

**FERROCART COILS and "CLASS B" in a PORTABLE**

# Popular Wireless

Every Wednesday  
PRICE  
**3d.**

No. 565. Vol. XXIII.

April 1st, 1933.

**A MODERN MIRACLE —**

**THE**

## "FERRO-B" PORTABLE

EMBODYING  
**AUTOMATIC TONE BALANCE!**  
**FERROCART COILS !!**  
**"CLASS B" AMPLIFICATION!!!**

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IT  
INSIDE



HOW TO MAKE A  
**PENNY-IN-THE-SLOT**  
MACHINE FOR RADIO

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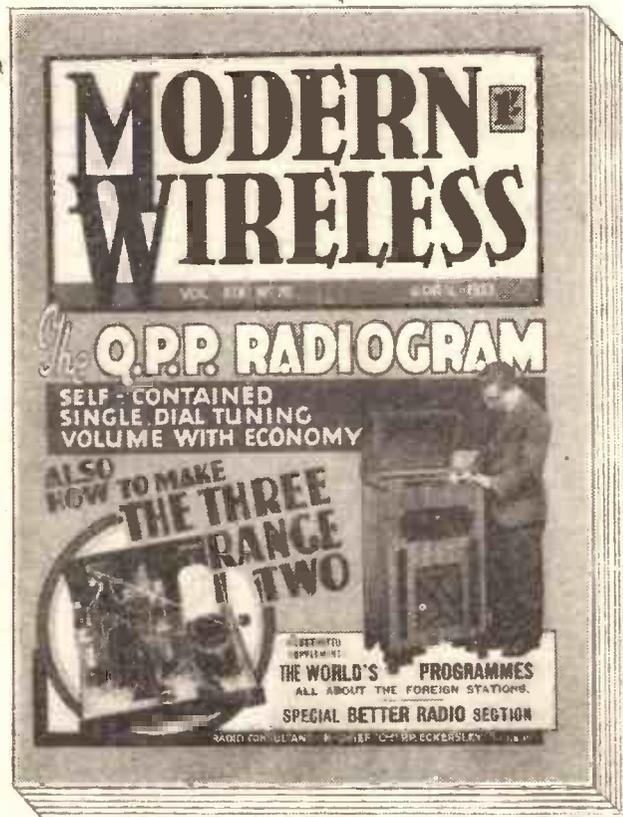
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APRIL ISSUE OF

# ★ MODERN WIRELESS

ONE SHILLING



### ARTICLES OF NOTE:

★ Rosita Forbes gives a dramatic and entertaining account of

#### UNDERGROUND WIRELESS ON TOP OF THE WORLD!

★ A description from the ordinary listener's point of view of

#### THE B.B.C.'s NEW ORGAN

★ Fine features dealing with the B.B.C. programmes including a 4-page

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A practical and entertaining feature which will help you to a better understanding of your receiver, better results from your listening and a better enjoyment of radio in general. More and more listeners are reading and benefiting from "Better Radio" every month.

# LOTUS COMPONENTS

**GUARANTEED**

## The New LOTUS TRIPLE COIL UNIT Specified in the "CLASS B" RECEIVER

The Lotus Triple Coil Unit, when allied to the requisite Tuning Condensers, contains all the essentials for the H.F.—Detector position of a Receiver. The Designers have not considered it wise to incorporate any Grid-Leak or Condenser or Decoupling Condensers, the values of which can be better assessed by the Constructor.

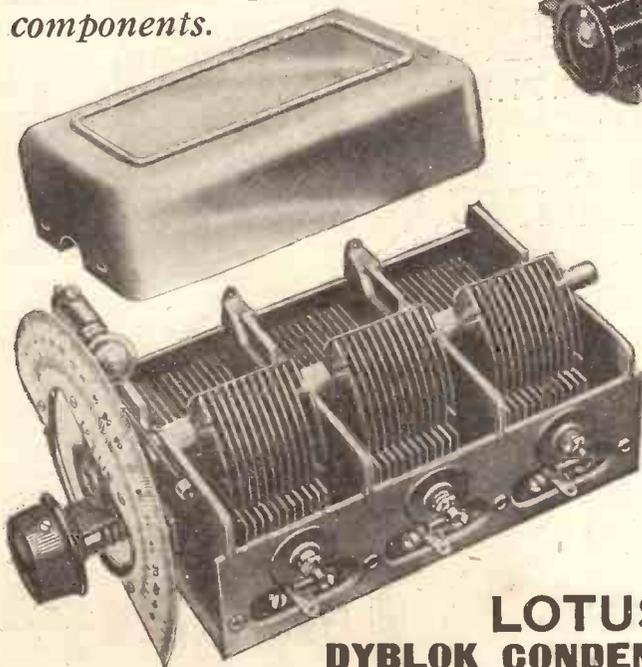
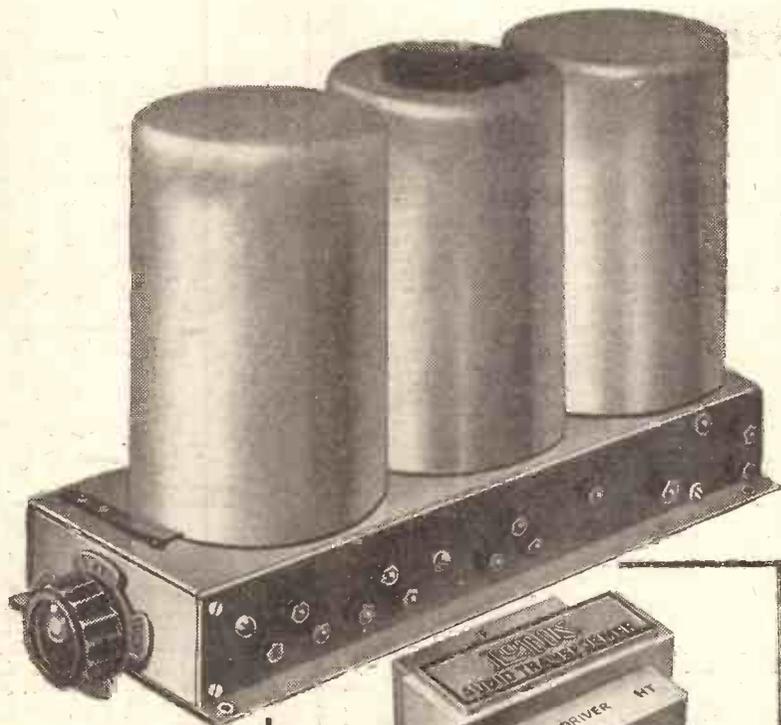
All switching includes for a complete Receiver—i.e., wave-change, Gramophone, Mains or Battery. Absolutely positive Switch Contacts, which will not weaken or deteriorate.

Accurately matched Band-Pass Inductances. Choice of Tuned Grid or Anode.

Provision made for "shorting out" the Band-Pass coupling Condenser, or increasing its value by means of an additional condenser in parallel.

Schematic diagrams printed on the Base, clearly numbered to show the appropriate terminal connections. **PRICE 27/6**

Send for particulars of other LOTUS guaranteed components.



## LOTUS DYBLOK CONDENSERS

Suitable for the "P.W." "B" Four

Rigid box construction of heavy gauge. Stout aluminium vanes, pressure cast in solid blocks, ensuring Rigid alignment of vanes, Precision of Spacing, Enduring Accuracy, Perfect Electrical Bonding, Low H.F. Resistance and freedom from Microphony.

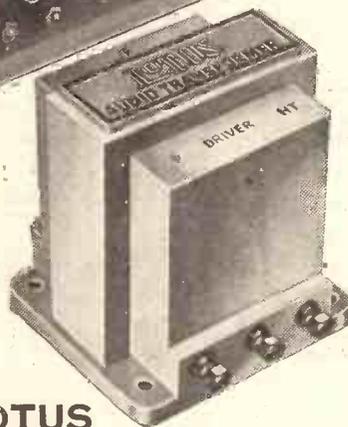
5/16 inch ground steel shaft in special self-aligning brass bearings, securing freedom from endplay and backlash.

Low losses due to minimum of high-quality insulation. Simple Baseboard Mounting. DISC DRIVE—Smooth non-slip drive with lampholder bolted to frame.

**PRICE 19/6**

Single Unit 9/6

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## LOTUS "CLASS B" DRIVER TRANSFORMER

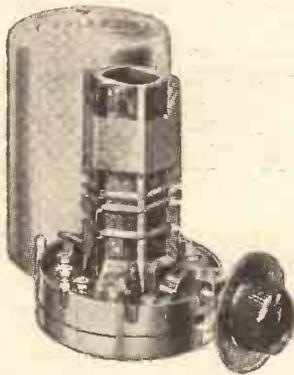
Suitable for the "P.W." Class Four 4.

A new Input Transformer capable of fully driving a Class B Output valve to deliver two speech watts! Exceptionally low Secondary Resistance—Primary Inductance—under working conditions 30 Henries. Housed in the new SILVER finished case to match aluminium chassis coil covers, gang condensers and metallised valves. **PRICE 11/6**

IF YOU HAVE ANY DIFFICULTY IN OBTAINING SUPPLIES WRITE DIRECT TO  
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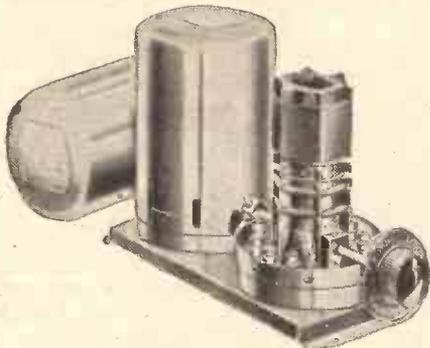
# TELSEN COILS

*A range which caters for every requirement*



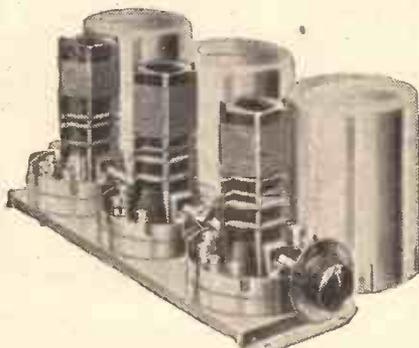
### TELSEN OSCILLATOR COIL

Particularly suited to Superheterodyne circuits in conjunction with the Telsen Band-Pass Coils. Operates at a frequency separation of 110 kilocycles from the Band-Pass tuning range, maintaining a constant frequency separation over both wave ranges **8/6**



### TELSEN BAND-PASS COIL UNIT

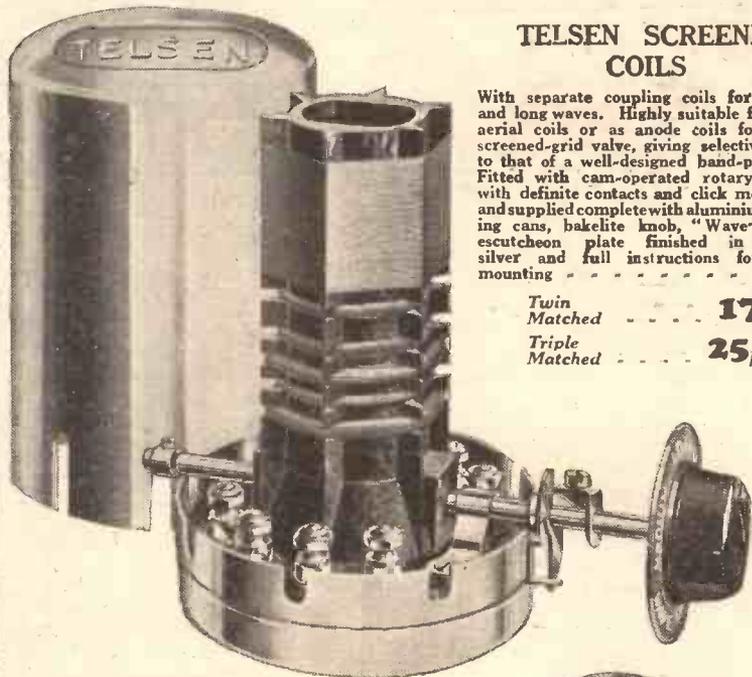
Comprises two accurately matched Screened Band-Pass Coils, on a single rigid plinth base. The coils are independent of each other and can be wired for any of the three types of Band-Pass Filter to give exceptional quality with Selectivity **17/-**



### TELSEN SUPERHET COILS Band-Pass and Oscillator Coil Unit

Comprises the Band-Pass Coils and Oscillator coil combined into a single compact unit. All wave change switches are ganged, with single knob control. **25/6**  
Ideal for any Superheterodyne circuit

Type No. S. 330. For Superhets which do not employ band-pass tuning in their pre-detector H.F. stages. Mechanical construction and wave-change switch assembly almost identical with standard Telsen Screened Coils **25/6**



### TELSEN SCREENED COILS

With separate coupling coils for medium and long waves. Highly suitable for use as aerial coils or as anode coils following a screened-grid valve, giving selectivity equal to that of a well-designed band-pass filter. Fitted with cam-operated rotary switches with definite contacts and click mechanism, and supplied complete with aluminium screening cans, bakelite knob, "Wave-Change" escutcheon plate finished in oxidised silver and full instructions for **8/6**

Twin Matched **17/-**  
Triple Matched **25/6**

### TELSEN DUAL-RANGE AERIAL COIL

incorporates a variable selectivity device, making the coil suitable for widely varying reception conditions. This adjustment also acts as an excellent volume control, and is equally effective on long and short waves. The wave-band change is effected by means of a three-point switch and a reaction winding is included **7/6**

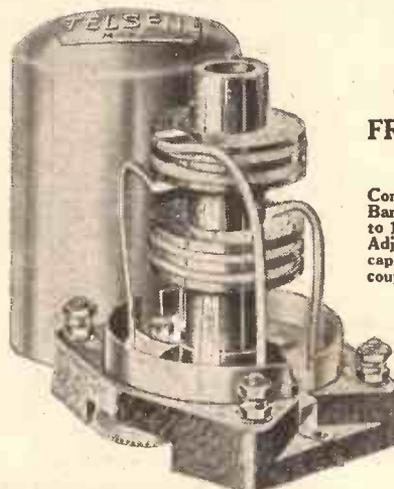
### TELSEN DUAL-RANGE H.F. COIL

may be used for H.F. amplification with Screened-Grid Valve, either as an H.F. Transformer, or, alternatively, as a tuned grid or tuned anode coil. It also makes a highly efficient Aerial Coil where the adjustable selectivity feature is not required **5/6**



### TELSEN INTERMEDIATE FREQUENCY TRANSFORMER COIL

Consists of two tuned circuits comprising a Band-Pass Intermediate frequency filter tuned to 110 kc. by two pre-set balancing condensers. Adjustable for different values of stray capacities, with variable filter coupling **12/6**



# TELSEN

**RADIO COMPONENTS FOR LASTING EFFICIENCY**

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

# POPULAR WIRELESS

**THE FIRST AND FOREMOST RADIO WEEKLY**  
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*The Paper that Made Wireless Popular*

**IF THEY DARE!  
 A NEW CELL  
 LUXURIOUS RADIO  
 EDISON MEMORIAL**

## RADIO NOTES & NEWS

**THREE PLAYS  
 "P.W." AHEAD  
 COWS AGAIN!  
 "BLATTNER-TUBE"**

Will they Dare to Try It?

I HAVE just seen and heard a "talkie" in which, in addition to the players' speeches, one hears their own voices expressing their secret thoughts. Not a pleasing innovation! At first I thought that there was a parrot in the cast.

However, this is to notify the B.B.C. that if it allows any of its bright young men to try the same game with radio plays I shall hurl the whole weight of my influence and eloquence into the combat on the side of "Listen foreign."

### THE LATEST

advance in detector design is incorporated in the "P.W."

### WESTECTOR SUPER

Described on page 97 it embodies the new

### 'COLD' VALVE

### Morocco Likes Radio.

AN official report on the radio market in Morocco shows that the chief demand is for 4-valvers with two stages of H.F., and for 6-valve superhets. Most of the sets sold up to date come from France and America, but the Germans and Dutch are beginning to compete.

Britain's share of this trade is simply this: So far no British sets have been imported. If any British trader can contradict this we shall be happy to recant.

### America's Millions.

FROM a survey of radio sales made in the U.S.A. during 1930-31-32 it has been found that of the 8,920,000 sets sold between April, 1930 and Jan., 1933, 4,760,800 went into homes which had not previously possessed one.

There are now approximately 17 millions of homes equipped with receivers, and it would be interesting to know the average price paid for them.

### Zinc-Carbon-Iodine Cell.

APPROPRIATELY attributed to a Chilean monk, François Boisier, this strange cell consists of a carbon positive in a zinc container (negative), the carbon being surrounded by activated carbon and the container being lined with cellulose.

The electrolyte is a solution of zinc iodide and when the cell is charged at 1.3 volts the zinc is deposited on the container and the iodine is absorbed by the

activated carbon. It is claimed that the electrodes suffer no chemical change, and that nothing analogous to sulphation occurs.

No gas is liberated and the cell can therefore be hermetically sealed.

### My Friend Merlin.

A. S. (Ilford) at whom I took a few passes some weeks ago on the subject of astrology, particularly about some broadcasting alleged to be done by planets, tells me that he is not "floored," and will revert to the matter when he has time. He adds that although he can describe the principles adequately enough for the simple-minded, he hesitates to send me a description until he is sure that there are no loose connections.

Let him not trouble about that; I am very simple-minded in astrological matters. Come on, A. S., reveal the truth to us!

## CIRCUIT DEVELOPMENTS

of the first importance are now occurring, and in the "P.W."

### — FERRO-B PORTABLE —

is provided a magnificent summer-time set using the new

### FERROCART COILS

Try the Patent Office.

DOUBTLESS some of you have matriculated and feel pretty powerful in science and maths. Well, if you are looking for an interesting, not-too-badly-paid and secure job, with pension, why not try for a post in the Patent Office as Assistant Examiner?

The age limit is 20 to 25, with extension in certain circumstances. Write for details to the Secretary, Civil Service Commission, Burlington Gardens, London, W.1, before June 1st next. And good luck to you.

