reads in a very convenient type from 0 to 4 inches by sixteenths.

When the pointer has made one complete revolution the figure 1 appears in a recess in the upper part of the dial, a click being heard as it does so. Succeeding revolutions are recorded in the same way. In use the wheel of the instrument is run over whatever it may be desired to measure and the length is then read

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7. SMALL KNOB. This moves independently of the main knob and works a slow-motion drive. 8. SLOW-MOTION DRIVE. Approximate reduction ratio of 200-1, enabling precise tuning adjustments to be easily secured. 9. BALL RACE, giving a velvet-smooth movement whether the direct or slow-motion drive is used, and with entire absence of backlash in either case. One Hole Fixing— $\frac{1}{4}$ -in. clearance. A large nut is provided for mounting on bench. Maximum Capacity '0005.



Advt of the Dubilier Condenser Co. (1925) Ltd., North Acton, W 3. ©139A



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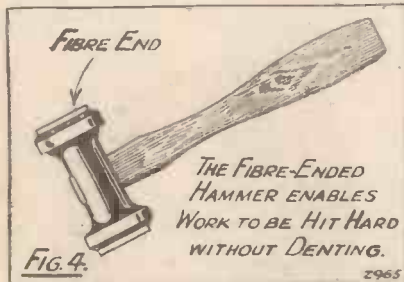
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London, E.C.1

## Chats at the Work-Table—continued

off from the dial. If, for example, after making a measurement the figure 3 appears in the recess in the dial and the pointer registers  $1\frac{3}{16}$ , as shown in the drawing, then the total distance measured is 3 by 4,  $+1\frac{3}{16}$ —or  $13\frac{3}{16}$  inches.



The uses of the map measurer in constructional work are many. Here is one of the most convenient. In the WIRELESS CONSTRUCTOR the wiring diagrams of sets or small pieces of apparatus are now accompanied by scales. If you want to discover the exact position on the baseboard of any component you can do so with the greatest ease by means of the measurer. Place its wheel upon the drawing and run it from the edge of the component to that of the baseboard. Note the reading and turn it back to zero. Then run the instrument over the scale of inches until the reading is repeated.

In a similar way the lengths of wires, the positions of components, and so on, can be read off approximately from good photographs, though the effects of perspective must not be forgotten. In dealing with a photograph there are always certain known dimensions, such as the length or height on the panel and the width of the baseboard. Another of its many uses lies in helping one to discover the answer to such a problem as: How much Litz wire will be required to wind sixty turns single-layer upon a former of given diameter? Run the instrument round the former, take the reading in inches, and multiply this by sixty.

## Soldering Leads to Dry Cells

A single cell is often used nowadays to provide the grid biasing potential for high-frequency valves. Unless some special form of mounting with spring contacts is used this necessitates as a rule the soldering of leads to the cell itself, a job which requires rather careful handling. It is very

important that in the process of soldering the cell should not be unduly heated up or it may suffer internal damage.

There is not, as a rule, much difficulty about attaching a wire to the little brass cap which forms the positive contact, for in most cases this will be found ready tinned. With a clean hot iron the job can be done so quickly that no serious amount of heating up occurs. The important point is that the iron should be hot. If it is not, it has to be applied for far too long before the solder will flow and the cell is warmed up to an undesirable degree. Soldering to the zinc pot in order to make the negative contact is not so easy, and unless one is careful a dry joint may be made which, though it may look all right, will come adrift sooner or later—probably sooner.

First of all the zinc should be thoroughly cleaned at the point at which the lead is to be affixed by scraping well with an old knife. A small amount of flux can be applied. After this a little solder is run on, and the lead, well tinned, is fixed in place. It is quite useless to employ a small

The rough and changeable weather that we have had during the present winter has induced many people to substitute wire for rope in their aerial stays, or at all events to resolve that this shall be done at the first opportunity. Wire is very much more satisfactory for the purpose since it does not sag in dry weather as rope does, or tauten with possibly disastrous results when it is wet.

## For Aerial Stays

The best material that I have come across for the purpose is ex-Army telephone wire made of steel strands and covered with both rubber and cotton. The covering is to protect the wire and prevent it from rusting. The difficulty that one has in using such wire is to get the stays tight to begin with and then to keep them properly tight, for the wire always stretches a little when it has been in use for some time. Besides supplying the necessary wire the dealer in surplus war stores can usually provide aeroplane wire strainers, which are ideal for the purpose.

One of these is seen illustrated in Fig. 2. It consists of a brass barrel

When winding coils, always see that the wire is wound on neatly and firmly and that the ends are well secured. Take care also that sufficient end lengths are allowed for connecting purposes.



light iron, for owing to the comparatively large area of metal to be dealt with heat is absorbed from it so rapidly when it is applied to the zinc pot that almost instantly it becomes too cool to do the work properly. A medium-sized or a large iron does not lose its heat so quickly and with such a tool a good sound joint can be made. After soldering leads to cells always be careful to give each a good pull in order to test its strength. One is not infrequently surprised at finding that a good-looking joint is really no joint at all.

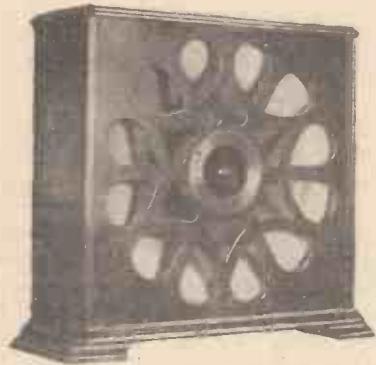
with female threads at both ends. One of these is right-handed and the other left. Hence as the barrel is turned by means of a tommy bar thrust through the hole in the middle of it, both eyes are simultaneously drawn inwards and the wire attached to them is tightened. These strainers are quite cheap, and two of them placed in each stay will enable the wire to be made perfectly taut. I have had a number of them in use for some time now and have always found them most satisfactory for the purpose.

(Continued on page 70)



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# HOW TO USE A KITE AERIAL

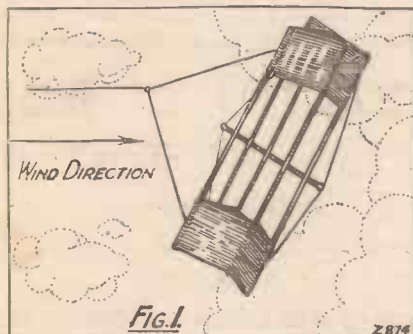
*Details of an interesting "line" for experiments.*

By J. A. LLOYD, F.R.A.S.

EVERYONE, I suppose, knows that an aerial with a long down-lead to the set and a short horizontal portion is generally more efficient than a long, low aerial with a short lead-in. Carrying this to its logical conclusion, we may conclude that the ideal aerial is one in which the whole 100 ft. is suspended vertically down to the set.

Unfortunately, however, it is not usually possible to arrange matters in this manner, and the average listener has perforce to be content with a much less ambitious scheme of things.

There is one method though by which the idea can be carried out successfully with a minimum of trouble and expense. The method is, moreover, admirably suited for use with portable wireless receivers. I



refer, of course, to the humble kite as a means of hoisting an aerial into the air.

### Better Reception

No longer need the owner of a portable set be satisfied with the insensitive frame aerial in the lid of his case, or a makeshift aerial formed by flinging a length of insulated wire over a gate or over the branch of a tree. He can obtain better reception on his portable than on his full-size aerial at home, always provided, of course, that there is a sufficiently strong breeze to fly his kite.

However, as most people who would like to try out the idea have very little knowledge of the art of kite flying, except of the paper toy variety they may have played with

as children, I propose to give a few hints as to the kind of apparatus required and how it can be employed to the best advantage.

Nothing very elaborate or costly is wanted, nor is a very large kite at all necessary, though the bigger the better, of course, in reason. The type generally employed for scientific work of any kind is the box kite, or "Hargrave" kite, as it is sometimes called; and this on account of its great lifting power and stability. While not wishing to detract from the box kite in any way, on the whole I prefer a simpler pattern. Anyone who has tried it will know what a problem it is to assemble a big box kite single-handed in any considerable breeze.

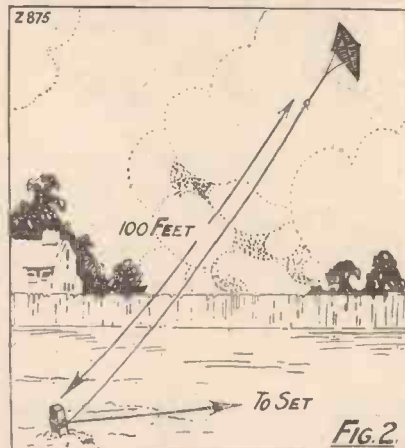
### A Suitable Kite

With kites of the aeroplane type, for instance, things are very different, There is only one, or at most two, stretcher poles, and the whole thing can be spread out flat on the ground and assembled ready for flight in a few seconds.

I have found the form of kite illustrated in the accompanying photo to be amply sufficient for raising an aerial. It is obtainable from Messrs. A. W. Gamage, and is known as the "Altikite." The one illustrated is their No. 4, and is some 40 in. wide, rolling up into a very compact bundle for travelling. This kite is chiefly remarkable for the high angle of its flying. When the position of the bridle is adjusted correctly to suit the velocity of the wind, this type of kite will pull almost straight upwards. Its stability is also very great, while in a fairly stiff breeze it can exert a surprisingly hard pull.

We must also obtain a quantity of suitable cord to fly it. Ordinary twine is no good, as it breaks too easily. The makers also supply special kite twine, enormously strong in proportion to its weight. No. 2 twine is what we want for our job. It is sold in 1 lb. balls, 320 yds. to the pound, and having a breaking strain of 69 lb. One pound will be ample for our purpose.

We shall also require a hand-winder of some kind for the cord, or, better still, a small winch such as the one shown in the photograph. The one



illustrated is home-made, as can be seen, and with it the kite can be hauled down very quickly. A coil of "Electron" wire, and a few hardwood pegs with sharpened ends to drive into the ground, completes the list of apparatus.

### Choosing the Spot

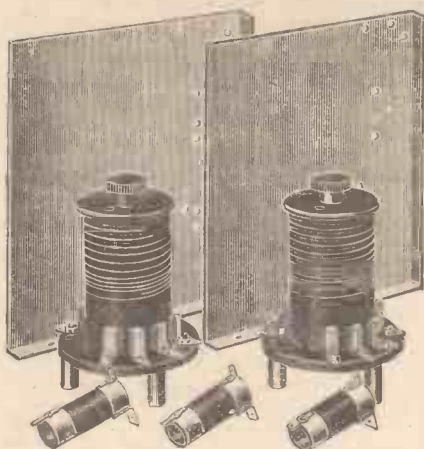
Next comes the selection of a suitable spot to fly our kite. We must find a large open space, as free from trees as possible. Trees seem to possess a peculiar fascination for kites, and more than one kite of the writer's has come to grief through suddenly



*The kite, winch, and two-valve portable set used by the author in his experiments.*

plunging into a tree and becoming entangled in the branches. The best place is open moorland with no trees at all.

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## HOW TO USE A KITE AERIAL

—continued from page 54

We will now assume that we have arrived on the ground and are ready to begin our experiments. Having assembled the kite we proceed to pay out a good length of line, say, two or three hundred feet. With a square type kite, such as the one we are considering, we can lean it against the wind, as shown in Fig. 1, slowly backing away from it and paying out line as we go. Then, if the wind is strong enough, a sudden jerk on the line will heave the kite into the air. This is a great advantage if we are working single-handed.

### Attaching the Aerial

Having thus got the kite going to our satisfaction, we continue to let out line until it is all off the winder or winch, taking care, of course, not to let go. Now have prepared a 100-ft. coil of "Electron" wire, which is insulated, stranded, steel wire, enormously strong and light, with a loop at one end.

Attach the loop to the end of the kite string and let out till the whole 100 ft. of aerial is drawn up taut. Now anchor the lower end to one of the hardwood pegs above mentioned, which is driven firmly into the ground, but leaving a short lead of wire for attaching to the aerial terminal of the receiving set. The arrangement is shown in Fig. 2.

This is the simplest method of attaching our aerial to the kite, and the results obtained in this way are astonishing. But it may be argued that we have not yet got the true vertical aerial. In that case we must proceed a little differently.

We must make a loop in the kite line at about half its length, and attach the end of the aerial to this point, paying out the line until the aerial hangs vertically downwards. We must, in this case also, peg down the bottom end of the aerial to prevent a sudden pull up by the kite.

### America on Crystal Set

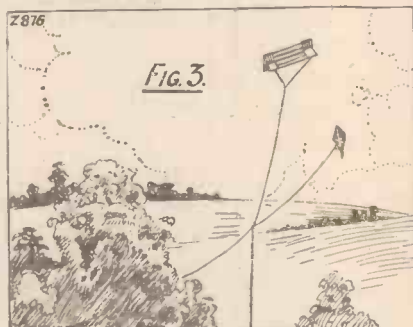
The trouble with this arrangement is that the weight of the aerial causes the kite-line to sag badly, and it may be necessary to attach another kite to the point of suspension to assist the first in a light breeze, as shown in Fig. 3.

Of course, there is no reason really why we should limit ourselves to 100 ft. of aerial wire in our experi-

ments, and the serious worker does, in fact, make use of much longer aeri-als.

The usual practice is to substitute for the kite cord a length, sometimes as much as 2,500 ft., of steel piano wire, and attach this direct to a very large box kite.

When the whole length of wire is used as an aerial, the strength of signals will be astounding. American signals have, it is stated, been well received in this country on such an aerial with an ordinary crystal set, without amplifiers of any kind!



But, on the whole, this kind of thing is not to be recommended except for the genuine experimenter who is not afraid of difficulties. One reason is that such an aerial collects something else besides programmes, and even when no thunder is about it is possible to obtain strong sparks and shocks from the wire.

However, with a good kite, some cord, wire, and a portable set it is possible to get a lot of fun with the simpler schemes outlined in the earlier part of this article.

\*\*\*\*\*  
 \* **MAKING IT** \*  
 \* **YOURSELF** \*  
 \* By A. V. D. HORT, B.A. \*  
 \*\*\*\*\*

**W**IRELESS is such a simple matter nowadays that we have quite lost sight of the days when the building of a receiver was an undertaking of some magnitude. Components were to be had, it is true, but the prices were alarming enough to make the enthusiast with a certain amount of workshop equipment wonder whether he could not make his own components; really make the whole receiver with his own hands, in fact.

Take a look at your latest broadcasting receiver, and try to imagine yourself setting out to make every detail of it from the raw material. Coils you could manage all right; fixed condensers would not present much difficulty. Items such as the

ebonite panel and the terminals, of course, would not be worth your while to attempt. If your workshop is really well equipped, you might make a good job of the variable condensers. But you would hardly be able to construct a satisfactory variable condenser in a "kitchen workshop" with only a drill, a saw, and a few files to help you.

### The Scrap Box

As a matter of fact, when you set out to make your own components, it is a great mistake to follow too slavishly the designs which you have in front of you. There is almost always "another way round," and with the exercise of a little ingenuity you can arrive at the same goal as the manufacturer by different means. Your component will possibly not look quite so smart, but you will have the satisfaction of having made it yourself, and there is no reason why it should not function equally well.

One of the most valuable assets of the man who "makes his own" is his store of "scrap" material. Very often the material of this kind which is ready to hand will decide the manner in which a component is to be made. Some small metal article, useless in itself, will form the nucleus, so to speak, round which the gadget can be built. But your scrap stuff is not going to be of much use to you if it is all piled up together in a box. You will never find what you want at the right moment.

If you have got a spare drawer to put the scrap in, you can store it in such a way that everything is always handy. Start by collecting all the small cardboard boxes in which wireless components or other articles are packed. Put these in the drawer, without lids, using the lids as boxes as well. Fit them in carefully till the bottom of the drawer is covered. Now you will have a place for everything.

### Separate Compartments

Sort out your untidy scrap box and allot a box in the drawer to each article: 2 B.A. bolts, 2 B.A. nuts, 4 B.A. bolts, flat washers, ebonite knobs, wood-screws, terminals, and so on—give them separate boxes. Whenever you dismantle a set, put all the small parts of this kind in their places. Keep a pair of long tweezers in the drawer, to help you to pick out the bolt or bracket you want at any time, without disturbing the boxes. Materials like ebonite panels, sheet metal, rods, etc., are best kept elsewhere, as they will only get in the way in the drawer.

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# GOOD NEWS FOR SET BUILDERS

In response to the urgent demand for first-class sets for family use, Mr. PERCY W. HARRIS, M.I.R.E., has now prepared the

## Wireless Constructor Envelopes

The first two of this series are Now on Sale, price 1/6 per envelope (by post 1/9).

**Envelope No. 1.—THE RADIANO THREE.** A famous loud speaker set which you can build in an hour or two—no soldering necessary and a wide range of components to choose from.

**Envelope No. 2.—THE CONCERT FOUR.** Made of standard parts, all easily obtainable, this is a highly-sensitive long-distance set, giving powerful reproduction of wonderful quality. Covering both long and short wave-lengths, with a switch for 3 or 4 valves, it is essentially a set to enjoy, both in building and operation.

In these envelopes you will find every detail of the set simply explained; photographic reproductions and diagrams are included, as well as a full-size Blue Print.

**NOW ON SALE** ————— **Price 1/6**

By post 1/9, from Radio Envelopes, The Amalgamated Press, Ltd., Bear Alley, Farringdon Street, London, E.C.4.

\*\*\*\*\*  
**OUR NEWS BULLETIN**  
 \*\*\*\*\*

*Some of the More Interesting Happenings  
 in the Radio World this Month*

**An Interesting Booklet**

I AM glad to see that radio manufacturers are now getting the habit of giving away really useful details of their products, with hints on maintenance, etc. Before me as I write, for instance, is the free booklet on Batteries given away by the Tungstone Accumulator Co., Ltd., to every applicant. This is an excellent production which must have cost a lot to produce, and will save many a set-owners' pocket by the practical hints on upkeep, etc.

**The Phantom Orchestra**

One of the latest stunts is the Phantom Orchestra. A band is on a stage playing a popular tune when suddenly one by one the players put down their instruments and leave the stage. But the instruments continue to play, and the effect is undoubtedly most uncanny. A

violin, for instance, can be heard giving forth a tune and yet there is no human contact with it. The explanation of this stunt, which is certainly ingenious, is that the source of music throughout the performance is a gramophone record to which is attached a pick-up device. The current from the pick-up is amplified in the usual way, and wires are connected from a loud speaker to a stand on which the musical instruments are placed, and these convey the sound vibrations which convert each instrument to a loud speaker for the particular tones required.

**Still Experimental**

The Postmaster-General recently stated in the House of Commons that wireless licences covering experiments in television had been issued to a number of persons, but he understood that tests had been carried out

with the result that his technical advisers considered that the matter had not yet advanced beyond the experimental stage.

**New Broadcast Scheme**

The Director of the Manchester Radio Station recently made an important announcement to the effect that a scheme of programme co-ordination among northern broadcasting stations was about to be launched, with the result that northern listeners will be in a position to choose between the reception of national programmes or regional ones. This will entail a twin wave-length high-power transmitter, one wave-length which will give national programmes and the other regional stations. This seems to be an offshoot of the Regional Scheme.

Although the "Sheffield Daily Telegraph" gives the announcement considerable prominence, it is hardly likely that anything will be done until the Post Office gives permission.