### Luxury Radio Ship.

NOT much more than twenty years ago ships went to sea equipped wirelessly with a few Leyden jars, a 12-inch induction coil and a coherer receiver. Now the new luxury liner, Queen of Bermuda, has a radio-telephone set with which she can link up with almost any telephone in the

world, and a telegraph outfit with practically world-wide range.

In addition, this vessel has a direction-finder, a band repeater and music-playing installation combined with a broadcast receiver, so that music can be shoved all over the ship except in the barber's shop!

### English for Selling.

MISS M. SOMERVILLE, Secretary to the Central Council for School Broadcasting, in some remarks about the value of the radio lessons on "King's English," gave herself and the Council completely away by saying that in anything to do with selling the possession of a standard English accent is essential.

This amply illustrates my contention that so many of the B.B.C.'s cranks and specialists have little or no contact with reality. Selling? A Jew selling a second-hand bedstead to an Aldgate lady! A Greek selling fags at Port Said! A Cingalee selling moonstones at Colombo! A Cockney selling flowers; a gipsy selling wicker chairs!

### New Radio Discovery?

REPORT states that Professor E. S. Palmer, of University College, Hull, has found out that a frame aerial of oval shape gives a thousand-fold better reception than a circular one. That is saying a great deal, and I confess that I think that the newspaper reporter or sub-editor has not said precisely what Professor Palmer would say about this "discovery." Nevertheless, if I am mistaken, I shall be only too pleased.

I should be grateful if someone at the Hull University would let me know in technical parlance exactly what Professor Palmer has discovered about elliptical frame aerials.

### Testimonial to Edison.

AN International Edison Foundation has been formed for the purpose of erecting memorials and establishing fellowships in physics and chemistry in

(Continued on next page.)

### THIS WEEK

another last moment development is used, in the

### FERRO-B PORTABLE,

in the form of

### Class "B" Amplification

# ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

universities in the U.S.A. and other countries as a permanent memorial to the great inventor. Under the fellowship scheme American students will be sent abroad and non-American students brought to the States. The Foundation was created by the American Institute of Electrical Engineers and the Edison Pioneers.

### These Inquisitive Americans.

I AM feeling just a little self-conscious as a result of reading a letter from a young gentleman resident in Oklahoma who offers to trade a frigidaire, an Indian's



feather outfit, and a collection of (Oklahoma n?) beetles for a Baird television transmitter—"or what have you"? Bless me, what a question! I have my usual lumbago, a split lip, and an unpaid gas bill, besides twelve-and-six in bullion and a snifter of a letter from the coal merchant. He can have the coal bill and keep the "frigidaire." I understand his anxiety to be rid of his "frigidaire," but he ought to know that no English gentleman recognises beetles socially.

### A Trio of Plays.

WEST Regional, April 3rd, "The Mirror," by H. A. Vachell; has a supernatural element. National, April 7th, "The Piper," based on Browning's "Pied Piper of Hamelin," by Herbert Ferrers; has been produced four times before.

On April 11th, "Escape," by John Galsworthy. This is the play which was to have been broadcast at the time of the Dartmoor revolt, but was rightly ruled out.

### Pleasure Taken Very Sadly.

TALKING of radio plays, that "Fall of the House of Usher"! Enough said!!

### Etheric Adventures.

WITH reference to my note about the wonderful wireless working of the Cape-Cairo aeroplanes, T. W. M. M. (Perth) tells me that when he was aboard a steamer in Aden last March as wireless operator he heard a British flying-boat on the 36 metres band asking for reports on its signals, the said flying-boat then being over Uganda. Nord-



deich (Germany) answered, and asked the flying-boat to call up the Graf Zeppelin, which was then flying from Pernambuco to Spain. No doubt my correspondent heard the Marconi engineers testing over the Cape-Cairo route.

### Very Canadian Note.

MAJOR GLADSTONE MURRAY, the Publicity Director of the B.B.C., has gone to Canada to confer with the Canadian Commission on the organisation of broadcast programmes. Major Murray is a Canadian, so everything is fine and Canadian.

And the Canadian Radio Broadcasting Commission is going to buy three stations, Ottawa, Vancouver, and Moncton, N.B., from the Canadian National Railways, for some £10,000.

### "P.W." Can Put This Right.

I READ in a "local" seaside newspaper that experts compute that at least two million of the radio sets now in use are obsolete. Dear, de-ear! Pity the "experts" cannot do something useful. However, no one can blame "P.W." for this terrible situation, because we are always ahead of the crowd!

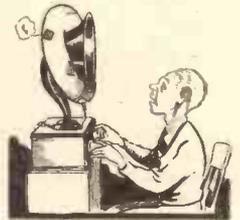
Anyway, the indictment is not distinguished by a very deep dye of turpitude, and no doubt much the same might be said truly of two million motor-cars, gas-stoves or international treaties—all now in force.

won't sell!)—this gorgeous adventurer is to speak at the dinner of the Royal Society of St. George at the Connaught Rooms on April 24th.

Listen to his words on the National if you possibly can, for only the most scarlet communist could resist this wonderful man. Read his books, and those of General Seely, and you will need no other tonic.

### Home-Made Blattner-Tube.

EITHER somebody has been trying to impose upon the credulity of A. G. (Dalston), or A. G. thinks that "P.W." is a comic paper. He says that a friend has told him that the way to get dance music on Sunday is to bottle up Henry Hall's Saturday show by connecting his lead-in wire to the valve of a motor-car inner tube which is pumped up during reception.



On switching on the set on Sunday the tube redelivers the programme. His friend has a tube of some great speech which was broadcast last year, and he can still enjoy it at will. A. G. asks whether these tubes are worth trying. What a life!

### Broadcasting and Newspapers.

HERE are two views of the question. Major J. J. Astor, M.P., told the Empire Press Union that the B.B.C. agrees that the function of its news service is to whet the public's appetite for the fully considered and balanced reports of contemporary events which only newspapers can give. That, I think, is how it eventually pans out.

Now hear Mr. Lloyd George in the Commons debate on the B.B.C. He suggested that radio would counter-balance the current newspaper practice of creating opinion less by the leading article than by the presentation of news in which emphasis is placed on that which suits their particular opinions.

Let the Press take heart, for broadcast news will never hurt its circulation.

### The Robber King.

AS though in fulfilment of my forecast, I understand that the police now believe that the increasing thefts of radio sets is the work of an organised gang which is controlled by a master crook—just as I said.

Personally, I think that a master crook should devote his perverted genius to commandeering better stuff than radio receivers.

But there's no accounting for tastes. All we now lack is the Edgar Wallace of radio crime to lay bare the secrets of the Q.P.P. underworld!



ARIEL.

## SHORT WAVES

Complaint is made that a B.B.C. rendering of "The Ancient Mariner" was overpowered by the orchestral accompaniment. The listener-in he cursed the din, For he heard the loud bassoon.

Loudspeakers were recently used during military manoeuvres on Salisbury Plain. This fact is no doubt responsible for the rumour that the next war will be broadcast.—"Punch."

"There's one thing I like about Peter. He certainly is an optimist." "I'll say he is. Why, he took a course in foreign languages before he bought his crystal set so that he would be able to understand the foreign announcers."

An Irishman entered the village Post Office and, placing ten shillings on the counter, said: "I want a licence for my mother, please." "You don't want a licence for your mother," said the assistant. "Oh, don't I?" replied the Irishman. "She's just bought a wireless set."

Nothing was good enough for the Listener, For he liked to show his skill; He kept passing from station to station, And he would not hold one still.

So I pulled him away from the sound-box And hit him in the face with a stone; And the weather and the news surged backward When the radio fiend was gone.

"Punch."

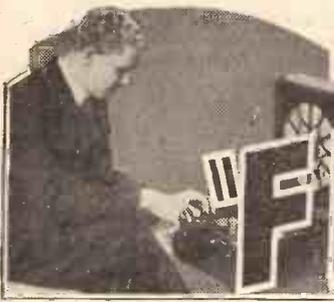
### "A Pint, Please!"

COWS again! How largely and frequently these animals appear in relation to radio. They were supposed to be partially responsible for the Indian Mutiny, and now they are made the victims of radio; people try to increase their milk supply by radio, and doubtless will require them to "moo" in "hot" numbers.

In New South Wales, I learn, the farmers are now advised by radio of the amount of milk they may send to the centre of distribution. A cow's life is a radio one!

### Winsome Winnie.

MR. WINSTON CHURCHILL, M.P., the enfant terrible of the House of Commons, and for whose command of our language I would give all my gramophone records, my second-best bedstead (Shakespeare's bequest to his wife), and all future royalties on my physics book (which



# THE "FERRO-B" PORTABLE

IN 1929 and 1930 millions of portable sets were built and bought; last year there was no widespread enthusiasm for portables at all. Why? Well, I don't think one has to look far for the reason.

The portable set has had a great novelty appeal; the idea of being able to collect music from the air with a magic box having no external antenna was one to be marvelled at as a miracle.

Also a portable was (and still is) a remarkably useful form of receiver. I don't fancy it has ever been transported to the "wide open spaces" in any great numbers, but it is an attractive thought to have the knowledge that one can take one's radio wherever one goes, upstairs, downstairs, into the park and woods, even though in actual fact it seldom travels beyond the parlour table!

### Distinctive Features.

Nevertheless, there could be no great future for the portable while it remained little more than an ordinary set uncomfortably pressed into an extraordinarily small case. It wanted special technical features of its own to compensate for the loss of novelty appeal owing to its increasing familiarity.

At long last a number of new inventions and developments have coincided to render the portable an entirely distinctive, characteristic entity.

And owing to the resources of our extremely well-equipped laboratory we are able to present a finished and perfected design well ahead of any other journalistic or commercial organisation.

We are all extremely proud of our "Ferro-B" portable, and I fancy constructors won't find it at all difficult to share our enthusiasm when I explain to them what a wonderfully compacted assembly of up-to-the-minute developments it is.

I've got two pages in which to do this, whereas I feel I could easily fill six!

Now hold your breath while I briefly list the main features of the "Ferro-B." Here they are: (1) A Ferrocart Coil. (2) "Class B" amplification. (3) A special light-weight moving-coil loudspeaker. (4) Automatic Tone Balance.

### Gives, Real Volume.

What a combination! And all found in an easy-to-handle, easy-to-make suit-case type of portable!

And note how miraculously these red-hot radio developments team up. They might well have been invented purely and

**The First Holiday Set  
WITH  
FERROCART COILS  
"CLASS B" AMPLIFICATION  
and  
AUTOMATIC TONE BALANCE**

simply for a portable, so marvellously are they applicable to this type of set.

Take "Class B" amplification, for example. Great volume and good quality for an insignificant expenditure of H.T.! Just the very thing we have been waiting for. Why the best of 1932 portables could give you only an apologetic compromise in the way of outputs, and even so, the less said about its H.T. current-eating propensities the better.

But now the "Ferro-B" portable provides an output better than that of a normal

weight of metal, and improved machining has permitted sensitive adjustments of parts. Result: small but efficient moving-coil loudspeakers light enough in weight to be applied to portable sets.

And reference to weight brings us to the Ferrocart coil. This component, while being extremely effective, is astonishingly small. Space is at a premium in a portable, but not only does the use of a Ferrocart coil enable a designer to accommodate items which he would otherwise have to sacrifice, but its very efficiency is a tremendous asset in a receiver which must rely for its aerial on only a comparatively tiny spread of wire.

### Amazing Reproduction.

Finally, there is an Automatic Tone Balance. With every successive application its value seems to increase. How many times have I said "in this set A.T.B. rises to its greatest height of usefulness"—or words to that effect? Well, if I've thought A.T.B. had reached its peak before, I now stand corrected.

In the "Ferro-B" portable it is simply indispensable. Reaction must of necessity play a big part in the operation of any such set (although I must hastily add that this is functional and is not a critical control imposed on the user), and as everyone knows reaction is no respecter of the "straight line," it simply mangles it.

The high notes are beaten down and the low ones are bolstered up.

A.T.B. is the policeman of the audio-frequency spectrum; it marshals the notes back into line and makes mumbblings and mutterings into music.

I wish you could all hear the "Ferro-B" working. You'd be amazed.

I guarantee that if you couldn't see the set you would be prepared to wager anything that a very much bigger outfit was in action.

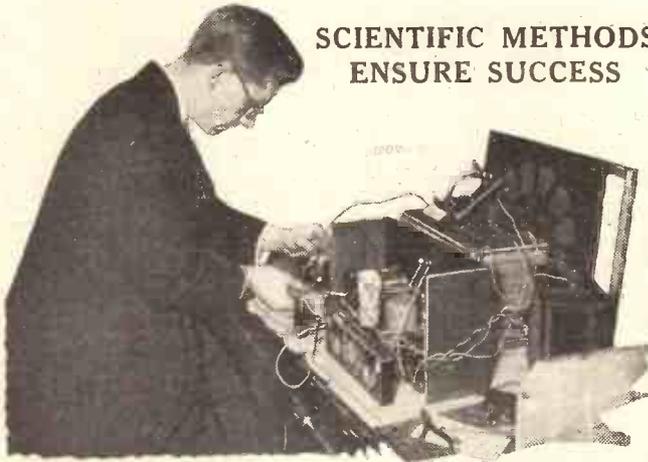
We have to offer no qualifications about its response whatever. In the ordinary way I think I can safely say that everyone subconsciously extends a charitable ear to a portable set in the usual way.

### Modifying Old Ideas.

You don't expect it to give results equal to a table or console outfit in point of quality and volume. When you come across a "Ferro-B," as in due course tens of thousands of you undoubtedly will, you will find it necessary to revise your ideas!

(Continued on next page.)

## SCIENTIFIC METHODS ENSURE SUCCESS



Extreme skill on the part of the designer and exhaustive tests of various layouts are essential preliminaries to the production of a first-class portable. Special technique is required to employ successfully such new developments as the latest type of "Class B" Valve and Ferrocart Coils.

battery set (and almost equal to that of an elaborate mains outfit) with standard size batteries not unduly overworked!

But what would be the good of that if we had to rely upon an inefficient moving-iron loudspeaker to transform this fine output into sound waves? It would certainly be an "ironical" state of affairs!

It so happens, however, that enormous strides have recently been made in the development of moving-coil loudspeakers. Special alloys have been invented to build up intense magnetic fields without a heavy

## THE " FERRO-B " PORTABLE

(Continued from previous page.)

Don't imagine for a moment that I am referring only to the reception of the local station. The " Ferro-B " is vastly more than a local station receiver. Of course, if you were to take it down to the bottom of a deep coal mine and shut it in a metal box it might have to struggle for stations. At least, I think so, though on reflection I'm not even sure about that!

But give it only fair conditions and you'll have a whole collection of programmes to choose from. Mark my word; I said *programmes*, and that means entertainment, not a medley of thin pipings and twitterings which you can barely distinguish from distant oscillation.

There is no doubt that the Ferrocart coils enable a most gratifying degree of sensitivity to be obtained, while the sharpness of tuning provided by this coil to the tuned anode S.G. circuit is a revelation.

This, apart from the frame-aerial direction effect, makes the " Ferro-B " one of the most selective portables I have ever tried. Not that the tuning is unduly critical, it is not difficult to find stations, but the

### FULL CONSTRUCTIONAL DETAILS

of this unique receiver, together with circuit and wiring diagrams, will appear

**NEXT WEEK**

case and rapidity with which nearby locals can be " left behind " is very marked.

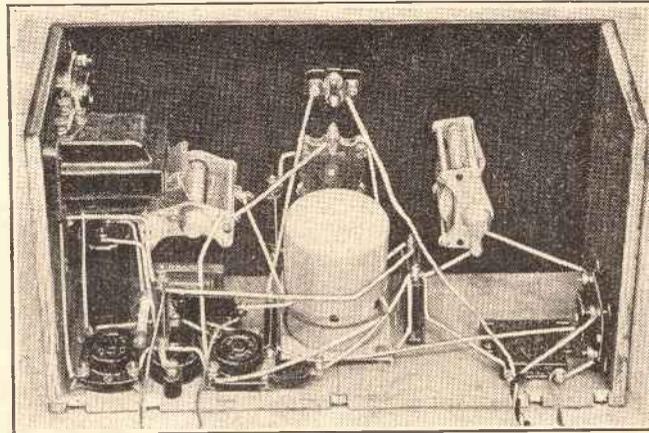
Thus, even if you want to tune in a station " in line " directionally with your nearby local, there is little danger of the latter interfering in any way—the Ferrocart

tuned anode will see to that for you.

On the L.F. side the power is due to the " B " stage incorporating the Cossor 240B valve, which is a real hard worker, giving amazing power output on local station and remarkable amplification on distant transmissions.

The whole of the set, except the speaker and frame aerial, is " chassis built," not

### IT USES THE VERY LATEST VALVE



By means of the resources of our extremely well-equipped laboratory, " P.W. " is able to present a finished and perfected design on the latest lines, well ahead of any other journalistic or commercial organisation

on a metal frame, but on the standard panel and baseboard, the latter being fitted with side pieces. Thus the receiver is particularly compact, allowing it to be placed in a container, the size of a small portable typewriter case.

When the lid (containing the frame aerial and moving-coil loudspeaker) is shut the " Ferro-B " Portable does not look

of reproduction to the portable gramophone. We have, I am glad to say, been able to do it, and once again POPULAR WIRELESS leads the way in a new stage of radio development, the portable receiver that is not only easily carried about, but is capable of truly equaling in vocal strength its mechanical rival.

(To be continued next week.)

### SELECT YOUR VALVES FROM THIS LIST

Make	S.G. Stage	Detector	Drive
Mullard	P.M.12	P.M.1H.F.	P.M.2A.
Cossor	220 S.G.	210 Det.	220P.A.
Mazda	S.G.215	H.L.2	P.220
Marconi	S.22	H.L.2	L.P.2
Osram	S.22	H.L.2	L.P.2
Eta	B.Y.6	B.Y.1815	B.W.604
Lissen	S.G215	H.L.2	L.2 (Special drive valve)

### THE " CLASS B " VALVES.

Tests with the " Ferro-B " Portable were conducted with a Cossor " Class B " valve, which we understand is now on the market and types by Messrs. Mullard, Mazda, Marconi and Osram will shortly be available.