**King Amanullah**

The King of Afghanistan, during his tour in England, has shown a great interest in most western ideas and modern inventions, and particularly  
 (Continued on page 60.)

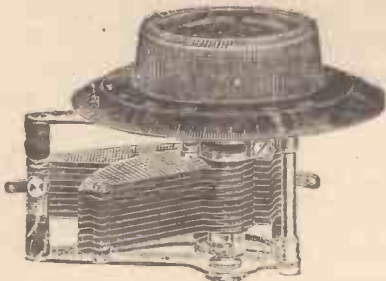
**T.C.C. CONDENSERS**

are specified for the **COSSOR MELODY MAKER**

and the only way to ensure the wonderful results this set can bring is to build faithfully to specification.

.0003 MFD

**THIS CONCERNS YOU**



J.B., S.L.F.

The startlingly successful record of J.B. Condensers must prove to everyone what masterpieces of design and craftsmanship they are. Almost invariably, when a "Star" Receiver is designed by a radio expert, you find one or more of the J.B. models specified. Not once, mark you, but time and time again.

This is not a unique record, but it does prove the sterling worth of everything which bears the Trade Mark J.B.

Remember, when you are constructing your next Receiver—J.B., the condenser with a record that speaks for itself.



J.B. Neutralising.



**Make your "Standard" H.T. Battery from 6<sup>D</sup> UNITS**

**OBTAINABLE FROM WOOLWORTHS STORES**

Now you can call at the nearest Woolworth's Stores and inspect these wonderfully efficient Standard Wet H.T. Battery units. At only 6d. each these 1½ volt No. 2 cells (completely assembled) have scored another triumph of value for the famous "Nothing over 6d. stores."

The "Standard" cells can be connected in series with your present dry battery or accumulator until you have built up the voltage you want. Simple instructions given free. Standard Electrolyte chemical in 6d. bottles.

Banish all your battery troubles by installing this permanent battery now. Make sure the name "Standard" is on every bottle.

Write for interesting free booklet to Wet H.T. Battery Co. (Dept. G.), 12-13, Brownlow Street, High Holborn, W.C.1.

All types of Standard batteries are also obtainable from Halford's Cycle Stores and Wireless dealers.

**STANDARD**  
Permanent H.T. Supply



**Hear the ONE-DER'S wonderful tone**

—ask your dealer for a demonstration



Fully licensed under Patents Nos. 239331, 243431 & 243432.



"One of the best Loudspeakers we have heard"—says Popular Wireless. "... One of the best Loudspeakers we have had under test for some time ... it is some way ahead of many cones that there are on the market at prices in excess of that figure."

Modern Wireless.

This is how the experts acknowledge the brilliant performance of the New One-der Loudspeaker!

But hear the wonderful tone for yourself. Ask your dealer for a demonstration.

Of a deep brown colouring it will harmonise with almost every scheme of decoration.

PRICE

**50/-**

FULL SIZE

**MADE THE NEW R.C. THREESOME?**

—send to-day for Free Instruction Book & Blue Print

**EDISWAN**  
"ONE-DER" LOUDSPEAKER

THE EDISON SWAN ELECTRIC CO. LTD.,  
123/5, Queen Victoria Street, London, E.C.4.

OUR NEWS BULLETIN

—continued from page 58

in wireless. He has purchased a very fine set which is to be installed at the Public Library at Kabul, the capital of his country, for public demonstration to the people of Afghanistan, and he has also ordered a public address system. The King has been carrying a receiver about with him in his car, and it is said he had an idea for a scheme to link up practically the whole of his country to his capital by wireless, so in the near future it is quite likely that, with this progressive King at the helm in Afghanistan, we may receive relayed programmes from Kabul.

An Attractive Offer

The Royal Corps of Signals of the Territorial Army is looking for men interested in radio, and who want to make good use of their knowledge. It would seem that at the same time they offer, by lectures and the practical handling of radio apparatus with the help of signal instructors, a course in radio which will help men to increase this knowledge. This instruction is

offered free of charge and a salary will be paid.

In return, when you join the Territorial Army, you agree to present yourself for instruction for a certain number of hours in the year. You get a free holiday as well by attending the Annual Camp. This takes place in the summer and lasts a fortnight, with no expenses to pay. In fact, you receive payment every day you are at camp.

**"POPULAR WIRELESS"**  
THE PROGRESSIVE AND  
LEADING RADIO WEEKLY.  
Price 3d. Every Thursday.

Readers who are interested should call any day between 10 a.m. and 2 p.m., or in the evening except Fridays, Saturdays and Sundays, after 6 p.m., at 56 (1st London) Divisional Signals Headquarters, 51, Calthorpe Street, London, W.C.1. Instructors will be there at the above times to answer any questions and to tell you anything you want to know about the Territorial Army.

B.B.C. Music Library

According to the "Daily News," attention to detail is one of the great

secrets of the success of the B.B.C. The B.B.C., for example, keeps a music library which is rapidly attaining a tremendous size. It has something like 8,000 orchestral pieces in the library, some with as many as 100 different parts. There are six or seven thousand vocal scores and several hundred military band parts.

All this music is kept in alphabetical order, so that it can be picked on suddenly when required. The dance music, however, is not arranged alphabetically, as it only lives about six weeks. All B.B.C. stations apply to this Central Library for their music.

Broadcasting Parliament

Although the Postmaster-General has lifted the ban on controversial broadcasts, it is pretty definite that the proceedings of Parliament will not be broadcast. It was hoped that possibly extracts from the Chancellor of the Exchequer's Budget Speech would be broadcast this year, and although Captain Ian Fraser, M.P., has asked the Postmaster-General whether he will consider the possibility of setting up a selective joint committee of the two Houses of Parliament, to ask whether the

(Continued on page 62.)

Construct

THE "ROADSIDE FOUR"

as described in this issue by  
Mr. Percy W. Harris.

1	Oak Portable Cabinet, with fittings as described	212	6
1	Amplion Cono Assembly, A.C.13, Oak	210	0
1	On-and-Off Switch, with Terminals	0	1
1	Ebonite Panel, 16" x 5 1/2" x 1", ready drilled	0	6
2	Magnum Panel Brackets (small)	0	1
1	Popular Condenser, .0005	0	7
1	Polar Vernier Dial for above	0	4
3	Clix Plug Sockets	0	0
3	Clix Plugs	0	3
1	Cydon Bebe Condenser, with small knob	0	7
1	Pair Grid Battery Clips	0	6
1	Clix Spade Terminal (Red)	0	2
1	Clix Spade Terminal (Black)	0	2
2	Clix Wander Plugs (Red)	0	4
3	Clix Wander Plugs (Black)	0	6
1	Dubilier 2 mfd. Condenser	0	3
4	Antiphonic Valve Holders	0	8
2	Dumetohm Holders	0	2
1	Lissen E.C.C. Unit	0	4
1	Lissen Combinator	0	6
1	Lissen Fixed Condenser, .0005	0	1
1	Mullard L.F. Transformer	1	5
1	Chimax H.F. Choke	0	8
2	Lissen Grid Leaks, 1/2 meg.	0	2
1	Lissen Grid Leak, 2 meg.	0	1
	Connecting Wire	0	0
		£9	10

Any of the above parts supplied separately as required.

If required—

1	Ripault H.T. Battery, Type C.M., 99 volts	0	16	6
1	Oldham 2-Volt Accumulator, Type O.L.4	0	13	6
1	Grid Battery, 9-Volt	0	2	0
4	Mullard Valves of types specified	2	4	0
		£3	16	0

The "Roadside Four" Portable Receiver can be supplied complete as above, wired, tested, and ready for use, price ... 16 10 0  
Plus Marconi Royalty ... 2 10 0

MAGNUM STANDARD WAVETRAP



Add selectivity to your set by fitting a Magnum Wavetrap. It can be adapted to any type of set without any alteration in the wiring, and enables you to receive stations hitherto blanketed out by the local station.

As used by Mr. P. W. Harris in "The Business Man's Four," also in the original "1928 Solodyne."

Price 15/- complete

Copper Screening Box can be supplied for the above, price 5/-



MAGNUM CALIBRATED RHEOSTATS

for baseboard mounting are now available in 3 ranges:

Zero to 6 ohms. Zero to 15 ohms.

Zero to 30 ohms.

Price 3/- each.

A NEW MAGNUM PRODUCT



Short-Wave Choke

Specially designed for short-wave work for below 10 metres up to 100 metres. The price is the same as the Magnum Standard Choke, viz.

7/6

WIRELESS CONSTRUCTOR ENVELOPES are now available.

Price 1/6 each, by post 1/9 each.

No. 1.—The "Radiation Three."

No. 2.—The "Concert Four."

These envelopes contain Blue Prints and full constructional details. We specialise in the above and can supply all components as specified. Lists on application.

**BURNE-JONES**  
& CO. LTD.,  
**MAGNUM HOUSE**  
TELEPHONE: HOP 6257-8  
**288, BOROUGHS HIGH ST.**  
**LONDON, S.E.1**





*If you want to*  
 get the best out of  
 your **MASTER THREE-**

Try these more selective coils. On the short wave-band they are guaranteed to bring in continental stations previously unheard. Terminal No. 3 has selective tapping on primary winding which considerably sharpens the tuning.

Obtainable through all good radio dealers.

**FOREIGN STATIONS GUARANTEED**

(Read Trade Mark)  
**LEWCO'S**  
 Six pin Coils

The  
 LONDON ELECTRIC WIRE CO. & SMITHS, LTD.,  
 Playhouse Yard, Golden Lane, London, E.C.1

## Do You Move With The Times?

If you want to keep right up-to-date in radio—to get the best from your set—to read the news whilst it IS news, be sure every Thursday to “tune-in” your copy of

# POPULAR WIRELESS

It costs Threepence—and saves you pounds! It comes out on Thursday—and holds good all the week. It is written by experts, who write helpfully and naturally about the problems of YOUR set.

WHY NOT PLACE A REGULAR ORDER NOW?

**POPULAR WIRELESS**      The Paper that Made Wireless Popular

Every Thursday.

Threepence.

**OUR NEWS BULLETIN**

*—continued from page 60*

broadcasting of Parliament is practical and desirable, the answer is pretty definitely in the negative.

Many Members of the House of Commons consider it would not be to the dignity of Parliament if proceedings were broadcast. It is said that many of them might be disposed to remove their objections if the innovation were strictly limited to ceremonial occasions; but outside the House it seems to be the general opinion that only once in a while would anything be worth while broadcasting from the House. Certainly the proceedings in the last session were extremely dull.

**Listening to Berlin**

Captain Eckersley, recently said, in his estimation, 50 per cent of British listeners, relied on the long-wave Daventry station, and no other station was listened to in 90 per cent of the rural areas of the country. But there seems to be a general consensus of opinion that the programme which is most listened to is that of Zeésen, the new 40-kilowatt Berlin transmitter. This

station offers a very easy alternative for reception by British listeners, and it undoubtedly occupies first place in popularity among the foreign stations.

**B.B.C. and Its Critics**

Mrs. Snowden, a Governor of the B.B.C., has again seen fit to give vent in public to some very strong views concerning listeners and broadcasting. Recently she referred to critics among the listening public as fools whom the B.B.C. had to suffer gladly. She further expressed the opinion that the licence fee of 10s. a year ought to make the B.B.C. immune from criticism.

This sort of thing, of course, is very annoying for the more responsible officials of the B.B.C., and they at once stated that no statement could be made regarding Mrs. Snowden's reported remarks. But an official did admit that there could be no question as to the invitation for criticisms extended by the B.B.C.

**"Ridiculous"**

The official went on to say that the B.B.C. has always welcomed criticism, and naturally does not expect that it will all be either constructive or in the B.B.C.'s favour. That the B.B.C. should be immune from criticism was, he said, ridiculous.

**On the Short Waves**

Readers report that the American stations 2 X A F and 2 X A D are being received at very good strength these days, and the new Phillips station, which has commenced transmitting from its new quarters, is also being heard with great success in many parts of the world.

Rome can often be heard these days on the 45-metre band, while Berne can be found on most evenings on a wave-length of 32 metres. Between the wave-length bands of 20 and 60, listeners on short-wave sets will indeed hear quite a number of stations which can be very well received.

**Empire Telephony**

In a recent interview, Senatore Marconi said: "I am certain that before long we shall be in telephonic touch with all the Dominions. I am arranging for telephony between England and Canada in a month or two. Full Imperial development depends very much upon the attitude of the Government. Technically, the whole thing could be completed in a very few months, but the Government is the controlling authority. With it

*(Continued on page 64.)*

**MAGNAVOX**  
*The Originators of the Moving Coil Speaker*

**REALISM**

You can hear the bowing of the strings of the double bass and the beats of the drum in their true tone-colour with a MAGNAVOX MOVING COIL LOUD SPEAKER UNIT.

There are no jarring resonances, no "s" sounds missing, and the violin does not sound like a flute.

The unit is complete with input transformer, leads and switch, ready for connecting right away to your set.

No troublesome pot magnet to wind, no ticklish job in centring the delicate moving coil. All that is done for you in the MAGNAVOX UNIT—and done as a precision job should be by people who specialised in moving coil loud speakers in 1915.

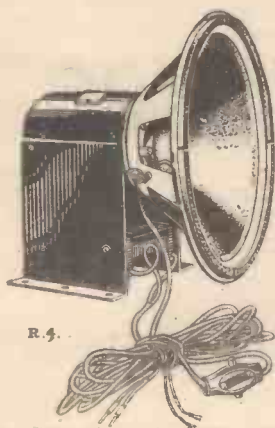
Type R4. Field winding takes 5amp. at 6 volts from an accumulator or trickle charger. . . . . £9.10.0

Type R5/1. For D.C. mains 105/120 mains. Consumption 5 watts . . . . . £10.10.0

Type R5/2. For D.C. mains 220/240 mains. Consumption 5 watts . . . . . £10.10.0

Type M7K. Fitted with permanent field magnet . . . . . £3.2.6

Ask your radio dealer for a MAGNAVOX MOVING COIL LOUD SPEAKER UNIT and enjoy realistic reproduction. In case of difficulty write direct to—



**THE ROTHERMEL CORPORATION LIMITED,**  
24-26, MADDUX STREET, LONDON, W.1.

Telephone: MAYFAIR 0578, 0579.



"1928" LOG

In two capacities:  
·00035 ·0005

5/-

Also

Dual Gang  
15/6

Triple Gang  
£1/1/0

Absolutely the—

**SMALLEST** - 2" Behind Panel.  
**LIGHTEST** - 3½" Span Fully Open.

**and most**  
**EFFICIENT** - 4½ ounces.

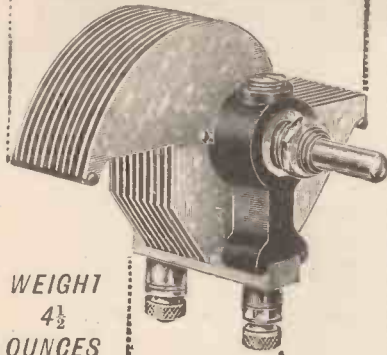
**EFFICIENT** - Perfect to Logarithmic Law.  
*yet produced.*

Write for Literature containing full details.

CROWN WORKS, 22, CRICKLEWOOD LANE, N.W. 2.

Telephone: Hampstead 1787.

SPAN FULLY OPEN 3½"



WEIGHT  
4½  
OUNCES

BEHIND PANEL  
2"



THE OLDHAM *Price*  
O.L.4. Unspillable  
Celluloid Accumulator **13/6**  
Capacity 2 v. 14 amp. actual

*Here is the Ideal  
Accumulator  
for Portables*

The Oldham "Faithful Service" Unspillable Accumulator has been designed with the sole idea of giving the most efficient results in portable sets. It will stand rough usage, and is guaranteed not to leak. The plates are particularly robust and long lasting, being made under the Oldham Special Activation Process.

This is the accumulator which Mr. Percy Harris has specified in the "ROADSIDE FOUR" described in this issue.

Summer days will soon be here. See that you give your portable set the accumulator it deserves—the long-lasting, "Faithful Service" Oldham. Obtainable from all Wireless Dealers.



Oldham & Son, Ltd., Denton, Manchester.  
London Office: 6, Eccleston Place.  
Glasgow: 75, Robertson Street, C.2.

Telephone: Denton 121  
Telephone: Sloane 7227/8.  
Telephone: Central 4105.

CA 2442

SPECIAL SOLODYNE NUMBER  
OF  
**MODERN WIRELESS**

*Now on Sale.*

*Price 1/6*

Whatever you do don't miss the April double number of "Modern Wireless." It contains a 20-page special Solodyne Supplement, in which you will find useful notes on the 1928 Solodyne, details for modernising the original 1926 model, and full constructional details of a new

**THREE VALVE SOLODYNE  
TOGETHER WITH 1/- BLUE PRINT FREE**

The latter is for the economist—the man who wants a first-class Solodyne set for which he can use components already "on hand." Three distinct versions of this famous three-valver are given—three articles showing how the set can be made in different ways so as to absorb components you have already by you as "spares."

There are also many other features of wide variety and interest.

*Don't miss this Double Number. It's on sale at all bookstalls,  
price 1/6—and a 1/6 issue of*

**MODERN WIRELESS**

*is always worth while*



## What constitutes an excellent Loud-Speaker?



MODEL C12.

**Even response.**

Not only on the low, but on the middle and the high frequencies.

**Extreme sensitivity.**

Sensitive to the output from the weakest set.

**Adjustment.**

Ability to produce weak as well as very heavy signals without readjustment.

**Improve with age.**

Improve and not deteriorate with the passing of the years.

**Distinctive appearance.**

An excellent loud speaker breathes craftsmanship in appearance, so careful and capable is the workmanship wrought upon it. And it must be British.

Let your dealer convince you that "CELESTION," most excellent of loud speakers, passes all these tests readily.

Write now to Dept. L for the "Celestion" illustrated folder and also for our new Gramophone Pick-Up leaflet.

# CELESTION

The Very Soul of Music

Write to Dept. L,  
THE CELESTION RADIO CO.,  
Hampton Wick, Kingston-on-Thames.

Showrooms:  
33/35, VILLIERS ST.,  
W.C.2.

French Agents:  
CONSTABLE & CO.,  
PARIS.



## OUR NEWS BULLETIN

—continued from page 62

rests entirely whether the scheme is encouraged or delayed."

### Superseding Morse?

Continuing, he said: "I am convinced that ultimately facsimile will supersede Morse. It is very much quicker and cheaper, for by the Morse method every word has to be spelt out. Clearly, there will be a great economy in operators."

### Catching Oscillators

The Post Office wireless direction-finding vans have been locating pirates and oscillators during the last few months with very great success, and over a thousand prosecutions have resulted. After tracing a howler, the engineers in charge of the van warned him that a repetition of the offence may cause cancellation of his licence, and if this warning is ignored and the offence repeated, his licence is very

### A SPECIAL SOLODYNE SUPPLEMENT

is included in the  
APRIL DOUBLE NUMBER OF  
"MODERN WIRELESS"

containing, among other articles,  
details for building three separate versions of the new  
**THREE-VALVE SOLODYNE**

A set that will appeal to all constructors.  
**MAKE SURE OF YOUR COPY.**  
Now on Sale. Price 1/6.

likely to be withdrawn, and if the trouble occurred for a third time, the offender might find himself prosecuted.

The active suppression of oscillators is a matter entirely for the Post Office, but we understand that their ether detectives work on information supplied by the B.B.C. and from the complaints received from engineers.