## THE FIRST PORTABLE RECEIVER WITH " CLASS B " AMPLIFICATION

Component.	Make used by the designer.	Alternative makes of suitable specification recommended by designer.	Component.	Make used by the designer.	Alternative makes of suitable specification recommended by designer.
1 Panel, 14 in. x 8 in.	Goltone	Peto-Scott, Becol, Permcol	1 H.F. choke	Graham Farish "Snap"	Lewcos M.C.
1 Baseboard, 14 in. x 4 1/2 in. x 3/8 in.	—	—	2 On-off switches	Lissen and Ready Radio push-pull type	Tunewell, Bulgin, Teisen Sovereign
1 Cabinet	Cameo Riverside Portable	—	3 4-pin valve holders	Benjamin "Vibroholder"	W.B. small type, Lotus, Teisen, Ready Radio, Lissen
2 .0005-mfd. tuning condensers	Polar type SM.2 Ready Radio, "Airsprite" type	Telsen	1 Class "B" ditto	Benjamin	W.B.
1 .0003-mfd. special diff. reaction condenser	"Airsprite" type	—	1 L.F. transformer	Igranic "Parvo"	R.I. "Parafeed," Bulgin "Senator"
2 .25-mfd. fixed condensers	Telsen, small type	—	1 Class "B" ditto	Lissen	—
1 .01-mfd. ditto	Dubilier 670	—	1 Output transformer of choke	Ferrant type OPM 12(c)	Multitone, Lissen, Sound Sales
3 .002-mfd. ditto	Dubilier 670	—	1 Fuse and holder	Belling & Lee "Wanderfuse"	—
1 .001-mfd. ditto	Dubilier 670	—	5 Battery plugs	Clix	Belling & Lee, Goltone, Selex
1 1-mfd. ditto	Dubilier 9200	—	2 Accumulator tags	Clix	See above
1 .0003-mfd. ditto	Dubilier 665	—	3 Yards insulated sleeving and 5 yards 18-gauge tinned copper wire	Goltone	Wearite
1 1-meg. fixed resistance with terminals	Graham Farish "Ohmite"	—	1 Piece copper foil, 2 in. x 2 in.	—	—
1 20,000-ohm ditto	Graham Farish "Ohmite"	—	2 Pieces wood, 7 1/2 in. x 4 1/2 in. x 3/8 in.	—	—
1 2,000-ohm ditto	Graham Farish "Ohmite"	—	1 ditto 11 in. x 11 in. x 3/8 in.	—	—
1 500-ohm ditto	Graham Farish "Ohmite"	—	1 Anode connector	Belling & Lee	—
1 200,000-ohm ditto with wire ends	Dubilier 1 watt type	—	2 oz. 22-gauge D.S.C. wire	—	—
1 Screened coil	Colvern type F.3 Ferrocart	—	1 oz. No. 38 ditto	—	—
			Wire, screws, flex, etc	—	—

# ECKERSLEY EXPLAINS-



Continuing his series of brilliant and provocative discussions on radio topics of to-day, P. P. Eckersley reveals some trenchant opinions on Television. This new feature by Britain's Leading Radio Technician will appear week by week exclusively in "Popular Wireless."

I AM a member of a Radio Luncheon Club. It must be a very good club because since I have been there we have listened to two very important speeches.

The last time I was present Mr. Barton Chapple, the Chief Engineer of the Baird Television Company, told us about television. He made an excellent speech—an excellent fighting speech. I have always known that it is better to go wrong in freedom than right in chains. I admire unstintedly those whose motives are ruled by enthusiasm.

### Time to Speak.

Mr. Chapple just went at it. He read a speech which put armchair critics of television even closer to the fire. They were roasted. What should they know of television who only theory knew? The "ridiculous dot theory" was swept away; instead, the streaky academy picture.

My heart beat fast. The audience looked round at an ashamed figure hastily jotting down a few notes. Yes, me! I afterwards learned that I was wrong in feeling thus; that we armchair boys ought to put a point of view, anyhow. So when the final punch had been delivered and ably seconded, I felt it was time to say something, too.

I said what I have written here, that it was stimulating and exciting to have someone making a speech who really had something to say, and didn't mind who heard him say it. I felt myself a little ashamed to have been a critic of television. No one could say I was uninformed, but they might easily say I was unfair.

### The Power of the Critic.

But I went on, if I was unfair, how did it really hurt the progress of television? Here was this thing, which has had more publicity by far than, say, Radio Relay (or, as I call it, Rediffusion), and yet a few critics have prevented it advancing commercially in any real degree.

Out of the five and a half million persons who must know all about it; must know of the B.B.C.'s co-operation with a private company; must know that this private company has semi-official and governmental backing—in spite of all this I am told only

three thousand people own television sets. This, it is inferred, is due to armchair criticism!

### Pleasing the Public.

It was, I said, a tremendous compliment to my reputation to suggest that I, by my ill-timed criticisms, could hold up the development of so vast an enterprise!

I wondered what might have happened had I defied the radio industry. Equivalently the thing could never have started—brave Horatius, and all that! No, it seemed to me that critics have never, will never and can never, prevent the development of any new idea. They can hold it up, they can deny it publicity, they can starve it of

been made. Naturally then the service may recommend itself more strongly to the public. A very kind and generous invitation has been given to me to come and see for myself. And, of course, I am going.

### Forgiving Imperfections.

It will be very interesting. The last time I saw television I went to the B.B.C. and saw a television play. It was then that I made the foolish mistake of believing what was actually four fingers of a hand on a cafe table to be four Zeppelins over Paris at dawn. I am told that everything is "much, much clearer" now. It will be interesting to see, because in the end what you see has got to be interesting.

Nothing can alter the fact that at the beginning of radio people forgave imperfections because they were interested and amused by what they heard. They, the public, would, at the beginning of television forgive imperfections if they were interested and amused by what they saw. The trouble about it all is that the public will be such armchair critics!

## CONTROLLING TELEVISION PROGRAMMES



Now that sight and sound programmes are regularly radiated by the B.B.C., broadcast artists have ample opportunity of making themselves seen as well as heard. Owners of television apparatus are assured of the technical excellence of the vision broadcasts by the close control exercised by the engineers at Broadcasting House.

capital—but even these things are no barrier in the long run.

Look at this Radio Relay business. It is disliked by the B.B.C., it is a nuisance to the Post Office, it has to struggle against financial arrangements conceived in its worst interests—but it goes on. It numbers, I suppose, something like 100,000 subscribers to-day. Television has money, publicity and B.B.C. co-operation. We critics are powerful people, it seems!

Truly, the thing which holds up or advances television is its public service value. The public are not fools. If they like something they will have it. If they do not like something, rave as we will, that something has no present and no future so long as this public attitude persists.

But I am told that great advances have

maintained horizontal sent signals through space. An earth, therefore, is not necessary to wireless communication.

It was Marconi who showed that by connecting one side of the spark gap to earth, and the other side to a vertical wire, you could repeat Hertz's experiments.

It was shown, notably by Lodge, that one of the factors in efficient wireless communication was to be able to establish a capacity between the two sides of the radiator, and it was a convenient way to use the earth as one side. When this cannot be done, as in aeroplanes, you treat the metal parts of such aeroplanes as an earth and you drag out a wire behind as the aerial.

Again, taking frame reception, it is one of the essentials of a direction-finding apparatus that the frame is not earthed.

THE MIRROR OF THE B.B.C.

By O. H. M.

## RELAYS FROM COVENT GARDEN

National Lectures—Transatlantic Debates—Sir Henry Wood and Dr. Adrian Boulton—Easter Programmes—Gramophone Libraries.

OPERA lovers will welcome the news that frequent relays are to be taken from Covent Garden during the forthcoming Grand Opera Season. On the opening night, Monday, May 1st, a complete act of one of the most famous operas will be broadcast to National listeners.

## The Eleventh National Lecture.

Sir Eric Drummond, K.C.M.G., C.B., who recently announced his retirement from the position of Secretary-General of the League of Nations Secretariat, which position he occupied for thirteen years, is giving the first of the year's National Lectures on Wednesday, April 5th.

No man is better qualified to speak of the League of Nations, which is the subject of his lecture, and there are few topics which are more interesting in these days when the attention of the whole world is focused upon the events in Geneva. So far, ten National Lectures have been given since they were inaugurated in 1929.

Each lecture is allocated forty minutes of programme time. They are not talks in the generally accepted sense so much as comprehensive discourses upon matters of politics, religion, science, history and art.

## Oxford v. Columbia.

Another transatlantic debate is in the Regional programme on Saturday, April 8th, when members of the Oxford Union will discuss the motion "That democracy has failed" with those of Columbia College, New York. The debate will be broadcast in America by the Columbia Broadcasting System.

## Sir Henry Wood and Dr. Adrian Boulton.

Both Sir Henry Wood and Dr. Adrian Boulton are paying visits to the West in the near future, the former to conduct a concert by the Herbert Ware Symphony Orchestra at the Park Hall, Cardiff, on Sunday, April 9th, and the latter to attend the Annual Dinner of the Swansea Orpheus Choral and Orchestral Society. The programme of Sir Henry Wood's Concert, in which Trefor Jones (Tenor) is the solo artiste, will be broadcast from 9.5 to 10.15 p.m. Dr. Boulton's speech in reply to the toast of "Our Guest," which will be proposed by Professor E. Ernest Hughes, will also be broadcast.

## Arrangements for Easter.

Some intimation has already been given in previous issues of what listeners can expect in Easter programmes. In addition to these, it can now be stated that on Easter Sunday morning, a service will be relayed from York Minster which will contain an address by the Archbishop of York.

The Easter Monday broadcast of Oscar Asche's famous Musical Tale of the East, "Chu Chin Chow," will be produced by John

Watt and Harry S. Pepper, with Stanford Robinson conducting the Theatre Orchestra. The play has, of course, been specially adapted for the microphone, but its great attraction to listeners will be that the leading part is to be taken by Oscar Asche himself.

I should imagine that the booking of the rest of the cast will cause more discussion than is usually given to such matters at Broadcasting House. Since it was first announced that a studio performance of the

## THE B.B.C.'s SUNDAY PROGRAMMES



The decision of the programme officials at Broadcasting House to present radio drama on Sundays lends added interest to this scene from the "Tudor Torch," which was an example of earlier radio dramatic broadcasting.

play was contemplated, large numbers of applications have been received for parts from members of the original cast and numerous touring companies.

The play will be broadcast on the National wavelengths and repeated on the following evening for Regional listeners.

## Programmes in the North.

So far as the broadcast programmes are concerned, the Easter programmes will

provide a pleasing sample of the good things to come at frequent intervals between then and the Autumn.

There is a programme of folk songs from Durham on Easter Monday, a relay of the Bouquets Concert Party from the Floral Hall Southport, on the following Wednesday and a "Blackpool Night's Entertainment" on Friday, April 21st.

The latter will consist of an act relayed from the stage of the Palace Theatre, an excerpt from a show on the Central Pier, an interlude by the Band in the Palace Ballroom, and another item from the Entertainment on the South Pier. Finally, on Saturday, April 22nd, another lively programme called "A Frivolous Hour," will be presented by Kenneth Adam, who will be responsible for arranging it.

## Christopher Stone.

I hear that Christopher Stone has a collection of 12,000 gramophone records, and that Compton Mackenzie wants only 2,000 discs to bring his total up to the same number. On hearing this I thought of my own 500 records, and wondered where they managed to store them!

No doubt a good library of gramophone records will be as highly prized in the future as is a good library of books to-day, so that I am not surprised to hear that the B.B.C. is starting one of its own in conjunction with that of the Blattnerphone-Stille system of records, which as most listeners know is done on a kind of magnetised steel tape.

Already the B.B.C.'s Gramophone Library contains about 5,000 records, which will constantly grow from careful selections taken out of each month's issues

by the various companies.

These records are kept in steel racks at Broadcasting House, and accommodation is provided for no fewer than 40,000 records. Eventually it is hoped to get together what will virtually be a National Collection of discs of unique interest and value.

The B.B.C. Musical Library of 13,000 items (excluding dance music) was recently valued at £30,000, while the Corporation  
(Continued on page 120.)

## THE LISTENER'S NOTEBOOK

A critical review of recent broadcasting topics.

TO deal with "The Week Abroad" in fifteen minutes is a tall order. Yet it is done, and the achievement is Sir Arthur Salter's. The performance involves rather rapid speaking, naturally, but Sir Arthur is never so speedy that he can't be followed with the greatest ease.

And he deals with all the situations, major and minor. Not only that, but he sums up with a message of hope that must have been the most inspiring thing to come over the air for many a long day.

It is such talks as these that makes listening-in very worth while.

## Too Much of a Good Thing.

The mistake about the recent two miniature operas by Mozart was that they were two. In both cases Mozart was in a whining mood. Had the

second been something offering a contrast to the first, then it would have been more acceptable.

Actually, I didn't listen it out. That terribly lengthy wail of one of the two rival sopranos at the beginning of number two was too much of a good thing.

The cast in both those miniature operas was very select, and it was interesting to note the extraordinary good acting ability of those whom we are inclined to think of only as singers.

I don't know whether the singers I have in mind already have reputations as actors as well. If they have, I must confess I was ignorant of the fact.

## In Honour of a Saint.

St. Patrick's Day follows close on the heels of St. David's. The most remarkable feature of the St. David's Day celebrations was the departure that was made from the ordinary type of programme usually given in honour of a patron saint.

In "Turk Smoke," however, we saw that the change initiated by Filson Young hadn't caught on. Ireland still prefers a programme consisting of prologue, music, poetry, songs, and an epilogue.

The contents of "Turk Smoke" were as artistically conceived as they were executed.

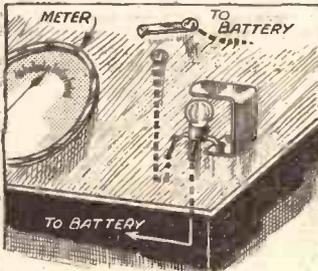
(Continued on page 120.)

# RECOMMENDED WRINKLES

## LIGHTER READINGS.

INvariably when one comes to test a set it is in a dark position, and the readings on the meter are difficult to see.

To overcome this I mounted on the panel of my home-made multi-ranged meter a flash-lamp bulb fitting to work off the dry battery supplying the valve and circuit tester. The holder was



The flashlamp bulb illuminates the meter dial.

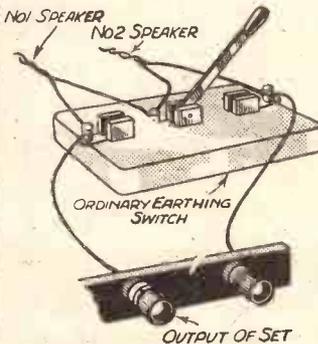
mounted in one corner with a shade cut out of an old condenser vane and bent over at the top.

A switch was made by a simple spring being moved over a screw on the panel.

## SPEAKER SWITCHING.

THE sketch shows a simple switching device for two loudspeakers, which I think would save many an amateur an extraordinary amount of "fiddling" changing leads and what-not.

The switch used is an ordinary earthing switch which only cost a few coppers.



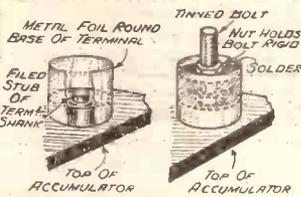
The simple switching allows three arrangements of the speakers.

You will notice that the speakers are in series all the time, and as well as being able to short out any one speaker by a turn of the switch, by leaving the shorting arm in the "mid air" position both speakers will operate.

Where a mains unit is used an output filter is advised.

## REPAIRS TO BROKEN TERMINALS.

IN serious cases of corrosion of accumulator terminals the shank sometimes breaks right off when the terminal is screwed right home, thus making it very difficult to make a connection. Being once in the same predicament myself I evolved the following satisfactory solution to the problem:



Repairing the results of serious terminal corrosion.

File the stub of the shank, which most likely remains, flat, and "tin it" with solder. Wrap round the limb in which the shank is set some metal foil (fairly heavy tin foil will do). This foil need come only about 1/4 in. above the surface of the limb. (Fig. 1.)

Procure a tinned bolt (1/4 in. to 1/2 in. long) with a flat head, and stand this on the old terminal shank.

Run plenty of solder around this so that it is held firm. A fairly large nut screwed on the bolt tightly will keep it rigid, and once more the accumulator

## FIXING A MOTOR SPRING.

THIS is a job some shy from simply because they think they can't do it. Try this.

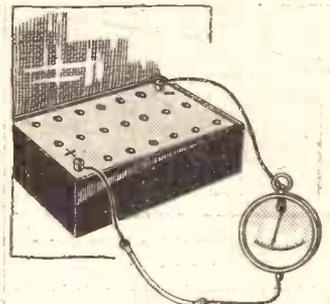
When you buy your new spring, it is coiled up tight and held intact by a band of wire with ends twisted.

Take the spring as it is and place it in your vice between two pretty soft grips, screw up tightly, and saw through the wire binding with your hacksaw. Now very gently slacken back the vice and the spring will gradually open out.

That done, take the spring box in the left hand and the outside end of the spring in the right hand, insert the end into the box, so that the hole in the spring engages in the catch at the side of the spring box. Now draw the box in an anti-clockwise direction with the left hand, and at the same time assist with the right hand, and keep pressure on edge of spring a moment or two and the spring is in.

While the operation is being done the right and left thumbs should be inside box, all fingers over side and

This multiplied by the resistance of the voltmeter which in most makes is marked on the dial gives the value of the unknown resistance in ohms.



Testing the value of an unknown resistance with an H.T. battery and voltmeter.

Assuming the resistance of the voltmeter in this case to be 4,000 ohms, and taking the voltages quoted above, the answer would be:

$$\left(\frac{120-30}{30}\right) \times 4,000 = 12,000 \text{ ohms.}$$

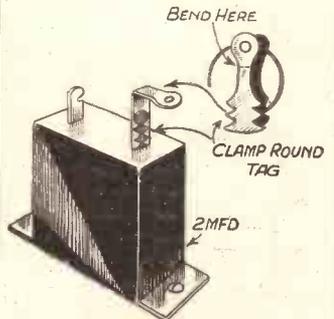
## FIXED CONDENSER CONNECTIONS

MANY constructors have on hand the old type of fixed condenser with two tags for soldering connections.

It is not an easy matter to solder to such tags and the job is not always satisfactory as you are sure to disturb the pitch filling (when you apply the hot iron), which runs up tag and spoils good soldering.

A most satisfactory way out of the difficulty is to get a small piece of sheet copper (such as is used for screens, etc.), and cut to shape, as shown, drilling a hole large enough to take an ordinary (pillar type) terminal. Cut a piece for each tag.

Clean the tags well, also prepare copper, and well clamp the zig-zag edged part, round the condenser tag. A firm, hard grip with strong pliers will ensure a firm connection at the finish.



Avoid soldering by fitting terminals.

Then bend the top part over to receive terminal. See that this is well tightened up, but don't put the strain on the copper support. Hold the body part of terminal with pliers and then tighten up nut.

It is now an easy matter to connect up into set, as no soldering is required, and two or three leads can be taken to same point (when required), which would be hard to accomplish with soldering.

(Continued on next page.)

## WE PAY FOR YOUR RADIO IDEAS!

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

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

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

The best Wrinkle last week was sent by Mr. A. G. Wybrew, of 6, Sayesbury Road, Sawbridgeworth, Herts, to whom a guinea is being awarded.

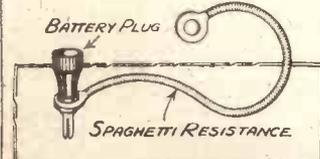
has a proper terminal shank. All that remains is to find a suitable terminal to screw on the shank.

## EASY SPAGHETTI CONNECTIONS.

IT is frequently found necessary to connect a spaghetti resistance to an H.T. or grid-bias battery, and difficulty may be experienced in making a good connection between the end of the resistance and the socket in the battery.

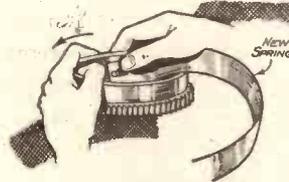
For instance, when the resistance of a spaghetti is to be tested by the well-known method of connecting it in series with an H.T. battery and milliammeter to measure the current which flows through it, or when the resistance is to be used as a low-value grid-leak, an easy connection is highly desirable.

The following diagram shows how an ordinary battery plug may be mounted directly on the tag of the spaghetti resistance and used as a wander plug.



An easy way of connecting a resistance to a battery.

If this method is used it will be found to be just as easy to make the connection to the battery as it would be if the plug were attached to a piece of ordinary flexible wire.



Move the box in an anti-clockwise direction and keep the spring still.

bottom, left palm pulling teeth of box, and right palm pressing on edge of spring.

## WHAT RESISTANCE ?

MOST wireless enthusiasts possess a voltmeter which reads up to 120 or 150 volts for testing high tension batteries or accumulators.

Here is a novel way of utilising this type of meter for determining the value of an unknown resistance, such as speaker windings, eliminator chokes, and unmarked spaghettis or decoupling resistances, etc.

Test with the voltmeter a high tension battery or accumulator the voltage of which reads in this case say 120 volts. Now connect the unknown resistance in series with the voltmeter and test the battery again.

The reading will now be, say, 30 volts, depending on the value of the unknown resistance.

A simple sum has now to be worked. From the first reading of the voltmeter, i.e. 120 volts, subtract the second reading, i.e. 30 volts, and then divide the remainder by the second reading.

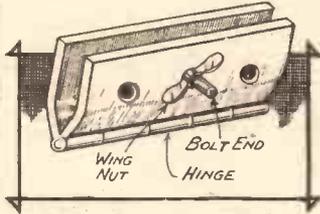
## RECOMMENDED WRINKLES

(Continued from previous page.)

### SUBSTITUTE FOR A VICE.

ALTHOUGH a pair of pliers may prove quite useful for holding articles that are being worked on, they have their limit and a simple form of hand vice is much more satisfactory.

If you can find an old hinge, either brass or iron in the junk-box, all the work required is to drill a hole about the centre to take a short bolt with a wing nut.



The bent sides of the hinge give a wider grip.

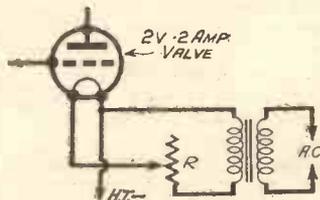
The hole must be an easy fit for the bolt, in fact, it is better if sawn at the top and bottom to make a small slot.

If the hinge is of brass the scope of the vice or clamp can be greatly improved by bending the sides slightly so as to obtain a wider grip as shown in the sketch.

### SAVING ACCUMULATOR CURRENT.

TO make your accumulator last longer is an easy matter if you have any sort of mains transformer with an output of, say, up to 5 volts in your junk box. The idea is to supply the output valve with raw A.C.

The circuit I used is below—there was no centre tap to the transformer—if there is it should go to H.T.—instead, where automatic bias can be applied.



The output valve is fed in this manner with raw A.C.

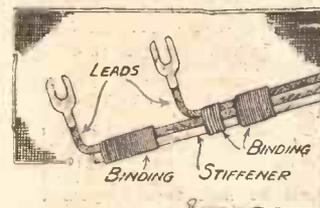
The resistance R was an old 30-ohm rheostat which was adjusted very carefully to give the same volume as before and not overrun the valve.

The dodge works well and there is no hum.

### BATTERY LEAD SECURITY.

THERE is danger to the batteries or the set or to both, if the leads should become loosened and inadvertently make contact, so it is worth while to go to a little extra trouble to prevent such a possibility.

I find that the best plan is to see that all the leads are cut to the exact length to reach their terminals and then to stiffen the intermediate pieces



It is almost impossible for shorts, due to loose connections, to occur.

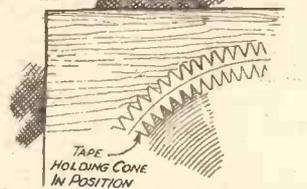
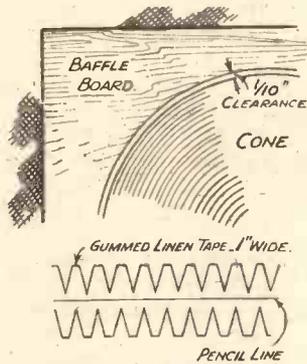
of cable so that the assembly becomes an almost rigid unit. The stiffening is done with pieces of wood about the thickness of matchwood, but of a stronger and tougher variety.

These stiffeners are cut to length and secured to the cable either by wrapping with fine cord, or better, binding with insulating tape. When safeguarded in this fashion, it is almost impossible for individual connections to become loose and detached and cause dangerous short-circuits.

### CONE-MAKING AT HOME.

MANY are the methods of mounting the cone of a home-made speaker to the baffle board, but I have found the following method the most satisfactory.

The hole in the baffle board is cut so that the edge of the cone just fits inside, with a clearance of about one-tenth of an inch all round.



The author considers this the best method of mounting a cone to a baffle.

Then a roll of gummed linen tape about one inch wide is purchased and a length cut off long enough to go round the "free" edge of the cone.

The tape is marked down the centre on the ungummed side and small "V" pieces are snipped out with scissors, as shown in the sketch.

When cut, the tape is moistened and stuck round the edge of the cone, and the projecting portion gummed to the baffle board.

### "SPATS" FOR LECLANCHE CELLS.

IT is well known that the small Leclanche cells, as used for H.T. purposes, should be separated from each other to obviate the spread of trouble. Generally the makers of such batteries use wooden separators when they supply the crate, but many constructors make their own crates.

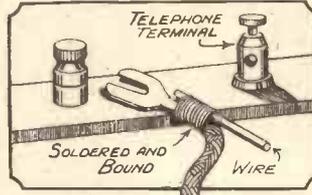
Separators of the egg-container type are not altogether easy to construct, however, and the job may be done in an altogether different manner if an old bicycle tube is at hand (a new one may be bought for little more than a shilling).

All that is necessary is to cut the tube into lengths. Each length should be equal to the measurement of the cell from its shoulder to bottom. The pieces of tube are then slipped over the cells.

Each cell having its own rubber "spat," it will be apparent that two thicknesses of rubber separate the cells, and this will be found quite as good as wood, maybe rather better in some ways, and generally better for handling purposes.

### AN ALL-PURPOSE TAG.

THERE are many uses for a tag that can be used either with a telephone or a W.D. terminal, and I find it very useful to have a length of cable fitted with such tags so that it



Any type of terminal suits this connecting tag.

can be used indiscriminately for coupling any set to any type of loud-speaker.

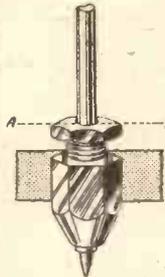
The tags are made very simply by attaching a cable to a sturdy spade tag and then soldering to it a piece of 16 or 18 gauge copper wire about one inch in length. There is considerable strain on the cable at the bend and it is best to strengthen it at this point by a wrapping of insulating tape.

The wire, of course, acts as the peg for making connection with the telephone type of terminal.

### NEEDLE ECONOMY.

THOSE readers using Burmese type needles for playing their home recorder records may have found that when the needles get very short they have to be discarded as the pick-up will not grip them.

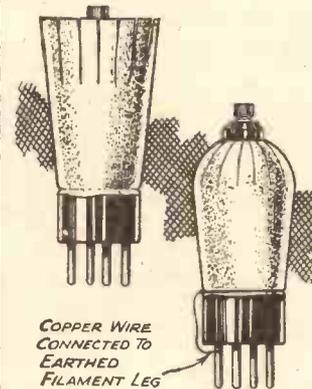
If an old loud-speaker chuck is cut off at A-B, and a gramophone needle or piece of loud-speaker spindle is soldered on, as shown, the chuck can be used to take needles as short as 1/4 inch, thus using them to the very limit.



Loudspeaker chuck for holding needle.

### METALLISING S.G. VALVES.

IN these days of economy many readers probably find the purchase of a new metallised screened grid valve for a particular circuit rather heavy—more so, when the builder has an ordinary plain bulb S.G. on hand.



See that the silver paper is connected to the filament pin which goes to earth.

It is to this class of builder that the following hint or "wrinkle" may prove useful. It did in my case and has in others which I have "attended" to.

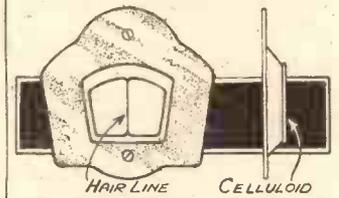
The problem is: How to metallise an ordinary plain-valve bulb—S.G. or det.—in fact, any.

Thoroughly clean the glass of valve. Procure a piece of "silver paper"—I find a piece from a twenty-packet of cigarettes very handy—take out the creases from the paper and lay it flat on a piece of paper. Coat one side of the silver paper with thin glue or secotone, etc., then lay the silver paper, glued side, to the glass, pressing it home nicely with a duster.

Then cut the silver paper, with a pair of scissors, to the "dome" of the valve. Press these "strips home and trim off with an old razor blade. To earth the "cover," bare about 6 ins. of 21, 26 or 28 gauge copper wire and wrap it between the valve base and bulb.—Connect other end of wire to fil. pin, whichever is earthed.

### FINE-TUNING ESCUTCHEON.

NOT every variable condenser today is supplied with an escutcheon plate suitable for fine tuning. My escutcheon consisted of merely a stamping with small pointers projecting at top and bottom, making it impossible to get a definite condenser



An inked line on a celluloid "window" gives hairline tuning.

setting. The difficulty was overcome thus:

A piece of celluloid was cut to the size of the plate bearing on the dial.

A (not too deep) line was cut by means of a knife, then by rubbing black lead or ink over it, a beautiful hair line resulted.

The celluloid was fixed by secotone, and served the dual purpose of more exact tuning and keeping the dial free from dust.

### AN AID TO LISTENING.

THERE are times, as for example, when the set is not developing its customary power or when a somewhat deaf friend is listening, when a little extra increase in volume would be much appreciated.

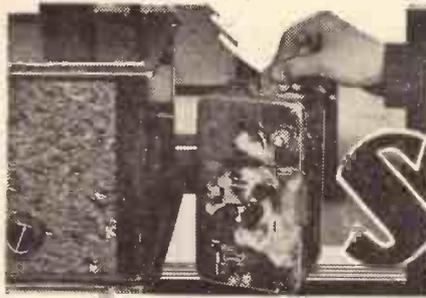


This simple expedient gives remarkable increase in volume.

A very considerable improvement in apparent volume can be obtained if the listener sits in front of the loud-speaker, not necessarily close to it, and places the thumbs behind the ears, shaping the hands to form cups; the openings being towards the loud-speaker.

This seems to operate in the fashion of the trumpet of the old-fashioned loudspeaker and the improvement in volume is really quite appreciable. I should estimate it at twenty-five per cent.

Most people will have noticed that a person who is deaf in one ear, will adopt this plan to help him in hearing, by concentrating the sound and thus intensifying it.



# Make Your Own SLOT-MACHINE RADIO

**H**IGH-TENSION batteries cost a good deal and renewals are all too frequent, but if the cost of running the radio set could be put aside as it was made use of most of the unpleasantness of paying out for new batteries would be overcome.

Few people would miss a copper or so a day, but what a pull £1 4s. is to many! Even those who use standard capacity batteries have to find 12s. for them, and even this seems a lot all at once!

To those who in honesty to themselves admit this is true, may I recommend the following little machine and assure them that, apart from the novelty, the time taken in making it will be well repaid.

### Cutting the Slots.

Procure a fairly large tin, say, about 6 in. long, 4 in. wide, and 3 in. deep. A square tin is preferable to a round one. If the tin is about this size, or larger, the measurements given may be taken as exact.

**By A. J. POTTS.**

To switch on you simply put a penny in the slot and so "pay as you go" for the programme. When you need a new battery or licence, open the box and take out the money you have saved!

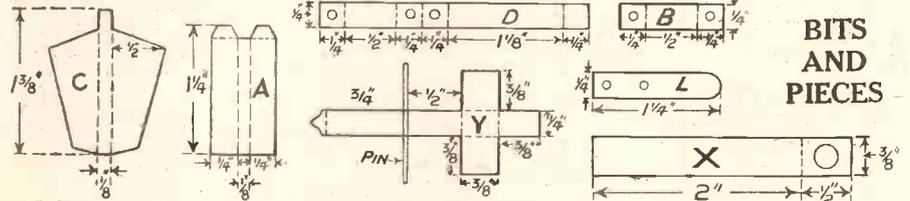
The two guides for the penny "C" and "A," and the contact pieces have also to be made, and should be cut from brass or copper about 1-32 in. thick.

and nuts. The soldering is not, however, a difficult thing to do.

All the necessary measurements for assembling are given, and by carefully following the diagrams no difficulty should be found. The measurements must be followed carefully, however, no matter what sized tin is used.

### Pressing the Lever.

A small spring is attached to the lower end of the lever and to "A," as shown. This spring is long enough to pull the bottom of the lever as far as it will go to-



**BITS AND PIECES**

Here are the various measurements referred to, with reference letters.

The shapes and measurements of these and all other bits and pieces used are shown. After having cut these to conform exactly with the diagrams, they must all be bent where indicated by dotted lines. The shapes of the finished parts after bending can be obtained from the other diagram. When

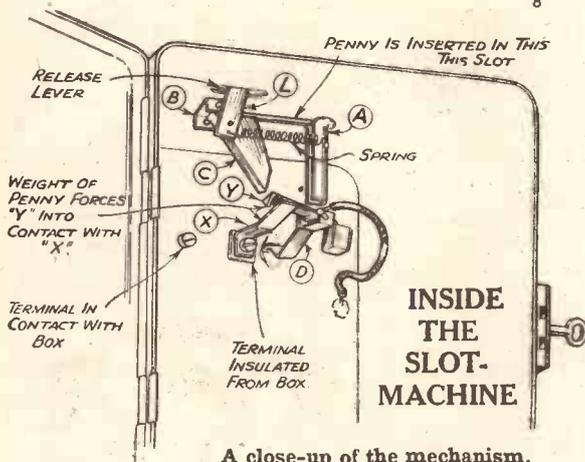
wards A, but should not be much tighter.

When the lever is pressed over from the outside in the direction of A, the guide piece C will be found to move away from the other guide piece, but when the lever is released, both this and C will spring back to their original places.

If a small spring is not available a piece of elastic would do the job almost as well, but will rot rather quickly and will need frequent replacement.

One important point must be observed. The contact piece X must not be soldered to the tin when mounting, but must be

(Continued from page 124.)



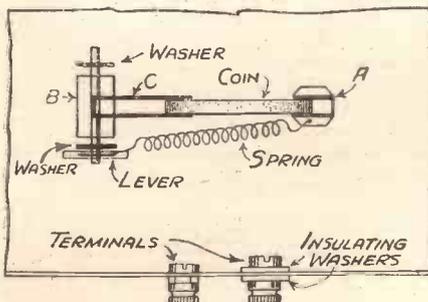
A close-up of the mechanism.

A smaller tin should not be used in any circumstances. Two slots have to be cut in one end of the tin, one for the penny to go through, and one for a lever. These are near the centre, the one farthest from the lid being 1 1/2 in. long, and wide enough to take a penny. The other is about half the size. (See above).