### Sir John Reith

There have been several rumours about lately that Sir John Reith intends to retire from his position as Director-General of the B.B.C., and that Mr. C. B. Cochran, the well-known theatrical producer, who is at present manager of the Albert Hall, is likely to be his successor. These rumours, however, have now been completely exploded, and it appears that Sir John Reith has not the slightest intention of resigning and, further, that Mr. Cochran has never yet been approached in connection with an official post at the B.B.C.

## HAPPENINGS AT SAVOY HILL

—continued from page 31

### Empire Broadcasting—a Saner View

It is refreshing to record what appears to be this time a real change of heart at Savoy Hill. I have not minced words in my criticism of the ungracious attitude of the B.B.C. towards Empire broadcasting. Therefore, I am all the more pleased at gratifying signs that the period of pique is supplanted by a period of serious constructive endeavour inspired by practical sympathy.

The Dominions and Colonies are no longer rebuffed when they seek advice and assistance at Savoy Hill. More than this, the B.B.C. is actually taking the initiative in trying to arrange for the exchange of suitable programme material within the Empire.

### Summer Programmes

Regular listeners will recall rather ruefully that, despite promises, the B.B.C. did not make its summer programmes as lightly seasonable last year as the year before. It is true that there was some reduction of the time allotted to education and serious talks. But the policy of seasonal adapting did not go far enough.

No announcements have been made yet this year, but it is known that the programme-builders must be engaged now in completing their arrangements for the summer period. Let me give them a word of warning in all friendliness. If they wish to avoid a slump in licences and, instead, to achieve a marked improvement on last year's rate of progress, let them deal drastically with the serious and educational elements during holiday months.

### India's Difficulties

I hear that, faced with the threatened collapse of the recently formed Indian Broadcasting Company, Mr. Eric Dunstan has returned to England in search of fresh capital with which to carry forward his enterprise. Mr. Dunstan will have the good wishes and the sympathy not only of his colleagues at Savoy Hill, but of British listeners as well. No one can say yet whether radio will "go" in the changeless East.

**PERFECT TERMINALS**



The unique advantages of the Belling-Lee patented terminal:—

- Insulated Non rotating engraved top.
  - Highly finished screw-action insulated head.
  - Non-threaded stem and cross-hole.
  - Specially made to grip spade or pin terminal or flex.
  - Shielded metal clamping faces.
  - Highly finished insulated collar.
  - Metal parts nickelled.
  - Transverse slot with clamping nut eliminating soldering.
  - Guaranteed.
- PRICES. Type "B"—Standard large insulated model. Polished black bakelite, 9d. each.
- Type "M"—As type "B" but smaller, and with only the engraved top insulated, rest nickel-plated brass, 6d. each.
- Made with 30 different engravings.

**BELLING-LEE TERMINALS**

Belling & Lee, Ltd., Queensway Works, Ponders End, Middlesex.

**THE DIX-ONEMETER**

is a precision instrument of universal use, with an ingenious system of Multipliers, which enable full scale readings of any value to be made over a wide range. 1 Millivolt to 2,000 volts, 50 ohms to 50 megohms. Mirror Scale, Jewelled knife-edge, a £10 de Luxe Model - PRICE 55/- Multipliers, 6/6 each.

GET OUR NEW 72-PAGE CATALOGUE Over a thousand bargains are listed, and hundreds illustrated. SEND 4d. IN STAMPS. ELECTRADIX RADIOS, 218, Upper Thames Street, LONDON, E.C.4.

**The World's Finest H.F. Choke**

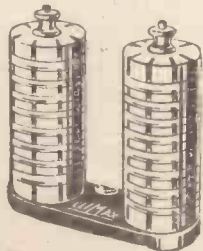
specially recommended for all receivers with 2 or more stages of H.F. because the Climax binocular method of winding gives no field effects.

The only effective H.F. Choke for both long and short wave work. High self inductance. Low self capacity. One hole fixing.

Ideal as anode or reaction choke in any circuit.

THE CLIMAX H.F. CHOKE.

From all dealers - 8/6



**CLIMAX**

Climax Radio Electric, Ltd., Quill Works, Putney, S.W.15.

A YEAR AHEAD

PLEASE be sure to mention "WIRELESS CONSTRUCTOR" when communicating with Advertisers. THANKS!

**THE "GENERAL PURPOSE 3-4"**

—continued from page 66

Set the reaction control at minimum, and likewise the neutralising condenser. Now, on setting the tuning condensers so that the two tuned circuits are in step with each other, it may be found that the set is oscillating. To test for oscillation, touch the fixed plates of the tuning condensers.

**Neutralising Notes**

You will probably find that the set will only oscillate under the above conditions when the two circuits are in tune with each other, and this can be used as an indication. It is convenient to perform the operation at some point near the middle of the tuning range. Now increase the capacity of the neutralising condenser.

Test at intervals for oscillation as this is done, and you will presently find that the set has ceased to oscillate, and will not recommence even when the tuning dials are slightly readjusted. Now increase the reaction a little, until the set once more oscillates, and again increase the neutralising condenser setting until oscillation ceases. Slightly readjust the tuning condensers again to make sure that the set is completely stable once more. Proceed in this way until it is found that the correct adjustment of the neutrodyne condenser has been overshoot. Once this point has been passed it will be observed that further increases of the neutrodyne condenser setting no longer stop oscillation but cause it to become stronger.

**Results You Can Expect**

The object is to find such an adjustment of the neutralising condenser as will permit the greatest setting of the reaction condenser to be used without producing oscillation. It will then be observed that when the two tuned circuits are in step and the set is brought to the verge of oscillation, a slight movement in either direction of the neutrodyne condenser will probably cause the receiver to break into oscillation.

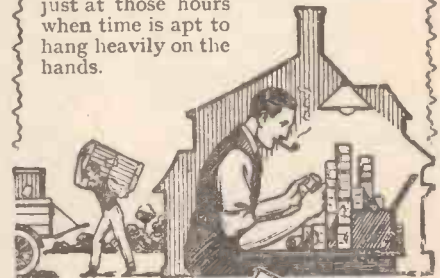
Three or four British stations may be expected at full loud-speaker strength, together with about a dozen Continental stations, the majority probably German or Austrian. Weaker, but nevertheless good, loud-speaking may be expected from several other stations.

**£300 A YEAR**

For Your Spare Time

Wonderful New Invention  
YOU can MAKE and  
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REALLY, genuinely, you can make at home and in your spare time a sum of extra money up to £300 per year. The work is of fascinating interest. It will open up to you new ideas, new vistas of money-making; provide many of those luxuries and necessities which you have so long wished for, and give you occupation just at those hours when time is apt to hang heavily on the hands.



IN THE COMFORT OF YOUR OWN HOME YOU CAN DOUBLE YOUR INCOME.

The work is a delight. You can keep at it just as long as you like each day or week. No "plant" or machinery is needed. A spare-room or even the kitchen table can serve as your profit-making "factory"—and the children can help too!

Others are doing this by working my enormously successful patents. Why not you? It costs you nothing to write for full particulars, and you can then see for yourself exactly what you can do.

My patents are in very great demand in the field of wireless and electricity—so much so that

**GUARANTEE**

your profits, and further guarantee to protect you against any infringement or interference with your market. Only one person in 50,000 of the population is allowed to manufacture under my Royal Letters Patent, in order to ensure unrestricted marketing. Let me hear from you NOW before somebody else is granted the licence and the extra income that can so easily become yours.

Simply forward the coupon below and, by return of post, I will send you every particular with which you may wish to be acquainted. It is those who seize opportunities who succeed. Take this opportunity NOW.

**"MAKE-MONEY-AT-HOME" COUPON**

To THE ENGLAND-RICHARDS CO., 96, King's Lynn, Norfolk.

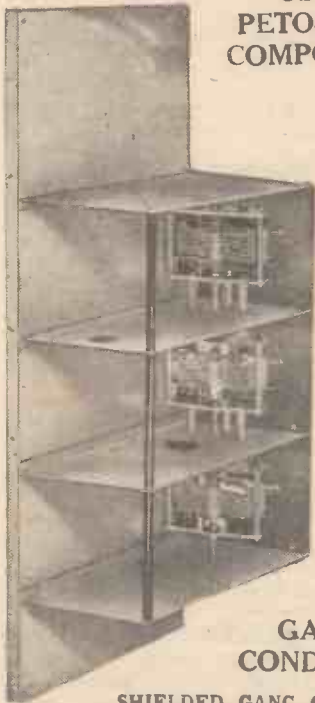
Sirs,—Please send me at once, and FREE, full details as to how I can Make Money at Home in my spare time. I enclose 2d. stamp for postage.

Print your name and address boldly in capital letters on a plain sheet of paper and pin this Coupon to it.

"Wireless Constructor," May, 1928.

# FOR YOUR 1928 SOLODYNE

USE  
PETO-SCOTT  
COMPONENTS



GANG  
CONDENSERS

**SHIELDED GANG CONDENSER** as illustrated, complete, mounted on 26" x 12" Copper Covered Plywood Baseboard, Four Copper Screens, Front Screen. 0005 Log Mid-Line Triple Gang Condenser, instantly and independently adjusted, fitted with extra micrometer balancing adjustment,

£4 10 0

Silver Marshall Drum Drive 15/- extra.

## WAVETRAP

STANDARD  
M.W.  
MODEL

Price  
15/-



## COILS & BASES

SET OF SPECIAL COILS AND BASES, 250/550 metres as specified, Laboratory Tested .. .. £2 5 0

Set of Long-Wave Coils .. .. £2 5 0

**POLISHED MAHOGANY CABINET** as supplied to "Modern Wireless"

£2 7 6

Baseboard extra.

If your dealer cannot supply send for our complete lists of parts.