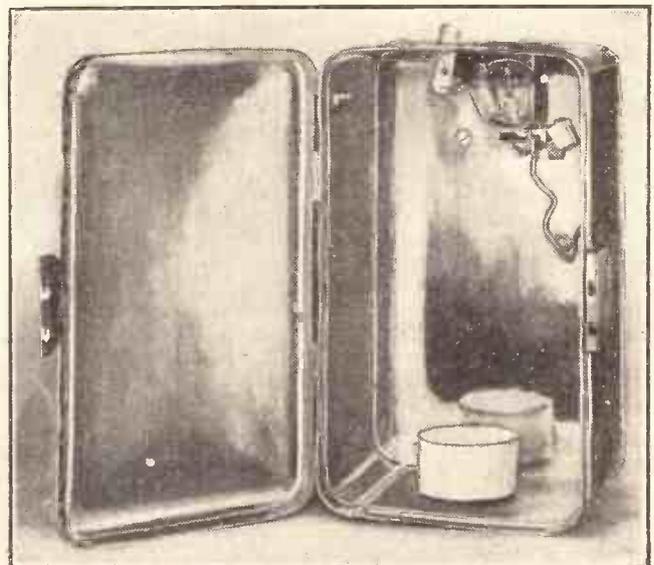
the bending operations are completed all the parts have to be assembled in the tin.

### Not Difficult.

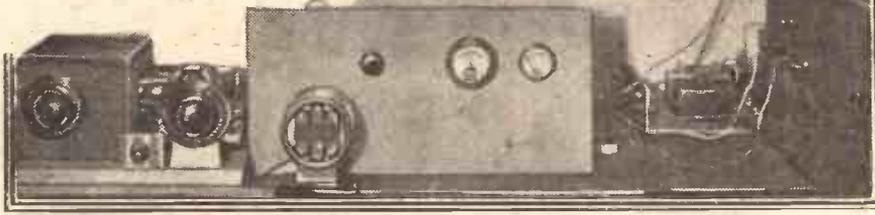
In the original all metal parts were soldered when they were to be fixed together, and soldering is strongly recommended but it is possible to fix all the parts by means of small bolts



To the right is Mr. Potts' own penny-in-the-slot machine, and to the left is a sketch showing how the coin is held between the C and A sections.



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

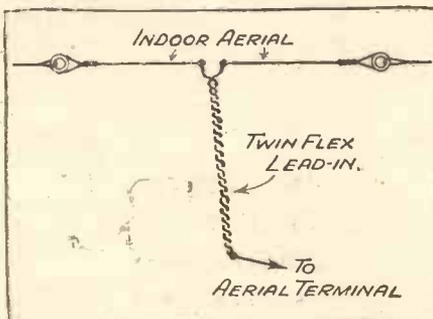


A weekly chat on short-wave reception and short-wave personalities by our popular expert.

FAMOUS people have a habit of remaining famous through the publication of their "Life and Letters." I make no claim whatever to fame, but the publication of my letters would certainly add something to the world's supply of humour. (I refer, of course, to the letters received rather than to those written, although the latter may be brimful of unconscious humour!)

Readers of these notes are only too familiar with the "W. H. R.'s" and the "W. W.'s" whose replies I make in print,

## FOR BAD LOCALITIES



This peculiar form of aerial is helpful in districts where interference is bad. The aerial can be erected across the room and the two sections should be equal. The down-lead is of twisted flex, not joined till it reaches the aerial terminal.

but I only deal in that way with the queries that strike me as expressing the thoughts that must occur to many others who have not the inclination to write. But for every one of these letters there must be forty or fifty others, and the most enjoyable part of my day is generally that which I spend reading and deciphering them.

### So Hot-Tempered!

A gentleman informs me, for instance, that ever since he has had a short-wave receiver his cabbages have been attaining dimensions hitherto unknown in the vegetable world. Another, on the other hand, says that ever since he has had one, his domestic relations have been somewhat strained. His daughter always wants to listen, and his better half always wants the pair of them to "stop twiddling those wretched knobs and be sociable."

Another much-treasured letter, from a man who made one of my sets and obtained absolute zero in the way of results, tells me just where I get off, with the sequel (received the next day) cancelling the previous remarks and explaining that the fault was his, and "these short waves do make one so hot-tempered, you know."

And then there was the man who wanted me to design a short-wave transmitter

that he could use for talking to his friend in the next street (and so avoid the expense of the telephone). What would the P.M.G. say to that?

Altogether I learn a great deal from my correspondence, although on occasions someone tells me that "I never learn anything about designing sets." But I wouldn't change the job for worlds.

### International Relay Test.

News is scarce this week, except for a few outstanding items, one of which is the reappearance of W2XV, New York, with a very consistent transmission on his old wave of 49.02 metres. "W. H. R." and others comment on the excellence of his transmissions. All the usual "Yanks" have been moderately good, and during the period of the full moon there was a quite outstanding batch of conditions for Transatlantic work.

I was taking part in the A.R.R.L. International Relay Test, and was able to work between 30 and 40 North Americans on each of three consecutive days, which I've never approached before. Two or three days after the full moon, however, conditions fell back to their old level of "moderate."

Lists of stations heard during that period (received from several different readers) positively teem with R9 and R8.

The precise effect of the phases of the moon upon short-wave radio has yet to be tabulated and considered seriously. Several "hams" are at work on the problem, and think they have definitely found some sort of rule governing reception conditions. On the other hand, quite an equal number are positive that the moon has nothing whatever to do with "conditions," and denounce the lunar enthusiasts as a lot of—well, imaginative persons.

I once saw a graph covering more than two years, with the number of Transatlantic stations logged each week-end shown against the phases of the moon, and the correspondence between the two curves was certainly remarkable.

### A Third Harmonic?

Unfortunately, when one deals with amateur stations—as the originator of this chart did—one has always to consider that there isn't the slightest hope of proving how many of them were actually "on the air" at each reception period.

"O. B. K.," a Norwegian reader of "P.W.," reports regular reception of a station announcing "Radio Normandie," just below 80 metres. It looks as though our friend Fécamp on 223 metres has a good strong third harmonic! "O. B. K." says: "I log Moscow, Vatican, GSA and

Wien without interference, so I find it peculiar that 223 metres should come in on about 80 metres!"

Luckily there aren't many European stations who waste their power on generating harmonics, otherwise we shouldn't have any room left for the genuine short-wave stations.

"P.W." goes further afield than Norway, though. Next on the list is a long letter from N. J. T. (Hawkes Bay, New Zealand) full of details about the Kingsford Smith Tasmanian flight. He says that the New Zealand and Australian broadcasting stations were in touch with him nearly all the time.

### The Cairn at the Top.

T. C. (Wakefield) makes a few remarks on "location." His house stands half-way up what appears to be a fairly gentle rise, but when he took his set to the top of the hill and rigged up a temporary aerial it seemed like a different set altogether. Whenever I find myself on top of a hill commanding a spacious view I begin to "talk shop." Someone told me that I only went up Snowdon last year to dream about the perfect D.X. results that one would get up on the cairn at the top.

J. B. M. (Glasgow) pleads for a paragraph on "bare versus insulated wire." I don't know whether he means for aerials or for wiring, but in any case I don't think there is much in it. Living near London, I generally use enamelled wire for my aerial, as I think a coating of enamel is preferable to one of copper oxide and the constituents of London fog.

For set-wiring I think ordinary bare tinned copper is probably best if one can make a neat and safe job of it. I say "safe" because one doesn't like two wires to touch when the H.T. is across them!



Weekly Jottings of Interest to Buyers.

THREE of the most popular of "P.W.'s" past successes—the "Comet" Three, the "Magic" Three and the "Cosmic" Three—have been selected by Messrs. R. I. as the subjects of special "quiescent" conversion blue prints.

The blue prints are full size and are double-sided. On one side, in each case, the output arrangement of the published design is shown, and on the reverse side a blue print wiring diagram shows the alterations necessary for the conversion of the set to "Q.P.P."

There must still be thousands of these sets in use if my correspondence is anything to go by, and judging by the rapidly increasing interest in "Q.P.P." I anticipate that the demand for copies of conversion blue prints will be particularly heavy.

(Continued on page 121.)



# THE "WESTECTOR" SUPER

(Continued from previous page.)

These are supplied so arranged that the mounting screws make contact with the metal base, which is in contact with the "cans" when they are on, and in order to earth the "cans" it is necessary to connect this base, via the screws to the E terminal on each unit.

This is best done by the simple expedient of placing a thin strip of copper foil under the E terminal, bending the foil over and under the base of the unit so that the fixing screw runs through the foil as it goes on its way into the baseboard.

When the construction has been completed valves and battery connections should be made as follow: V1 is a screened-grid valve, V2 is of the "L" type, V3 is a screened grid, V4 is another L type valve, and the fifth valve, V5, is a power type.

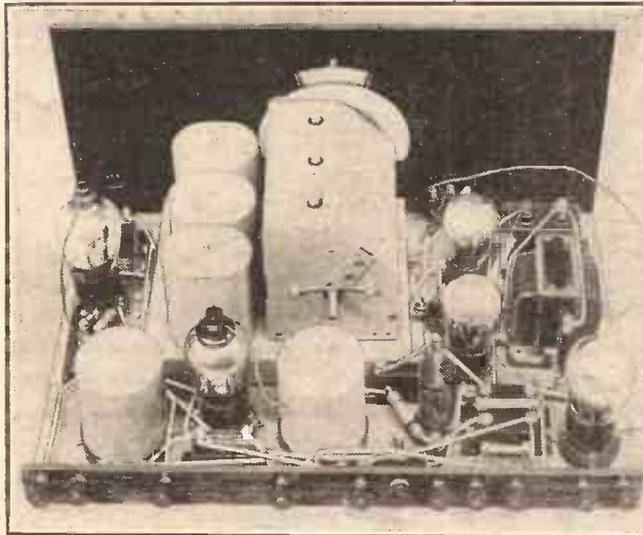
### G.B. and H.T. Voltages.

Contrary to oft-used practice in diode rectification, the first L.F. valve is not self-biased, that is, by the incoming "signal," it is biased in the normal way when the Westector is used—so that you will require about 1½ to 3 volts bias on V4 and some 4½ or more for the output valve, according to the type you decide to use. Suitable valves for use with either battery or mains H.T. supply are listed, so

## FEATURING THE VERY LATEST DEVELOPMENTS

### THE PARTS—THE MAKES—THE ALTERNATIVES

Component.	Make used by the designer.	Alternative makes of suitable specification recommended by the designer.
1 Panel, 16 in. x 8 in.	Goltone	Peto-Scott, Lissen, Permeol, Wearite, Becol
1 Baseboard, 16 in. x 10 in.		
1 Cabinet to suit above	Gilbert	Camco, Pickett, Osborn, Lock
1 Band-pass superhet tuning unit	Radiophone type B.P. super 100 K.C.	
2 .0001-mfd. fixed condensers	Dubilier type 620	T.C.C., Ferranti, Telsen, Goltone, Graham Farish
1 .0001-mfd. fixed condenser	Dubilier type 670	Ferranti, Telsen, Goltone, T.C.C., Graham Farish
1 .01-mfd. fixed condenser	T.C.C. type 34	Graham Farish, T.C.C., Dubilier
1 .0003-mfd. fixed condenser	Telsen W.242	Graham Farish, Dubilier, T.C.C., Ferranti
2 .25-mfd. fixed condensers	Telsen	T.C.C.
1 2-mfd. fixed condenser	T.C.C. type 50	T.C.C., Telsen, Dubilier
1 ½-meg. potentiometer	Igranac "Megha"	Ready Radio, Wearite, Varley
1 20,000-ohms resistance with vertical holder	Graham Farish "Ohmite"	
1 30,000-ohms resistance with wire ends or terminals	Dubilier 1-watt type	Graham Farish
1 ½-meg. resistance with wire ends or terminals	Dubilier 1-watt type	Graham Farish, Goltone, Igranac, Ready Radio
1 2-meg. grid leak with wire ends or terminals	Goltone	As above
1 Intermediate transformer	Colvern 100 K.C.	
1 do. 1.5 : 1 ratio	Colvern 110 K.C.	
1 H.F. choke	Goltone Super	Slektun, Lewcos, Peto-Scott
1 2-point push-pull switch	Ready Radio	Tunewell, Telsen, Bulgin
5 4-pin valve holders	W.B. small type	Telsen, Bulgin
1 Compensating L.F. transformer	Telsen "Audio-former"	Varley, Lewcos, R.I.
1 Fuseholder	Belling & Lee type 1034	Goltone, Telsen
1 Terminal strip, 16 in. x ½ in.	Goltone	
10 Terminals	Belling & Lee type "R"	Bulgin, Igranac, Clix
7 Wander plugs	Clix	Goltone, Belling & Lee
2 Spade terminals	Goltone	Belling & Lee
4 yds. insulated sleeving	Goltone	Wearite
6 yds. 18-gauge tinned copper wire	Goltone	Wearite
1 150-m.a. fuse	Belling & Lee type 1056	Goltone, Telsen
1 ft. twin copper screened sleeving	Goltone	
2 Anode connectors	Belling & Lee	
1 1-megohm resistance	Graham Farish "Ohmite"	For optional local-distance control (see text)



## CONSTRUCTION TO ENJOY

Never before have you come across a super-heterodyne which presents fewer difficulties in the way of construction. This photograph, which shows almost every wire, displays how the use of a band-pass unit, accounting for nearly half the baseboard, ensures extreme simplicity of wiring.

Then proceed to unscrew all the trimmers on the top of the Radiophone unit. Next gradually screw up the one nearest the panel until you hear the station whose wave you are tuned to at the loudest volume. Needless to say, the volume control on the panel is placed at maximum (hard over to the right) while this is going on.

When the station has been obtained at its loudest, reduce the volume till the reception is only just audible and adjust the other two trimmers until the loudest possible reception is obtained.

### Adjusting Intermediates.

Now turn to the long waves and tune in the Daventry broadcast. (Obviously all this must be done when there are plenty of stations in the air.) It will be found that the wavelength calibration of the tuning scale is pretty accurate, and we are not at the moment concerned with the tuning

(Continued on page 100.)

that you can make a choice to suit your individual requirements.

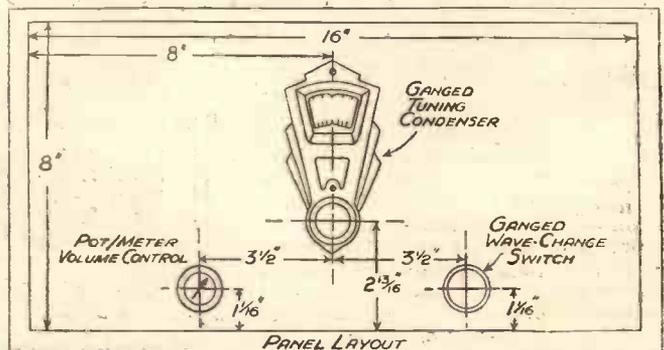
For H.T. a 150-volt battery is best, though 120 volts can be used if desired. The battery should, however, be of the super-capacity variety.

### Trimming Details.

With valves in and batteries connected, join up the speaker and aerial and earth and proceed to gang the set. This is a somewhat critical business and has to be carried out in steps of a definite order. Probably on first tuning the set, without any ganging, you will not be able to hear anything although the receiver is "alive."

This is because the ganging is very definitely out, and the following procedure

must be carried out to enable results to be obtained. Turn the tuning dial till it denotes the correct reading in wavelength for the lowest wavelength medium wave station among what may be termed locals. That is, you must turn to the most powerfully received of your medium-wave stations, keeping the wavelength as low as possible.



THREE CONTROLS ONLY are to be found on the panel of the "Westector." Super; volume control, tuning and wave-change switch. The drilling, therefore, is easier than for a simple "straight three."

# TECHNICIANS IN CONSTANT CONFERENCE..



and all because we insisted  
on keeping ahead . . . .

Directors were holding meetings. Sales executives in continued communication with research departments. Scientists working overtime. Workshops waiting for the news. Mullard must keep ahead. Mullard must construct an A.C. valve that would withstand high percentage mains variations. And then he discovered the way out. He put a floating heater into the Rigid Unit Construction. That was the solution. Long since, the invention of the Rigid Unit principle had cured microphony. Cured it completely. Which meant that this principle must not be tampered with in any way. So he incorporated the Floating Heater within the Rigid Unit.

Sheer mechanical strength is needed in A.C. valves to withstand the sudden expansion and contraction through spasmodic switching on-off, on-off, and through serious percentage mains variation. This strength came with the floating heater. To-day, this new principle within an established principle makes Mullard A.C. valves impervious to every kind of strain—gives them all the mechanical perfections of the wonderful Mullard battery valve.

## FLOATING HEATER WITHIN RIGID UNIT CONSTRUCTION

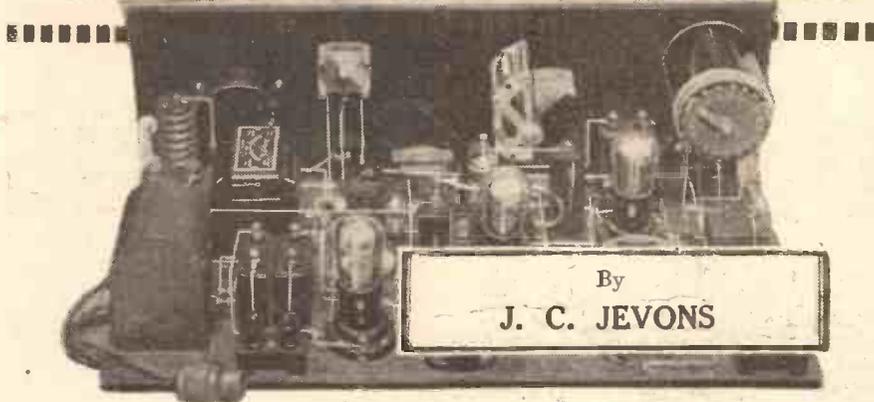
*ASK T.S.D. Whenever you want advice about your set or about your valves—ask T.S.D.—Mullard Technical Service Department—always at your service. You're under no obligation whatsoever. We help ourselves by helping you. When writing, whether your problem is big or small, give every detail, and address your envelope to —T.S.D., Ref. C.E.G.*

# Mullard

## THE MASTER VALVE

The Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, London, W.C. 2

# From D.C. to A.C.



By

J. C. JEVONS

**U**NDER the so-called "Grid system" the public supply of electricity is gradually being standardised throughout the country. Localities formerly supplied with direct current are being converted, willy-nilly, to the use of alternating current, and this is going on at such a rate that within the next few years supply mains carrying D.C. will probably be as extinct as the Dodo.