**PETO-SCOTT Co., Ltd.,**  
77, CITY ROAD,  
LONDON, E.C.1

and 62, HIGH HOLBORN, W.C.1.  
Also at 4, Manchester Street, Liverpool.



## TELEVISION PROBLEMS

—continued from page 22

so as to sweep the ray from each light-source in rapid succession over the object to be televised.

In the first place this gives a seven-fold increase of the number of light-impacts for every rotation of the drum, and in the second place the area of the track is increased seven times, with a corresponding reduction in the maximum rate of traverse and a corresponding gain in average illumination.

### The Cathode Ray

Von Mihaly has devised another solution in the form of minute mirrors, approximately one square millimetre in area, mounted on a very thin loop of platinum wire and placed between the poles of a powerful electro-magnet.

Such an arrangement has very small mass when compared with the rotating discs previously considered, and is accordingly capable of being vibrated at an extremely high speed so as to sweep a ray of light in lateral zones across the object to be televised.

None of these suggestions, however, can compete, at least in theoretical advantage, with the use of a cathode-ray stream from a Brauns tube for analysing and reassembling the transmitted picture.

Such a cathode-ray has no mass and is easily controlled in direction either by an electrostatic or magnetic field, so that it can be swept to and fro over the object to be televised at a speed comparable with that of light.

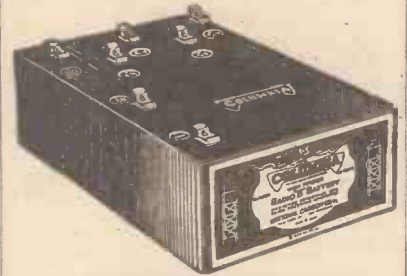
### The Receiving End

Probably the first to suggest this method of attacking the problem was Boris Rosing, a Russian professor, who in 1907 assembled the apparatus illustrated in Fig. 3. At the transmitting station, two sets of rotating mirrors are mounted at right angles to each other, as shown, so as to vibrate the light beam simultaneously from top to bottom and from side to side. In this fashion they throw an image of the object on to the sensitive cell, so that corresponding electric currents are sent to line.

At the receiving end, the picture-element signals are applied to a pair of control electrodes, C, C, which deflect the cathode-stream relatively to an apertured disc P in such a way that the intensity of the stream passing through varies with the intensity of the signalling currents.

(Continued on page 69.)

## Why Columbia Batteries are cheapest



**Columbia**

No. 4780, 60 volts type: 22/6.

The amount of electricity producing material in a dry battery is decided by the total weight of the battery. Obviously, the greater the weight, the greater the proportion of electricity producing material.

Now, the average weight of a 60-volt battery is 5 lbs. The weight of the 60-volt Columbia High-Capacity Battery is 13 lbs.—2½ greater weight consequently about 3 times more active material.

You pay 22/6 for the Columbia High-Capacity Battery, therefore you should pay not more than approximately 6/5 for any other 60-volt Dry Battery of equal quality, and weighing 5 lbs., on the market.

And remember that the Columbia High-Capacity Battery is manufactured by the National Carbon Company, the world's largest and most famous battery manufacturers, and is sold under their full guarantee.

**J. R. MORRIS**

15, Kingsway, London, W.C.2.

Scotland: J. T. Cartwright, 3, Cadogan St., Glasgow

## WET H.T. BATTERIES



Solve all H.T. troubles. SELF-CHARGING, SILENT, ECONOMICAL. LARS (waxed) 2½" x 1½" sq. 1/3 doz. Zincs New type, 1½ doz. SACS 1/2 doz. Sample doz. (18 volts), complete with bands and electrolyte, 4/3, post 9d. Sample unit, 6d. 16-page booklet free. Bargain list free.

AMPLIFIERS, 1-Valve 19s. 2-Valve 30s. 2-Valve All-Station Set £1.

C. TAYLOR, 57, Studley Rd., Stockwell, London.

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Any make of L.F. Transformer, Loudspeaker or Headphones repaired and despatched within 48 HOURS—TWELVE MONTHS GUARANTEE with each repair. 4/- Post free.

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## MODERNISE YOUR WIRELESS

The  
"RADIOLA"  
BUREAU

Costing no more than a Loud Speaker, quickly transforms YOUR SET into a Stately Drawing-Room Receiver.

Highest approval, Radio Press, leading experts — and over 3000 delighted clients

FROM

£5 . 5 . 0

3 ft. high. Solid oak or mahogany. Beautifully polished.



De Luxe Model

Sent ON APPROVAL in sizes for every set. Send for full particulars — FREE.

**PICKETT'S**  
CABINETS

W.C. WORKS, BEXLEYHEATH, KENT.

**"POPULAR RADIO" (U.S.A.) Sept. 1927.**  
 -In order to secure long life from the paper condensers used in an assembly, the condensers employed should be of a working voltage rating that is ample for the work to be done.

**ATIP FROM U.S.A.**

**PRICES.**  
 Tested on 500 volts D.C. (working voltage 240 d.c.):  
 1 mfd. - 2/6, 2 mfd. - 3/6, 4 mfd. - 5/3.  
 Tested on 750 volts D.C. (working voltage 375 d.c.) equal to 500 volts A.C.:  
 1 mfd. - 3/-, 2 mfd. - 4/-, 4 mfd. - 6/9.  
 Inquire for prices of condensers tested at 1,000, 2,000, 4,000 and 6,000 volts D.C.



**LOUIS HOLZMAN**  
 34, Kingsway, W.C.2.  
 Telephone: Holborn 6209

**Does YOUR H.T. BATTERY Last 9 Months?**

**The "Roadside Four"**  
 as described in this issue requires an adequate supply of high tension, and there is no doubt that the designer has a very good reason for specifying a **RIPAULTS** Self-regenerative H.T. Dry Battery. On test they are proved to possess **50% Longer Life.** Ask your dealer for a Ripaults **STANDARD (MODEL C.M.) 99 VOLT AT 16/6.** If he cannot supply or will not get one for you, write us direct and we will see you have what you need. Send for a Free copy of our "LIFE CHART" AND "RIGHT CHOICE" TABLE. There is a "Ripaults" for every type of set. We will gladly advise any reader sending us details of his set which is the correct battery to use with it.

**RIPAULTS**  
 King's Road, St. Pancras, London, N.W.1.

WHEN replying to advertisements please mention "Wireless Constructor," to ensure prompt attention. THANKS!

**TELEVISION PROBLEMS**  
 -continued from page 63

Simultaneously, synchronising currents proportional to the speed of the rotating mirrors are fed to a pair of control windings D, D, so that the track of the ray across the fluorescent screen at the end of the tube coincides exactly with the track of the original image across the selenium cell. The screen is accordingly lit up in successive patches, which follow each other so rapidly that the eye sees the image as a coherent whole.

**Further Improvements**

This method of utilising a stream of cathode-rays has since been elaborated, both for transmission and reception, by Professor Campbell-Swinton and others.

The problem of synchronisation, or of keeping the receiving apparatus accurately in step with the transmitter, so that the received signals are accurately spaced out in their proper position on the viewing screen, becomes particularly troublesome when true wireless television—or radio vision as it has aptly been termed—is involved.

It necessitates the transmission of a distinct set of frequency-control signals, quite separate from the picture-element signals proper, and is probably the reason why—apart from recent transatlantic claims—the longest successful wireless transmission of a moving picture has been limited to a distance of only 22 miles.

**No Satisfactory System**

In this connection it is interesting to note that no satisfactory system of picture transmission has yet been attempted without special synchronising means. In the case of still-picture transmission, it is possible that local control devices such as phonic motors, pendulums, and tuning forks might be used independently and without direct connection between transmitter and receiver, but such methods would be quite impossible at the speeds necessary in television.

It is true that Fournier d'Albe has proposed to convert light and shade effects into a corresponding series of audio-frequencies, and to employ at the receiving end a bank of specially tuned resonators, so spaced that they automatically respond to, and "group," the received signals in proper formation, but his method has not so far proved capable in practice of producing clearly-defined results.

**MULLARD MASTER THREE**  
 HANDSOME OAK CABINET FOR THE MASTER 3 (American Type), with parts, **12/6** carr. 2/-

**FREE** With Components  
 Grid Bias, 9 Volts; 100 Volt H.T. (British); Aluminium Panel, 18" x 7" (drilled). Best Quality.

**COMPONENTS (Blue Print Free) as specified:-**  
 2 Term. Strips 2 1/2 x 2, Iewcoas Base, 2 J.B. Condensers, Climax H.F. Choke, Master Three Coil, 3 Eye Valve Holders, Magnum Brackets, 4 Terminals, Spade Terminals, Wander Plugs, Buglin Switch, R.I. Unit, R.I. L.F. Transformer, Mullard 0003, 2 meg. Leak, Flex. Screws, &c., and Three Mullard P.M. Valves. Above Kit **£6. 17. 6**

**The Corsor "Melody Maker"**

**FREE WITH KIT**  
 Drilled High-grade 21 x 7 Polished Panel with Radion Strip.

**GENUINE COMPONENTS £4 : 10 : 0 kit.**  
 2 Ormond -0005; 2 Do. S.M. Dials; 6 T.O.C. Condensers, -001, -002, two -0003, -0001, 2 mfd.; 2 Grid Lk. Clips, B.B.; 1 Var. B.B. Rheostat; 3 Cresos; Leaks; -25, 3, 4 meg.; 3 Lotus V.H.; 1 Ferranti A.F.3; 2 Panel Switches; 1 Corsor Melody Wound Coil; Terminals, Name Tabs, Glazite, 9-v. Grid Bias (all as specified).

Handsome Oak Cabinet 12/6 with parts (as shown above). Also Cabinets at 15/11, 18/11, and Mahogany Polished at 20/- (with parts). Carr. 2/-

**THREE SOLODYNE SETS**

(“MODERN WIRELESS,” April, 1928.)