The conversion to A.C. has already been the cause of much tribulation to listeners using mains-driven sets of the D.C. type, and before long many others who are now using D.C. sets with satisfactory results are bound to find themselves in the same predicament.

## Who Foots the Bill?

There is no doubt that, on the whole, a set can be operated rather more efficiently, and very much more economically on A.C. than on D.C., so that from this point of view the change is all to the good. But unfortunately a receiver designed for D.C. operation cannot be plugged into A.C. mains without extensive alteration.

The point at once arises, who is to pay the cost of alteration? Why should a listener who may be quite content with a D.C. supply be forced to foot an expensive bill to meet a change he has not asked for.

The Electricity Commissioners, who now administer the various Acts of Parliament regulating the supply of electric current to the public, state definitely that in all cases

where the decision as to a change-over rests with them they make it a condition that the Company shall carry out, at their own expense, any alterations to consumers' existing apparatus necessary to suit such apparatus to the new type of supply. Alternatively the Company is liable to pay such sum as may be agreed upon, or in default of agreement such sum as may be determined by arbitration.

The Supply Companies do not, in practice, hesitate to make good to their

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**Our contributor takes this timely opportunity of explaining to listeners with D.C. mains just how they will stand when the "Grid system" is completed, and sets out the legal position between the supply company and the consumer.**

---

consumers any expense incurred in adapting ordinary apparatus, such as electric lamps or motors, when a change is made in the type of current supplied. But before applying the same argument to a wireless set there are certain other considerations which have to be taken into account.

In the first place the cost of adapting a wireless set is out of all proportion to the current it consumes. The profit made by the Company out of the current taken

by the average mains-driven set is negligible. In fact, it is so small that it would probably take a generation to recover the cost of altering the set from D.C. to A.C. operation.

Of course, this ignores the fact that in many cases the wireless set has been the means of introducing electricity into the consumer's home in the first place. Many a house now using electricity would still be warmed and lit by gas were it not for the outstanding convenience of being able to use a mains-driven set for broadcast reception.

## Not an Exceptional Case.

Certain Supply Companies are prepared to go all the way in putting their consumers on the same footing as they were before the change. In one instance, which may be quoted, the Company first supplied a rectifier, but as the existing smoothing-circuit (which was, of course, designed only to handle D.C. irregularities) proved inadequate to eliminate "hum" on the rectified A.C., they rewired it and so ensured perfectly satisfactory results.

This is by no means an exceptional case, though unfortunately it is not universal.

Of course, it must be borne in mind that no liability falls upon the Supply Companies when a D.C. set is installed after they have given warning that a change from D.C. to A.C. is impending. It is only in respect of sets which have already been in operation for some time that the consumer can be said to have any claim for compensation.

The original Electric Lighting Acts were drafted long before broadcast reception was even dreamt of, and this, to some extent, explains the legal ambiguity of the position that has now arisen.

Apparently the only way to secure a binding decision is to put up a test case before the Courts.

## Up in Arms!

In Fleetwood, where the supply has recently been converted from D.C. to A.C., the local Council has taken the bold view that it is not legally bound to defray the cost of adapting wireless sets to the new type of supply.

Some 3,000 owners of the D.C.-driven sets are up in arms at this unreasonable attitude, and acting on the previously-mentioned ruling of the Electricity Commissioners are now raising a shilling fund in order to establish what they consider to be their legal rights in a Court of Law.

## ★ THE "WESTECTOR" SUPER ★

(Continued from page 98.)

section of the set; what we have now to do is to set the intermediate trimmers—those levers on either side of the two Colvern units.

Volume must be kept reduced in the usual way while this is going on, or the maximum point of trim will not be easily apparent.

That done, return to the low end medium band and finally adjust the three main trimmers for maximum results, doing those two furthest from the panel first. In all probability the third one, the oscillator trimmer, will not need any alteration. For this final brush up you will be able to tune

in a distant, fairly weak, station, for the set is all but adjusted and it will be found to be very sensitive.

Further use consists in the mere tuning according to the dial readings and volume controlling and wavechange switching as desired. It is possible, however, that if you are within 20 miles of your local you may find that it is impossible to reduce the volume below a point that is causing distortion due to overloading.

## Suppressing the Local.

This is occurring in the intermediate-frequency stage and to prevent it in such instances as the tuning in of the local station, a "local-distant" alternative aerial tap is a useful adjunct. This we would suggest could be conveniently arranged on the side of the cabinet.

Two Clix sockets are fixed in the cabinet and from them go two leads to the aerial terminal of the set. One lead goes direct and unbroken, while the other has in it a series resistance of about a megohm.

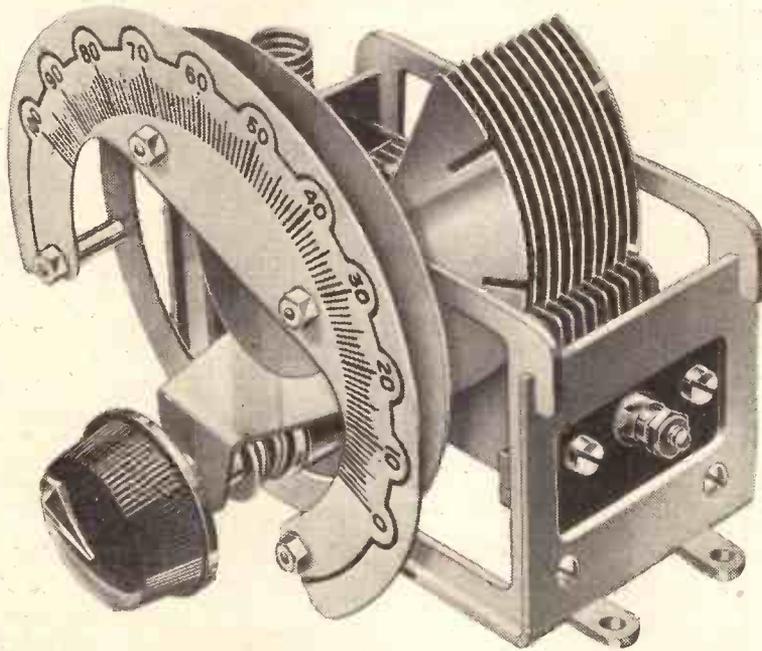
The aerial lead-in is attached to a Clix plug and inserted in one or other of the sockets, according as full or reduced input is required.

The "local" socket, of course, is that which is in contact with the resistance.

This scheme is easily arranged, and can be inserted in a few minutes. Many set-builders will not require it, hence we did not include it in the receiver design.

As to results obtainable with the Westector Super, we can but say they are remarkable. In London, Zeesen is perfectly clear of 5XX or Radio Paris, and selectivity is knife-edge on both bands.

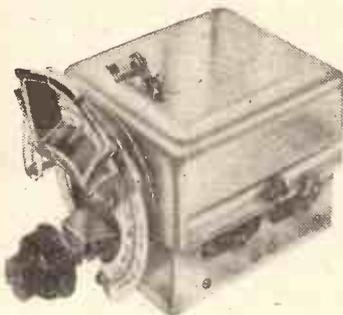
# TELSEN PRECISION GANGED CONDENSERS



## TELSEN SINGLE CONDENSER UNIT

Designed for use in modern receiver circuits where accuracy of tuning is essential. A pressed steel frame of great rigidity completely obviates any tendency to distortion, the Rotor and Stator vanes being let into high pressure die-castings to ensure permanent accuracy of spacing, and totally eliminating the possibility of the vanes working loose. In attractive stove aluminium finish, complete with disc drive, pilot light holder, knob, degree and wave-length scales ... price

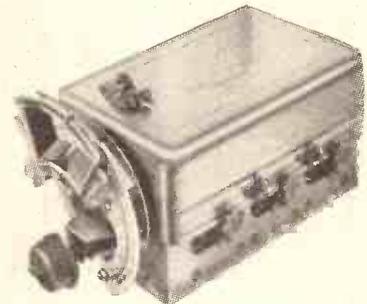
9'6



## TELSEN TWIN GANGED CONDENSER

Comprises two perfectly matched units, giving accurate and simultaneous tuning of two circuits by rotating a single dial. A knob concentric with the main tuning control operates a variable trimmer. Complete with disc drive, dust cover, escutcheon plate, pilot light holder, degree & wave-length scales, price

16'6



## TELSEN TRIPLE GANGED CONDENSER

Comprises three perfectly matched units, giving accurate and simultaneous tuning of three circuits by rotating a single dial. Trimmers are provided across each section. Complete with disc drive, dust cover, escutcheon plate, pilot light holder, degree and wave-length scales, price

22'6

# TELSEN

**RADIO COMPONENTS FOR LASTING EFFICIENCY**

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

## OPERATING THE "CLASS B" FOUR

Some practical notes on getting the best results from this last-word "P.W." set.

By K. D. ROGERS.

"... when you're on the air." The smooth-voiced vocalist of the Savoy Hotel Orpheans finished the chorus of the well-known signature tune and the band burst into the final few bars of the lilting refrain.

I switched off. Not because I dislike dance music, but because it was a fitting ending to an interesting evening "on the air" with the "Class B" Four.

In pursuance of our usual policy of trying every set both at Tallis House and elsewhere, before it is passed for publication, I had taken home the "C.B.F." and had spent three really fascinating hours touring Europe.

### Surprising Sensitivity.

And a right merry evening we had, enjoying it so much that a further "Class B" session is on the list of future events.

Armed with the set, a nice new H.T. battery of 120 volts, and a Cossor 240B. valve on which the whole of the set has been based, I arrived home early to listen to a particularly attractive section of the B.B.C. programme. I don't often listen to the B.B.C. for entertainment purposes on any but my standard mains six-valver, but this evening I decided to cast this aside and use the "Class B" Four, which I knew would give me ample volume, something like two watts A.C. output being available.

The B.B.C. items over, I switched on again and began to search for "distant" stations, though so many of the Europeans came in with local strength that I could call very few of them "distant" in a radio sense, though they were hundreds of miles away.

The selectivity and sensitivity of the "Class B" Four are surprising, and there is no doubt that the Lotus three-gang unit is an exceptionally good one. Reaction was used occasionally to help cut down heterodyne interference and sideband "splashing," but for fully thirty per cent of the stations received no recourse to reaction was necessary.

### Stable as a Rock.

The low-frequency side of the set provides a high degree of amplification, and thanks to the 240B., combines with the H.F. to make the "Class B" Four one of the liveliest battery sets I have handled.

It must not be inferred from the above that the set is prone to instability or that it is tricky to handle. It is as stable as a rock and is remarkably easy to control. But it gives one a most satisfying feeling of pent-up power; power which is ready for immediate use, either in the provision of loud volume or the pulling in of some miles-away programme.

I found that the ganging of the three-coil unit and condenser remains trimmed all over both wavebands extremely well, so that if the condenser is properly trimmed on a low wavelength distant station (below

250 metres) to start with, there is no need to touch the trimmers again, unless, of course, the aerial is changed for some reason or other, when this section of the coil will need re-trimming.

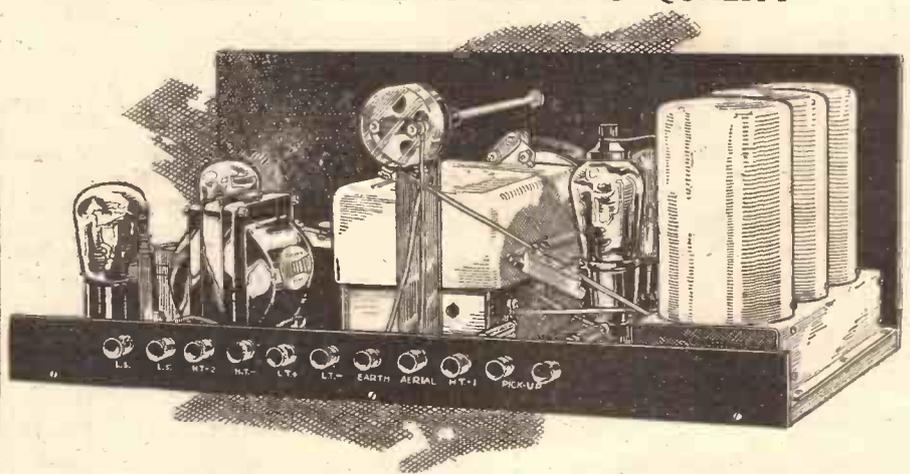
I should say that the average anode current consumption of the set is a few milliamps more than it is in a perfectly adjusted Q.P.P. receiver of similar circuit; but I consider that the advantages of "Class B," the absence of any anode current matching, no grid bias for the output stage, and the greater possible maximum A.C. output, outweigh the increase of 2 or 3 milliamps in average current.

### Valve Holder Details.

Incidentally, since publishing constructional details of the set last week the orientation of the valve pins has been finally settled, and though the pins are situated in a like pattern to that shown on our wiring diagram, the connections are somewhat altered.

Therefore it will be necessary to change the wiring diagram somewhat to this extent. The filament valve holder sockets are as shown, but the grids and anodes are interchanged in a peculiar manner.

## "CLASS B" FOR DISTANCE AND QUALITY



On test this remarkable set—constructionally described last week—proved capable of bringing in an amazing variety of programmes, and the volume control (central, near the top of the panel) had to be used on a large number of the foreign stations.

Looking at the valve holder from above, with the two filament sockets (closer together than any other pair) towards you (at "six o'clock" as compared with the face of a clock), the other sockets become as follow: First on the right becomes the blank pin, second on the right is one anode, the top one (marked "not used" in our diagram) becomes a control grid, and, coming down on the left-hand side the next socket is also a grid. That leaves the second anode connection to be made to the remaining socket (next to the left-hand filament socket).

The alterations of the set wiring to accommodate these changes are quite

simple, of course, and will not necessitate any movement in the components.

Since the last article, too, I have received a sample of the Mullard Class B valve, and understand that "B" valves will later be available in the Osram, Mazda and Marconi ranges.

There is a possibility that one of the "Class B" makes will require a small bias, some 1½ volt or even less being required; but this is still being discussed by the firm in question, and the pros and cons of small bias and no-bias valves are being thrashed out in the laboratory.

### Using Ordinary Triodes.

All the "B" valves will, however, conform to the new 7-socket valve holder, using six of the sockets. The remaining one is required for double diode triodes and other valves that are fast approaching experimental completion, and will shortly be put into production.

Cossor "B" valves are now available, but should you by any chance be kept waiting a day or two for delivery by your dealer, there is no need to hold up construction of this set, for with a couple of ordinary valve holders and two of the Cossor 220P.A., or Osram L.P.2, Mullard P.M.2A., Mazda P.220, etc., you can use the set as an interesting mixture between Q.P.P. and Class B.

All you have to do is to take the two grids of these valves to the two G. terminals of the transformer, the anodes to the anode points on the output transformer, and take the centre of the input (drive) transformer to about 4½-6 volts negative bias. Then

the valves will take quite a low quiescent anode current, and they will give a surprising output power.

This is due to the fact that the grid input is not limited by any considerations of preventing grid current, and the valves can run into grid current with impunity without loss of quality. This could not be done with the normal Q.P.P. input transformer.

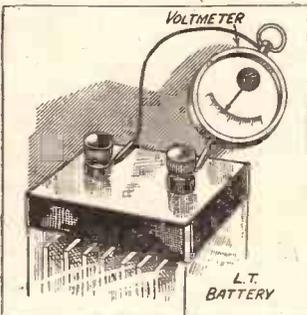
The power output is not so good as that obtained with the Cossor 240B. valve, and as soon as this arrives readers are advised to complete the set properly, but the two small output valve arrangement gives an interesting and economical interim alternative.

# RADIO SIMPLIFIED

# A PRACTICAL OUTLINE FOR BEGINNERS

THE voltmeter and milliammeter are the two essential instruments in radio test work. We dealt with some of the chief uses of a milliammeter in last week's issue, and we shall now show how a voltmeter may be employed as an aid towards maintaining the set at its maximum efficiency.

## CHECKING THE L.T.



A voltmeter can be used to determine the condition of the L.T. battery, but the reading should be taken when the set is working.

First of all, a few words about the choice of a suitable instrument. There are two types of voltmeter, viz., the moving-iron and moving-coil.

### The Type to Choose.

Of the two, the moving-coil meter is the better so far as radio work is concerned. It is more accurate and, owing to its high resistance, requires only a small amount of current for its operation.

For this reason, a moving-coil instrument should always be chosen for measuring high-tension voltages, particularly when the source of supply is a mains unit.

Moreover, the meter should have a really high resistance, otherwise the current consumption of the instrument may cause it to give a misleading voltage reading. This might easily happen with a mains unit, since the voltages across the tappings depend to a large extent upon the current taken.

### Across the Supply.

High-grade voltmeters of this type are somewhat expensive, but the degree of accuracy obtainable renders them a sound investment.

As we pointed out in the article "Voltage and Current"

# THE VOLTMETER in USE

(Feb. 25th, 1933, issue), a voltmeter is always joined across the source of supply, and not in series with it, as in the case of current-measuring instruments.

### The H.T. Volts.

In view of this, let us see how the meter should be connected if we wish to measure the voltages at the H.T. terminals of the receiver.

In the first place, we must assume that the voltmeter is a good one of the moving-coil type, preferably provided with a length of insulated twin flexible

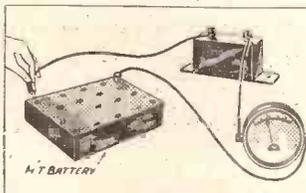
when the battery or mains unit is actually delivering current, and in the case of a dry battery H.T. it is advisable to measure the voltages when the set has been working for half an hour or so.

This gives the battery time to "settle down," and is particularly important when checking the condition of dry cell units that have given a fair amount of service.

### 'Ware Resistances.

Some listeners, when testing their voltages, endeavour to obtain readings by joining the meter between H.T. - and the anodes of the valves. Measure-

## TESTING A CONDENSER



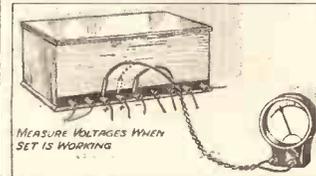
To test a large condenser, join it up as shown above. As explained in the text, the voltmeter can then be used to indicate whether or not the condenser is leaky.

wire terminating in red and black testing prods.