SET "A"	SET "B"	SET "C"
Gylton D'ble Drum -0005; Peto-Scott -0001; Irganic On-and-Off; 3 Lotus V-holders; Peto-Scott B.B. Neut.; 2 Six-Pin Bases; Lissen -0002 mfd.; 2 Meg. Leaks and Holder; Burne Jones H.F. Choke; Irganic "G" L.P. 3-6 to 1.	Ormond Twin; Gang; Ormond S.M. Dial; Ormond -0001; 3 W.B. V-holders; Burne Jones -000025; 1 On-&-Off Switch; Burne Jones -0003; Lissen 2 mfd.; 2 Meg. Leaks and Holder; Burne Jones H.F. Choke; Lisan H.F. Choke; R.I.-Varley S.L.F.	2 Polar -0005; 2 S.M. Dials; -0001 Reaction; 1 On-&-Off Switch; 1 Bapp. Clip; 3 B.B. Rheostats; 1 Neutralizing; 2 Six-pin Bases; Lissen -0002 and -0003; Lissen 2 mfd.; 2 Meg. and Holder; Irganic H.F. Choke; R.I.-Varley S.L.F.

Kit **110/-** Kit **95/-** Kit **75/-**

FOR 2/- EXTRA WITH EITHER OF THESE KITS YOU CAN PURCHASE 9 Engraved Terminals, Strip 7 x 2, Do. 2 x 2, materials for screening partition, flex, screws, plugs, wire. This lot for 2/-, WITH PARTS ONLY.

**LISSEN**  
 Valve Holders, 1/-; Fixed Con., 1/-, 1/6; Leaks, 1/-; Switches, 1/6, 2/6; Latest 2-way Cam Vernier, 4/6; Rheostats, 2/6; B.B. 1/6; Lissena, 13/6; L.F. Transformers, 8/6; 100-v. H.T. 12/11; 60-v. H.T. 7/11; Coils, 60 X, 6/4; 250 X, 9/9.

**EDISWAN NEW THREESOME**  
 EBONITE PANEL 5 Ply Baseboard 2/6  
 The two with above kit only.

**COMPONENTS.**  
 Three Coupling Units, Tubular Fixed Condenser, Multi-flex Cable and Plug, -0003 Variable with S.M. Dial, 2-way Geared Coil Holder, Connecting Wire, Red and Black Flex.  
 The lot post free **42/- nett**

**EDISWAN VALVES.**  
 H.F. 210 ... 10/6  
 R.O. 2 ... 10/6  
 P.V. 2 ... 12/6

Our New 100 page **CATALOGUE 6d.** allowed Profusely Illustrated, Valve Data, etc. on first Very handy for Reference, 10/- order

**WE ARE OPEN**  
 ALL DAY SATURDAY  
 ALL DAY THURSDAY  
 ALL DAY EVERY DAY  
 Hours : 9 a.m. to 8 p.m.  
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Lists of parts for orders over £2 given an inclusive price; this subject to goods being obtainable at once, and not held up by manufacturers' delays. **ALL SERVICE FREE.**

**K. RAYMOND**  
 27 & 28a LISLE ST., LONDON, W.C.2  
 Come to LEICESTER SQUARE TUBE  
 This address is at the back of Daly's Theatre  
 Phone: Gerrard 4637.

## Finest London Made Valves AT REDUCED PRICES

L.F., H.F., R.C. and DETECTOR in 2 and 4 VOLTS  
The World's Best Valve The World's Best Valve  
**SELECTIVE PURE STRONG**

P. R. VALVES are the latest product of one of the finest factories in London. Years of experiment and research are behind every one. It was only by the lucky discovery of new elements and new methods of manufacture that the P. R. VALVE at 3/6 became an established fact. Hitherto the had been sold at 8/6. The new price brings a good and reliable valve within the reach of everybody.



Trade Enquiries Invited

NOW ONLY **3/6**

Post & Packing 4d.  
2 Valves for 6/9  
Post & Packing 6d.  
3 Valves for 10/-  
Post & Packing 6d.  
4 Valves for 13/-  
Post & Packing 9d.

Type	Fil. Vts.	Fil. Amp.	Imp. Ohms.	Amp. Fac.	M/C	
PR 1	2	.06	35,000	15	.4	H.F.
PR 2	2	.06	25,000	12	.43	Det.
PR 3	2	.06	18,000	8	.44	L.F.
PR 4	2	.06	120,000	40	.33	R.C.
PR 5	2	.15	40,000	20	.5	H.F.
PR 6	2	.15	30,000	15	.5	Det.
PR 7	2	.15	12,000	6	.5	L.F.
PR 8	4	.06	23,000	15	.65	H.F.
PR 9	4	.06	19,000	9.5	.5	Det.
PR10	4	.06	11,000	6	.55	L.F.
PR11	4	.06	120,000	40	.33	R.C.

P. R. POWER VALVES challenge comparison with any other, no matter the make or price.

Power Valves	2V.	.20	6,000	5	.82	P.
	4V.	.15	4,000	4	1.0	P.

7/6 Each. Post and Packing 4d.

Tell us what your circuit is. We can help you to select the right valves. MATCHED VALVES for the intermediate stages of Super-hets specially selected for 1/- per set extra. All valves despatched by return of post under guarantee of Money Back in Full if not satisfied. All valves carefully packed and breakages replaced. Valves 1 vital.

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### Real ACCUMULATOR HIRE SERVICE. H.T. OR L.T.

We lend you one of our fine wireless accumulators while we recharge yours. Or keep you continually supplied with our own fully-charged accumulators. Collection, maintenance and delivery free, anywhere within 12 miles of Charing Cross. Any voltage or capacity. Skilled service. The famous C.A.V. accumulators supplied for H.T.

Write for full particulars to-day:

**RADIO SERVICE (London) LTD.**  
105G, Torriono Avenue, Kentish Town, N.W.  
Telephone: North 0623-4-5.

## The HOME for your WIRELESS SET

OUR STANDARD CABINETS

are DUSTPROOF and house the whole apparatus, leaving no parts to be interfered with. All you do is UNLOCK and TUNE IN.

Made on mass production lines, hence the low price. Provision is made to take panel up to 30 in. wide and baseboard 20 in. deep. Carriage paid and packed free England and Wales. Thousands supplied with full satisfaction.

**MAKERIMPORT Co.**  
Dept. 29  
50a, Lord Street, LIVERPOOL.

From £3 0 0. Write to-day for descriptive pamphlet and suggestions for adapting your receiver or panel in our Standard Cabinets. Immediate Delivery.

## CHATS AT THE WORK-TABLE

—continued from page 52

### Tap Wrenches

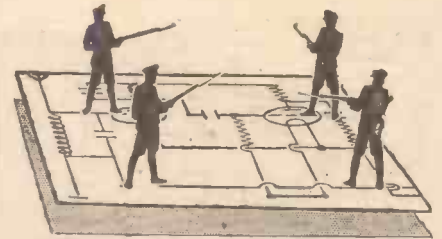
Not a few people find it difficult to go straight when tapping a hole. The reason, I believe, is very largely that they use wrenches of the ordinary kind. When a tap is fitted into one of these a T is formed by it and the arms of the wrench. As it is turned in it is very difficult to keep it from leaning slightly away from one's body, for there is a natural movement in that direction as force is applied.

For wireless constructional work no great amount of force is needed to drive the tap in a broach handle or a hand vice with a three-jaw chuck such as that shown in Fig. 3 makes one's task very much easier; there is, in fact, little difficulty about starting the tap straight or keeping it straight as it makes its way into the hole prepared for it. I can strongly recommend any constructor who is not satisfied with the accuracy of his tapping to discard wrenches of the ordinary pattern and to try instead one like that seen in the drawing.

### Hard Hitting Without Damage

One often has to flatten out or to shape small pieces of brass or copper by hammering them. If an ordinary steel hammer is used for the purpose it makes unsightly dents upon the surface which are difficult, if not impossible, entirely to remove afterwards. The presence of these makes the work look "amateurish" and they are an eyesore to those who take a pride in the jobs that they do.

As a matter of fact, such disfigurement is easily avoided if an inexpensive tool is added to the workshop outfit. This is a hammer shaped like that seen in Fig. 4, whose faces, instead of being of metal, are made of vulcanized fibre. Hammers of this kind are obtainable in weights from about 5 ounces to 1½ lb. or so. They are, therefore, excellent for light work. With them one can flatten or shape thin metal strips without making dents. For heavier work bigger hammers are made with raw hide faces. It is, by the way, of no use to provide a special hammer for the purpose unless you make quite sure that the surface beneath the work that is to be hit is perfectly smooth, for if it is uneven dents will be made in the underside of the metal whatever kind of hammer is in use.



## PROTECTION at 4 vital points in the circuit

VALVE SET OWNERS are rapidly realising the enormous importance of incorporating an accurate measuring instrument in series with the valve circuit itself.

Without this protection there is no definite method of obtaining that vitally important adjustment of plate and filament current.

Newly charged accumulators for instance register 25 volts above normal. Without a Sifam Radio Meter you cannot adjust this excess. Reception appears the same, but the life of your valves is reduced by hundreds of hours!

Haphazard control is out of date. Modern set design demands Sifam accuracy and Sifam protection!

Follow the lead of over 250,000 listeners who have learned the wisdom and saving by using Sifam Radio Meters.

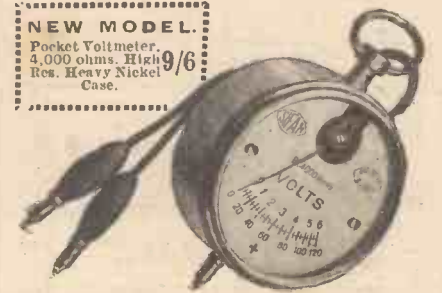
Your dealer will gladly show you the popular priced range, or write direct for leaflet "Detecting Distortion," free from

**SIFAM ELECTRICAL INSTRUMENT CO., LTD.**  
(Dept. C), 10a, Page Street, WESTMINSTER, S.W.1.



## RADIO METERS

NEW MODEL.  
Pocket Voltmeter,  
4,000 ohms. High 9/6  
Res. Heavy Nickel  
Case.