The negative terminal of the meter, or black prod, is connected to the negative H.T. terminal on the set. The positive meter connection or red prod is then brought into contact with each of the H.T. + terminals in turn, and the various voltage readings noted.

The only reliable method is to take these readings

## MEASURING INDIVIDUAL VALUES



The voltages at the H.T. terminals can be found by joining the positive connection of the meter to each H.T. positive terminal in turn.

ments of this type are rarely accurate. The valve anodes often have resistances in series with them. For instance, an

## WATCH THE G.B. BATTERY!

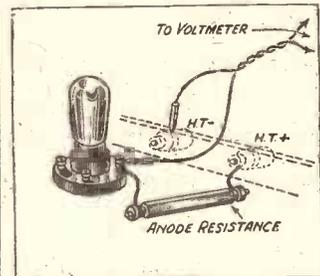


The grid-bias battery is sometimes forgotten and its voltage not regularly checked. While it is true that no current is taken from this battery, its life is definitely limited and the voltages between the tapping sockets should be measured occasionally.

The anode voltage, however, can be determined provided a milliammeter is available and the value of the series resistance is known.

Suppose, for example, there are anode and decoupling resistances in the anode circuit which together have a total value of 120,000 ohms. Let us

## THE WRONG METHOD



Voltage measurements taken at the anode of the valve are often unreliable, particularly if the circuit contains a high value of anode resistance.

also assume that the current flowing in this part of the H.T. circuit is 1 milliamp.

The H.T. voltage can be determined by joining the voltmeter across the H.T. + and H.T. -.

We will suppose this to be 150 volts.

All we now have to do is to find the volts dropped by the resistances, and subtract these from the H.T. voltage. The volts dropped in this case are 120,000 multiplied by 1 and divided by 1,000. This is equal to 120 volts (rather a high figure). Subtracting the volts dropped from the voltage at the H.T. + terminal, we find that there are only 30 volts at the anode of the valve.

A 2-volt L.T. accumulator should read its full 2 volts when the valves are switched on. For low voltages of this order the meter range must, of course, be a suitable one.

### Testing Condensers.

The uses of a voltmeter are varied, and it can be employed for testing large fixed condensers. The connections are as shown in the sketch.

If the condenser is leaky, the meter needle will move across the scale to a steady reading. On the other hand, if the condenser is not leaky, only a momentary deflection of the needle will occur when the plug is inserted.

Again, there are the decoupling resistances and other components such as H.F. chokes, all of which have a certain amount of resistance.

Special Beginners' Supplement—Page 2.

# MOVING COIL LOUDSPEAKERS



OF the three main types of loudspeakers those of the moving-coil class are the most satisfactory from the standpoint of fidelity. The mere fact that a speaker incorporates a moving-coil action does not, however, necessarily indicate that it is a good reproducer of sound impulses.

## Two Main Types.

Only by careful design is it possible to achieve fidelity superior to other types, but provided due consideration is given to the practical application of the principles involved, the moving coil, without doubt, ranks foremost among the present-day reproducers.

Moving-coil loudspeakers can be divided into two main types, viz., permanent-magnet and mains energised.

The working principles are identical in each case.

First of all there is a cone which forms the diaphragm. At the apex of the cone there is a coil of fine wire, usually having a resistance in the low-resistance types of between 4 and 8 ohms.

## Surround and "Spider."

The base of the cone is secured to the loudspeaker frame by a "surround" of some flexible material such as thin stockinette or rubber, and the cone is arranged so that the coil is free to move to and fro in the powerful magnetic field.

It stands to reason that the intensity of the field or flux density in which the coil moves should be as high as possible. The coil is, therefore, centred in a very small air gap between the magnet pole faces, and a centring device is necessary to keep the coil true and to prevent it from touching the pole faces when the speaker is working.

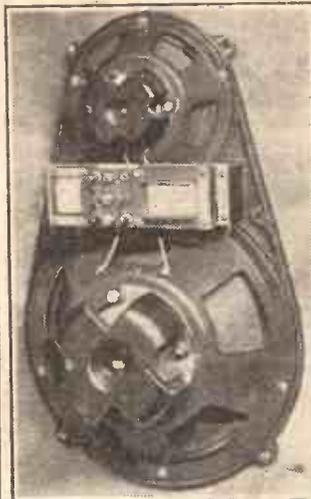
The centring device is sometimes called the "spider" be-

cause in certain cases portions of the disc are removed to give it increased flexibility.

## Air Gap Design.

As we have already pointed out, the air gap in which the coil moves is necessarily small. This is essential from the point of view of sensitivity, and is one of the problems with which designers are faced.

It is not difficult to see that if the diameter of the air gap is reduced so that it just gives clearance for the coil, the cone suspension will have to be reasonably stiff.



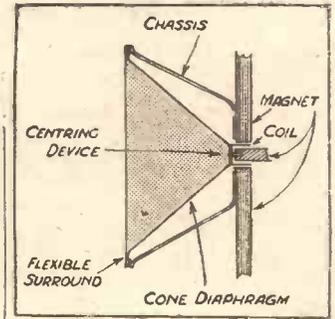
While in this way great sensitivity can be achieved some departure from the ideal response to musical frequencies is bound to follow.

Conversely, if the air gap is increased—unless the intensity of the magnetic field is increased proportionately—the sensitivity will be reduced, but the more flexible suspension then made possible may improve the frequency response.

Other factors of importance are the diameter of the cone and the rigidity of its construction. Some of the cones used in modern moving coils have corrugations which serve to stiffen them. It is by no means easy to find a material which combines light weight with rigidity, the latter being necessary in order to avoid a "breaking up" of

## HOW THEY WORK

The diagram shows the principle of the moving-coil speaker. The coil attached to the cone diaphragm moves to and fro in the air gap between the magnet poles.



the musical notes at certain frequencies.

Generally speaking a large diameter cone gives a better bass-note response than one of small diameter. But a large cone may also produce a poor response at the other end of the musical scale, hence the question of best cone diameter is involved and cannot be dealt with in an article of this nature.

Cone diameters in commercial units vary from between approximately 6 to 9 in., and recently



## MATCHING THE OUTPUT VALVE

Many of the modern moving-coil speakers are equipped with a suitable output transformer, as depicted in the circle.

On the left is the Celestion dual speaker, which consists of two units. In this way a remarkably even tone balance is achieved, one unit dealing with the treble and top frequencies and the other with the bass.

Below is the well-known B.T.H. moving coil, one of its features being the special type of corrugated cone employed.



there has been a tendency to mount two loudspeaker units on a single chassis. One of these is designed to give a good high-note response, while the other looks after the lower frequencies.

In this way it is possible to obtain a remarkably uniform response over a wide range of frequencies.

The majority of moving-coil units available at the present time have low-resistance coils.

Units of this type are obviously quite unsuitable for connecting directly in series with the anode of the output valve.

A step-down transformer of suitable ratio is therefore interposed between the output valve and the coil, the ratio depending upon the type of valve in the output stage. The ratio for a pentode, which has a high impedance, is therefore greater than for a low-impedance valve.

## Transformer Coupling.

Given the correct ratio the loudspeaker is matched up to the output valve simply by joining the transformer primary winding in series with the anode of the power valve or pentode, and the secondary winding to the moving coil.

The low-frequency variations in the output circuit are thus applied to the coil via the transformer, and cause the coil to be attracted or repelled by the flux in the air gap according to the direction and strength of the currents flowing in the coil.

It is by no means impracticable to have a moving coil with a high-resistance winding, but naturally with such very fine gauge wire as this necessitates it is difficult to ensure reliability, and an output filter circuit or 1-1 ratio transformer is practically essential in order to deflect the steady anode current from the coil itself.

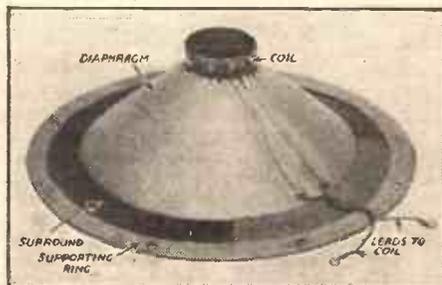
It is common practice for manufacturers to supply moving-coil units complete with their output transformers. These are often mounted on the chassis and are provided with alternative terminals for matching purposes.

## For Various Conditions.

Usually the ratios obtainable by the use of the appropriate terminals render the loudspeaker equally suitable for power, super-power, or pentode output stages.

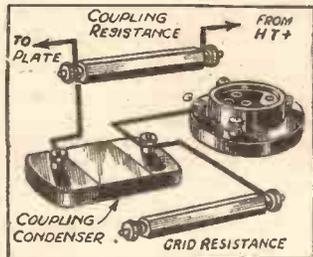
Listeners do not always appreciate that satisfactory reproduction is only possible when due care is taken to achieve fidelity in the low-frequency amplifying stages. If the amplifier distorts, the results from the loudspeaker will likewise be distorted and it is therefore unwise to employ a good loudspeaker in conjunction with a poor amplifier.

## THE CONE ESSENTIALS



The cone and coil are clearly illustrated here. Note the two leads from the coil and the flexible "surround."

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## MEANS AND METHODS

To the left is the popular resistance-capacity coupling arrangement. The voltages developed across the resistance are passed to the grid of the following valve via the coupling condenser, which at the same time insulates H.T. from the grid.

**WHAT** do phrases such as "loosen the coupling" mean? What is the function of a coupling condenser?

Unlike some of the terms used in wireless, the term "coupling" really does mean what it implies—a linkage.

We have already noted how even the simplest set is a collection of different circuits, dependent upon one another. The aerial circuit, for example, in which weak high-frequency currents, due to the distant broadcasting station, are flowing, is linked with the tuning-circuit.

### Magnetic Phenomena.

And as soon as one considers how the energy of the aerial circuit reappears in the next stage (tuning circuit), one realises that coupling is not a simple or easily-understood process. But its main features are so interesting that the time spent in considering them is well repaid.

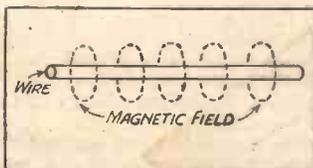
When you switch on your set, and current commences to flow along the various wires, you bring into play, all unseen, some remarkable magnetic phenomena. Around every wire a magnetic field comes into being. And there it stays—sometimes comparatively still and sometimes extraordinarily active—until you switch off, when the complicated magnetic structure collapses.

### Current Flow.

In the bottom left-hand sketch on this page we have depicted a wire, with rings around it. These rings represent the aforesaid magnetic field that surrounds a wire all the time that current flows in it.

If the current increases the rings will expand—the magnetic field gets bigger. When the current diminishes the rings get smaller; and if current ceases to flow the rings collapse and the magnetic field goes out of

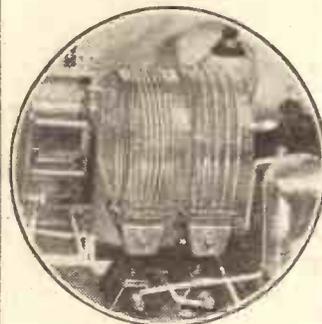
## THE MAGNETIC FIELD



Around every wire carrying current there exists a magnetic field, the rise and fall of which corresponds exactly to the variations in the current flow.

existence. Every current in a wire has its magnetic counterpart.

So around every current-carrying wire in your set you have this invisible accompaniment—its magnetic field. And every change, variation and fluctuation of current is accompanied by a corresponding magnetic movement.



### IN THE SET

The typical pair of short-wave coils in the circle above, illustrate how inductive coupling takes place across a considerable space between coils.

★ ★ ★

To the right is an illustration of a resistance-capacity coupling arrangement in practice, the coupling resistance being in the foreground, and the grid resistance on the opposite side of the valve-holder.

★ ★ ★

Two coil units, arranged in this way, will couple together, and energy will be transferred across the space between them.



Now consider the picture in the bottom right-hand corner of the page.

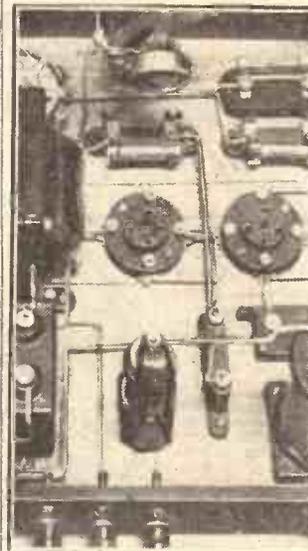
It shows how current in one wire may cause its surrounding magnetic field to affect another wire, even though there is a space between. The magnetic field will expand or contract as the current in the first wire grows or diminishes; and if the second wire is close enough the unseen magnetic field will cut across it.

When this happens a voltage is created in the second wire; and if the circuit is suitably arranged a second current will come into being there!

# CONCERNING COUPLING

It will be a current caused by and corresponding to the first or "primary" current. And all increases, changes, falls and fluctuations in the primary will be faithfully reproduced in the secondary.

In other words, the two separate circuits are "coupled." Such electro-magnetic coupling by coils is called inductive coupling. (All transformers depend upon this principle, though, instead of air between the primary and secondary, the L.F. types employ iron or an alloy.)



Note that it is only changes in the primary that get transferred to the secondary. A perfectly steady current in the primary does nothing to induce currents in the secondary except at the moment it is created, and when it dies away.

### Charging a Condenser.

A totally different and yet unexpectedly similar state of affairs happens inside a condenser. If you charge one set of plates by applying a voltage, the other set of plates—although separated by insulation—become equally (and oppositely) affected.

Every change in the voltage at one terminal is accompanied by a corresponding change at the other terminal of the condenser. And thus the effects of oscillating (H.F.) or alternating (L.F.) voltages can be transferred from one circuit to another by a condenser connected between and coupling these two. It is termed a coupling condenser, and may be fixed or

variable, of large or of small capacity, according to its associated circuits.

A resistance, also, can be used for coupling, by connecting it suitably in both the circuits. As current flows in the first circuit it causes a voltage drop across the resistance, and any such voltage will be applied to the second circuit in which the resistance is connected.

### Degree of Coupling.

In practice, resistance and capacity coupling are commonly combined into what is known as an R.C. stage of L.F. At the high-frequency end of the set it is the degree of coupling which is often of the greatest importance, and we must consider this in some detail because of its practical importance in operating a set.

In general, a strong coupling is called "tight coupling," with large transference of energy from one circuit to the other. And loose coupling is the term for the opposite condition, in which the two circuits are only lightly interlinked.

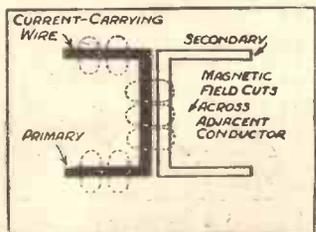
### Coil Fields.

One of the photographs shows a pair of short-wave coils placed side by side. Although not generally styled as such, this arrangement is really an H.F. transformer, and the "aerial" or "primary" coil transfers its energy to the "grid" or "secondary" coil by virtue of the interacting magnetic fields.

If the coils were placed closer together the coupling would be made "tighter." Similarly, if a larger number of turns were employed the two circuits would again be more tightly coupled.

Variable coupling, of course, is when the relative positions or the turn numbers can be altered, the latter being conveniently done with a clip on coils of the type shown.

## TRANSFERRING ENERGY



If a conductor (right) is placed so close to a wire in which current is flowing that the magnetic field cuts across it, voltages will be induced in the secondary corresponding to those in the first (primary) circuit.

Special Beginners' Supplement—Page 4

FROM the point of view of quality reception, nothing is more important than the high tension supply.

It is often supposed, quite erroneously, that "a good H.T. battery" or "a good mains unit" must mean pure and undistorted reception. But actually the best H.T. supply in the world would cause distressingly-evident distortion if wrongly connected to the set.

All that the battery or mains unit can do is to supply uninterrupted current at a certain voltage, and it is up to the set-owner to see that the current

**THE LEADS**



Untidy leads are a source of annoyance, and often cause or conceal a fault. Use a proper battery-cord if possible.

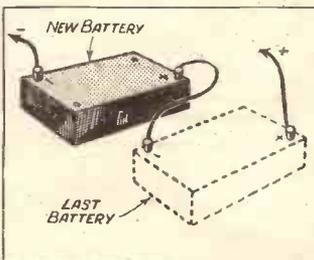
obtainable from it is adequate for his set's requirements, and the voltage applied to the various valves is at the correct figure, and not (greatly) above or below this.

One hint well worth remembering is that the battery-voltage figure markings are much more likely to be correct than the voltage markings on a mains unit. For the battery voltage is—within limits, of course—independent of the set, and a 60-volt tapping on a good battery will give its 60 volts to sets of widely different character,

**Voltage Variations.**

But when a mains unit is marked "60 volts" it always implies "60-volts-at-so-many milliamps." And if you try to take excessive current from such a tapping on a mains unit the voltage will necessarily fall below 60, whilst if a very much smaller current is taken the

**THE WRONG WAY**



This is the incorrect way to try to use up an old battery. It should be connected as shown in the other sketch on this page.

**HIGH TENSION HINTS**

"60 volts" may rise up to perhaps 100 or so!

This fundamental difference between the two classes of H.T. supply is due to the fact that H.T. batteries are of low internal resistance compared to H.T. units. Inside the unit there are chokes and resistances, etc., and these all drop the voltage to some extent.

**Series Resistances.**

Moreover, the greater the current the greater the voltage drop. And this voltage-drop (or rise, if too little current is taken) will affect the unit's output voltages, which will therefore be too high if it takes less current than it was intended to, or vice versa.

Another point which needs to be stressed again is that the voltage on the plate of any valve is always less than the voltage at

ages so its voltage will fall, and the intermediate plugs should therefore occasionally be "promoted" to higher readings.

If for instance the S.G. screen is supposed to have 65/70 volts on it, there should be, say, 72 volts at the plug when the battery is new. And the plug may have to be "promoted," to 84 or higher, to get the right voltage as the battery ages.