Its safer with Sifam.

M.B.

## BEAUTIFUL TRANSFERS

Perfect Reproduction. Best Inlay. List Illustrating 600 Designs and Samples 2/6.

**WR, AXON, JERSEY, C.I.**

## The WHITELINE VALVE HOLDER

Mechanically and Electrically Perfect.



**Bowyer-Lowe** 2/3

3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

**ARTCRAFT RADIO CABINETS**  
BRITAIN'S BEST VALUE  
New Catalogue Free  
**THE ARTCRAFT COMPANY**  
156, CHERRY ORCHARD R' CROYDON



H.T. from the Mains

D.C.  
34/-  
Complete

**CLIMAX H.T. SUPPLY UNITS**

Study these special features of Climax Auto-Bat H.T. Units and then the prices. Ten H.T. Tappings with one fixed and two variable voltages. Insulated sockets, insulated wander plugs, insulated terminals. Earthed metal cases. Safety-first design. Shock-proof. Fire-proof. Large guaranteed outputs. No mains noise. Same simple control as with ordinary H.T. Battery. Very attractive finish.

**Climax Auto-Bat D.C. Model.** 100/250 volts. Output approx. 200 volts max. on 200/250 volt mains, and 100 volts max. on 100/125 volt mains. 50 milliamperes max.

PRICE 34/-

**Climax Auto-Bat A.C. Model.** 200/250 volts, 40/100 cycles. 100/125 volts, 40/100 cycles. Output approx. 150 volts max. H.T. at 50 milliamperes.

PRICE £4

Plus royalty 12/6 net, plus 2 D.U. 10 rectifying valves at 15/- each. Complete £6.2.6 (obtainable from all radio dealers).

**CLIMAX**  
A YEAR AHEAD

CLIMAX RADIO ELECTRIC LTD.  
Quill Works, Putney, London, S.W.15

**WHAT IS A MAINS UNIT?**

—continued from page 19

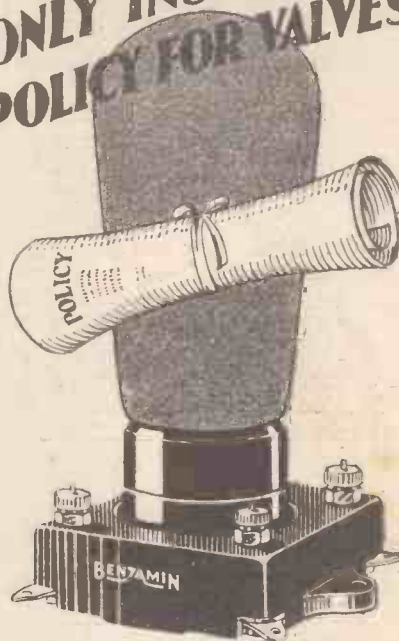
make up a very satisfactory instrument with a very good "regulation," as it is called. When we say the "regulation" of a mains unit is good, we mean that the curve plotted to show the variations of the output voltage with load is not too steep.

In America, where voltages on commercial sets are very much standardised, and where they have sets designed to work on 45 volts for the detector, 90 for the high-frequency and power valve, 135 to 180 for the output valve, and where the current consumption of commercial sets does not greatly differ among types, the mains unit manufacturer can design his unit to give approximately the correct voltage with any existing set. Furthermore, there has come into use recently a very interesting accessory for mains units in the shape of a "voltage regulator valve." One of these valves now being tested out in my laboratory is shown in a photograph. The principle of working is as follows:

**"Voltage Regulator Valve"**

The total power output of a rectifier-filter unit remains substantially constant at all loads, i.e. if we are getting 50 milliamperes at a 100 volts, or 5 watts, then a 100 milliamperes will drop the voltage to about 50, and our power output will be no more than 5 watts. If now you examine Fig. 4, you will see a voltage regulator valve shunted across H.T. positive 2 and H.T. negative. This is a special two-electrode device, the voltage drop across which remains at 90 for all currents between 10 and 50 milliamperes. A certain current passes through this voltage regulator valve when no current is flowing through that portion of the set which is not connected to H.T. + 2. We can say, roughly, that any energy not flowing through the set is flowing through the voltage regulator valve. If now we switch on the set and take current through H.T. positive 2, the voltage across the terminals of this valve remains the same, and as the total power going through the filter is approximately the same at various loads, the current flowing through the valve must be reduced. The valve thus works in such a way that within its working limits the combined current flowing through it and through H.T. positive 2 is always just the same.

**THE ONLY INSURANCE POLICY FOR VALVES**

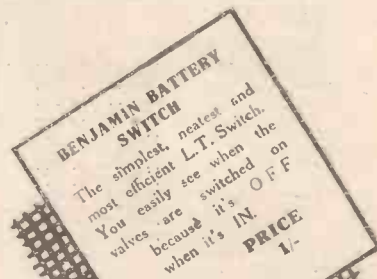


**The BENJAMIN Valve-Holder!**  
The valve-holder that floats your valves on four super-sensitive, one-piece springs which effectively absorb every shock, every quiver of vibration. Prolong the life of valves, eliminate microphonic noises, and improve reception all round by fitting Benjamin in every stage. All radio dealers sell

**BENJAMIN VALVE-HOLDERS**

- (1) Valve sockets and springs are made in one piece with no joints or rivets to work loose and cause faulty connections.
- (2) Valves are free to float in every direction.
- (3) Valves can be inserted and removed easily and safely.
- (4) Valve legs cannot possibly foul the baseboard.
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**SOME OPEN LETTERS FROM A BROADCAST LISTENER**

—continued from page 20

And with regard to the quality of the programmes, would it not be better to engage the services of two gentlemen who would, within reasonable limits, have full control of the arrangement of programmes; one gentleman to deal purely with the entertainment side, and one gentleman to deal entirely with the educative side? It would be fair and reasonable to split the programme time available exactly in half, and so allot 50 per cent of programme time to entertainment and 50 per cent of programme time to educative broadcasts, religion, talks, etc., etc.

**An Annoying Hitch**

At the moment it seems to be the policy of the B.B.C. to present mixed programmes to listeners every day. Certainly it must be admitted that one cannot glance through the "Radio Times" for any given day without finding something in the programme list which should appeal to everybody, but on the other hand it is very annoying, as I found the other evening, to sit down by the loud speaker in anticipation of hearing a certain symphony and to find that, because of the mechanism of the programme department, which was not quite so efficient as one was led to expect, the symphony could not be finished, as another item on the programme was due for broadcasting.

This may seem but a minor detail, Sir John, but believe me it is one of those little things which cause annoyance to the average listener.

And with regard to controversy and broadcasting, there are millions of listeners in this country who are

largely awaiting some signs of the effect of the removal of the ban on controversial broadcasting. An Englishman likes nothing better than an argument, and although you come from across the border, your work for the B.B.C. has been so consistently broadminded in the past that it is felt sure that your knowledge of the English mentality is sufficient to make you realise that the strain of pugnacity in the English temperament—a strain, by the way, which was admirably illustrated during the

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recent World War—cannot tolerate wishy-washy arguments. To put it bluntly, and in a phrase which your knowledge of the classics will enable you to interpret, the public expect a little more *viscera* in the broadcast talks.

Believe me, Sir John,  
Yours very faithfully,  
SUBURBAN SEER.

J. L. Baird, Esq.

Messrs. The Baird Wireless  
Television Development Co., Ltd.

DEAR SIR,—In common with many other listeners, I have been reading with considerable interest the reports of your television experiments in the newspapers and the criticisms which have been levelled against you and which have culminated in the offer of a thousand pound challenge. And,

in common with many other listeners, I must say I am very surprised to find that you have decided not to accept the thousand pound challenge. Surely, if you can televise a recognisable image across the Atlantic, it must be child's play to televise over a distance of twenty-five yards the simple objects which constitute the basis of the challenge referred to?

**Matter of Public Interest**

It may be, of course, as I have seen suggested in the newspapers, that you feel it beneath your dignity to accept such a challenge, but I think you ought to remember that television is such a matter of public interest these days that you should waive considerations of personal dignity and accept the challenge, thus demonstrating—successfully, I hope—that the optimistic statements which have appeared so often of late in print with regard to the work of your company can be justified in the public mind.

Before the challenge was made I was on the verge of expending quite a considerable sum of money in the purchase of component parts for a home television outfit, but I am afraid that my purchase will have to be postponed until either the challenge is accepted and won or until some television experimenter can demonstrate before an impartial committee that even the crudest television pictures can be received in the home by means of a home television outfit.

Believe me,  
Yours faithfully,  
SUBURBAN SEER.

**"F5"**

In the list of components given on page 418 of the April issue, the author specifies one Reinartz aerial coil. Actually the coil required is a standard Reinartz Transformer, and it is this type which should be employed.

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**"Remarkably High Mutual Conductance—**  
For the AC/G valve the mutual conductance is enormous when judged by ordinary valve standards—about 2 milliamperes per volt for an amplification factor of 36—and the heater current is only 1 ampere at 4 volts. The latter figures are quite comparable with valves of the 4½ volt 0·8 ampere L.S. class. For the AC/R valve the amplification factor is about 10, and the mutual conductance 4 milliamperes per volt, giving an A.C. resistance of about 2,500 ohms."

The writer continues by comparing the Cosmos AC/R Valve, very advantageously with other makes of valves for similar duties.

Note also what Mr. G. A. Exeter, the London Area Manager of the Radio Society of Great Britain says about the "Cosmos-Met-Vick" A.C. Valve:—

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