It is often asked whether the H.T. neg. plug should be left in all night, etc. There is much to be said for removing it when the set is out of action, as a small condenser leak or failure in insulation may have but little effect during working hours, but become expensive on a 24-hours-a-day basis.

**Making a Choice.**

The best check on H.T. is by means of a milliammeter and/or

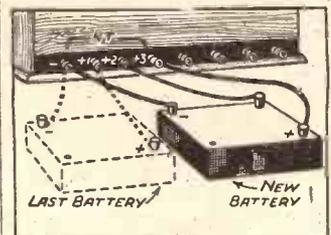
is as good as four or more smaller batteries, although it costs much less than four times as much.

As regards the care of H.T. batteries, the chief points are to guard against mishandling and shorting, and to keep them in a cool place. Chimney-corners and situations in windows or on tables, etc., where they are in direct sunlight are harmful to an H.T. battery.

**The Correct Method.**

In response to many requests we show on this page the right and the wrong way to use an "old" battery. (Actually, of course, a really run-down battery is only fit for the dustbin; but nevertheless it often effects

**USING TWO BATTERIES**

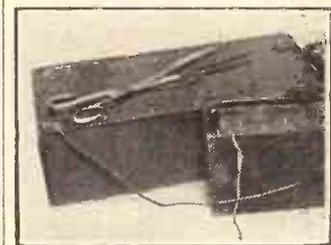


Each battery should have its terminal connected to H.T., and the old battery's plus should go to only one terminal, preferably that which supplies the detector or other low-current consumption valve.

quite a saving on H.T. to use up a partly run-down battery to supply one H.T. terminal, as illustrated. The other method of connection, "in series," is useless.)

When the high-tension supply takes the form of an H.T. mains unit, the set-owner sometimes tolerates a certain amount of hum, under the impression that this is inevitable when using the mains.

**DANGEROUS!**



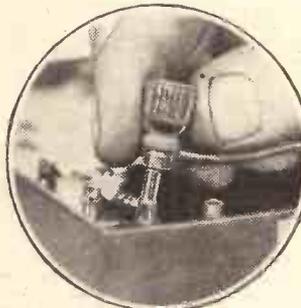
metal objects, such as scissors, cigarette cases, knitting needles, etc., will "short" sections of the battery if carelessly laid on it, unless its sockets are protected by a cover.

Such a supposition is quite unfounded on fact, for the supply, adequately smoothed, should be as silent as a battery's. Sometimes the trouble is caused by placing the H.T. unit too close to the set, or some of its wiring. The remedy is obvious.

**NEVER**

forget to pull the H.T. negative plug out of the battery before altering the wiring.

take the H.T.—or appropriate H.T.—plug from a battery which is supplying a penode-output set unless the L.T. is switched off first.



**ALWAYS**

keep the prongs of the plug opened out, so that it sets tightly in its socket.

have the battery-lead fixed neatly to the plug, as loose and "whiskery" connections are liable to cause crackles.

the H.T. + terminal supplying it. The reason for this, of course, is that between the + plug and the valve itself there are various resistances—perhaps in the form of transformer primary, or decoupling resistance or choke—and whenever current is passed through a resistance there is bound to be a voltage drop across it.

**Finding the Drop.**

So it is always advisable to plug in to a somewhat higher voltage than the one required on the plate of the valve to make up for voltage drop. (Incidentally the voltage drop can easily be calculated, by Ohms Law, and the necessary extra voltage to apply will then be known, as already explained in this series.)

Failing calculations or measurements, the results of varying voltages should be tried by ear. And remember that as a battery

voltmeter, and the special "P.W." articles dealing with these subjects will be found full of interest in connection with H.T. upkeep.

One most important point is to choose the right battery (or mains unit) to start with, and in this connection the makers themselves are now giving the listener every assistance. On inquiry it will be found that the leading makers definitely recommend certain lines for the various popular sets, and thus if you ask for "A battery for the 'Airsprite Three,'" the makers will gladly tell you which type is most suitable and therefore the most economical to run.

**Care of H.T.**

The fallacy of buying a small battery to supply a big set is now well known, because listeners who have tried it soon find that one "triple-capacity"

**NEXT WEEK :**

**THE DETECTOR—YOUR OUTPUT CIRCUIT—THE IMPORTANCE OF GRID BIAS—TUNING TIPS.**

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1 Lissen "B" Transformer	1	2	6
1 Ferranti L.F. Transformer O.P.M. 12c	1	5	0
2 Polar Variable Condensers S.M.2	1	3	0
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1 Polar Star 3-gang Variable Condenser with slow-motion dial	1	10	6
1 Ferranti "Quiescent" Input Transformer A.F. 11/c	1	14	0
1 Ferranti "Quiescent" Output Transformer O.P.M. 13/c	1	6	6
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1 Telsen compensating transformer	1	1	6
1 Radiophone band-pass super-het. tuning unit. B.R.P.	3	15	0
1 Set of 6 valves as specified (less rectifier)	3	7	9
1 Westector Rectifier, model W.6	7	6	
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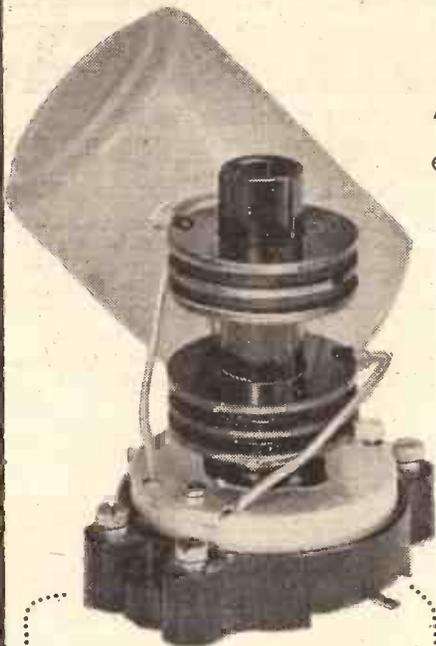
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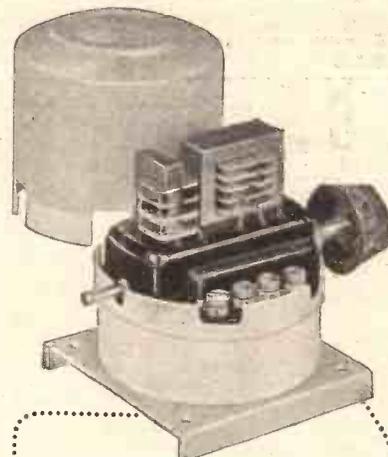
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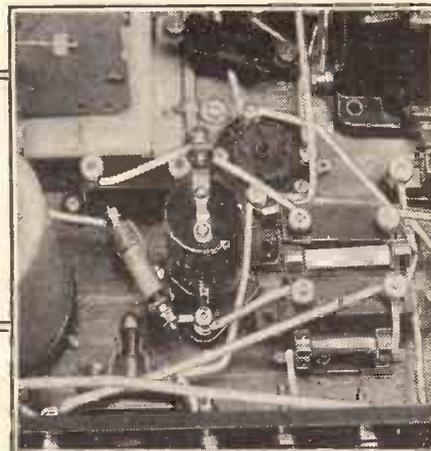
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The illustration shows that portion of P.W.'s receiver which revolutionises present Superhet design by the use of the Westector, shown on the left-hand side of the choke. You'll want to know more about this new method of detection. The attached coupon will bring you full particulars.

 **The Westinghouse**   
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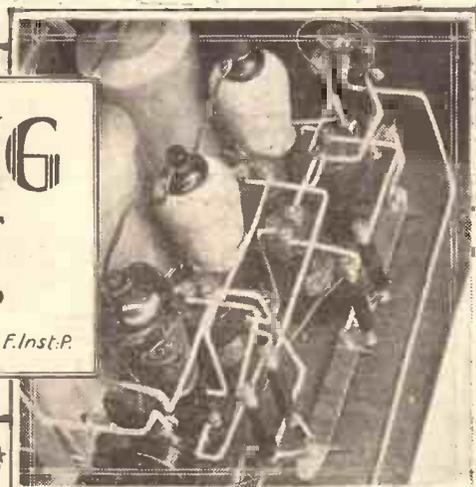
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P.W.14



# SEPARATING H.F. & L.F.

By Dr. J. H. T. Roberts. F.Inst.P.

\*.....\*

No matter how abstruse the problem, you can rely on Dr. Roberts to give a clear, easily-read explanation of it. His characteristically simple style makes the topic of keeping H.F. in its place of unexpectedly absorbing interest.

\*.....\*

It is a common practice to introduce a high-frequency choke into the anode lead from the detector for the purpose of helping to keep the high-frequency current out of the low-frequency parts of the receiver circuit which, of course, is very important if we are to avoid complications due to H.F. oscillations being set up in the amplifying stages.

### A Compromise.

The inductance of the H.F. choke must be chosen so that whilst it has a high impedance so far as radio-frequencies are concerned (even the lower radio-frequencies) at the same time it does not offer an unduly large impedance to the higher audio-frequencies. In practice this resolves itself into a compromise, and the choke must necessarily produce a certain amount of cut-off or attenuation in the higher audio-frequencies whilst, at the same time, its effectiveness in choking the lower radio-frequencies must to some extent be sacrificed.

For instance, a choke of, say, 100,000 microhenries, which is by no means an unduly high value—in fact, a good many chokes on the market have an inductance value a good deal more than this—will have an impedance of roughly 3,000 ohms at a frequency of about 5,000 cycles. It is an open question as to how much of the quality of reproduction is attributable to frequencies in the region of 5,000 cycles—undoubtedly the majority of the audio-frequencies are much lower than this—but it is evident that a choke of the value in question must have quite an appreciable choking effect upon the upper audio register.

### The Use of a By-pass.

To improve the effect of the choke so far as isolating the H.F. is concerned, it is a common practice to introduce a by-pass condenser across the anode and filament of the detector so as to provide an alternative path for the H.F. For general purposes this condenser need not be greater than about .0001-microfarad capacity.

This arrangement is often considered to be sufficiently satisfactory, and it can be shown that it does, as a matter of fact, keep out by far the greater percentage of the

H.F. current from the L.F. part of the circuit. Nevertheless it is not perfect,

Until comparatively recently a very small amount of H.F. in the L.F. stages would not have been a serious matter, but in view of the high efficiency of present-day amplifiers, the refinements called for are much increased. It is quite possible, moreover, that owing to accidental combinations of inductances and capacities, high-frequency oscillatory systems may occur and be maintained in continuous oscillation

by the H.F. current which gets through.

A resistance is often used in the grid-lead of a low-frequency valve for the purpose of still further preventing H.F. current or rather H.F. oscillations from being set up in the L.F. stages. A resistance of this kind—sometimes called a grid stopper—will often be very effective, whilst in other cases it appears to be of relatively little use. Its effectiveness, however, depends very much upon its value in relation to the other constants of the circuit.

### Discriminating Action.

The action of this stopper resistance in the grid-lead of an L.F. valve depends upon a discriminating action between the impedance at high and low frequencies. It is obvious that a pure resistance will not discriminate, but this resistance is not the only factor in the circuit.

We have the capacity across the grid and filament of the valve, and we have the self-capacity of the secondary of the transformer which couples the L.F. valve in question to the previous valve. Let us deal with the capacity between grid and filament first.

The reactance due to this capacity will depend naturally upon the frequency. At a wavelength of about 300 metres the valve capacity just mentioned may have an effective impedance of the order of 3,000 ohms. Now let us suppose that the resistance introduced in the grid-lead is, say, 100,000 ohms.

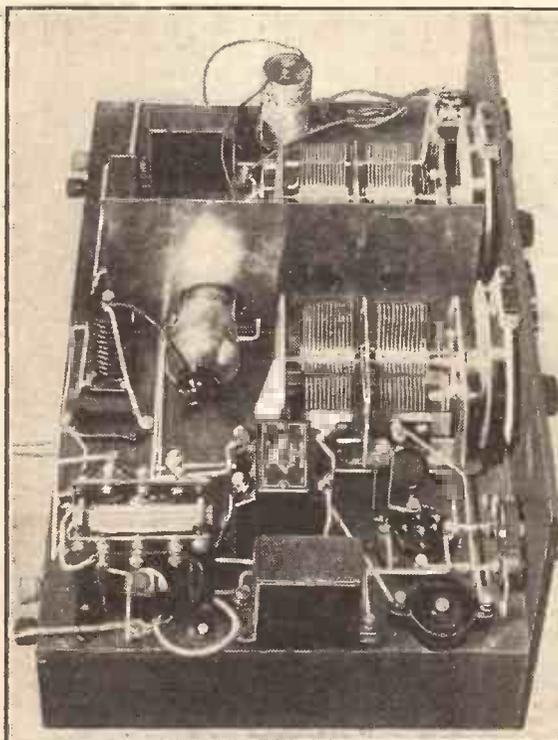
### Like a Potentiometer.

It is convenient to regard the resistance introduced into the grid-lead, together with the impedance of the valve capacity, as being in the nature of a potentiometer across the source of potential—which is the transformer secondary. The potential developed across a part of this potentiometer will naturally depend upon the proportion of the total resistance which is included by the part in question.

If the resistance in the grid-lead is 100,000 ohms and the equivalent impedance of the valve capacity (at 300 metres) is, say, 3,000 ohms, then it is obvious that only a very small percentage of

(Continued on next page.)

## KEEPING HIGH-FREQUENCY IN PLACE



One of the greatest problems in set design is to confine H.F. currents to their proper circuits. Screening offers a solution to the problem as far as actual H.F. components are concerned, but further steps (as explained in the article) are required to keep the L.F. components free of wandering high-frequency currents.

## SEPARATING H.F. & L.F.

(Continued from previous page)

the total voltage (due to the H.F.) will be developed across the valve and consequently the valve will act as a relatively inefficient amplifier of the unwanted H.F. This is precisely what we desire. So far, so good.

### Taking Care of the L.F.

Now let us see whether we have interfered with the proper action of the L.F. currents. The impedance of the valve at low-frequencies of the order of, say, 500 to 1,000 cycles per second, will be enormously greater than at a wavelength of 300 metres.

We can easily show that it may be of the order of several megohms. Let us take the figure of 5 megohms, which is quite a reasonable one.

Now our potentiometer consists of 100,000 ohms resistance in the grid-lead and 5,000,000 ohms due to the valve. Therefore, practically the whole of the potential from the transformer secondary will be developed across the valve, which

### CHOKE OR RESISTANCE?

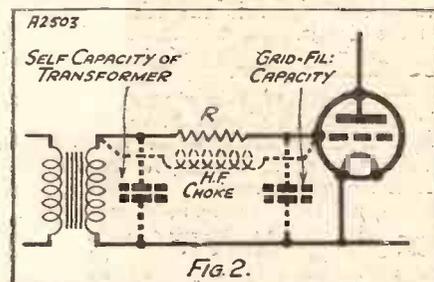


Fig. 2. Either a resistance or an H.F. choke may be used to act as a "grid-stopper" to prevent H.F. getting into the L.F. amplifier.

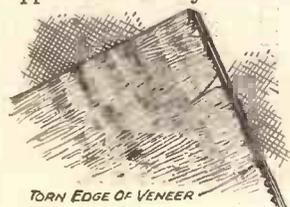
is thus given the opportunity of amplifying the low-frequency oscillations practically to the fullest extent.

So you see that owing to the variation of the reactance of the valve at high- and low-frequencies, our grid-lead resistance gives us the means of making the valve a good amplifier for low-frequencies and a poor amplifier for radio-frequencies.

### CUTTING VENEERED PATTERNS.

IN the interests of economy many constructors, when rebuilding their receivers, make use of a wooden panel as an alternative to ebonite, and in some instances where it is desired to match the cabinet, a plywood veneer is chosen.

When cutting this type of panel to the required size care should be taken to mark out and saw from the faced side, otherwise the sawcut will have a jagged tear on the edges of the veneered surface. The above applies also to any cabinet-making work.



Don't break the veneer by careless cutting or you will get the effect shown here.

TORN EDGE OF VENEER

No doubt it occurs to you whilst considering this matter that it would be preferable to put an H.F. choke in the grid-lead instead of the simple resistance. This is perfectly true and, in fact, the choke would meet the case even better than the resistance.

### Choke or Resistance?

A choke can be so chosen as to give actually a much higher impedance than 100,000 ohms for radio-frequencies and a much lower impedance than 100,000 ohms for audio-frequencies. In other words, the choke, like the condenser (but unlike the resistance), differentiates between high- and low-frequencies.

If we use an H.F. choke in the grid-lead instead of the resistance then our "potentiometer," as we have called it, consists of the choke in series with the valve capacity. At radio-frequencies the impedance of the choke is high and that of the valve capacity is low, whilst at audio-frequencies the impedance of the choke is low and that of the capacity is high.

In the case where we use a resistance in the grid-lead we have to rely for our discrimination between high- and low-frequencies simply upon the discriminating power of the valve capacity.

The only reason for using a resistance in the grid-lead instead of a choke is because, of the two components, the resistance is much the cheaper.

### Effect of Transformer.

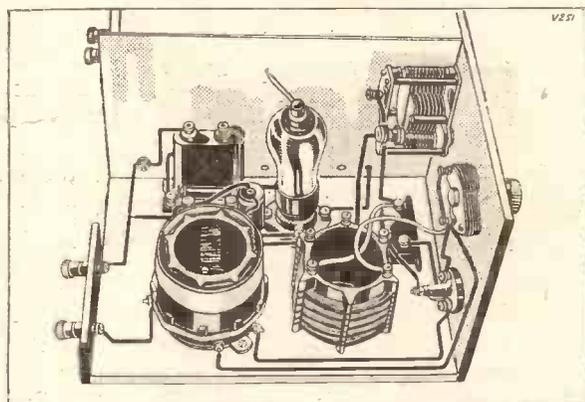
Finally we have to consider the effect of the self-capacity of the transformer secondary which I have already mentioned above. Like the other capacity in the circuit, this naturally discriminates between high- and low-frequencies and may be considered as being in series with the resistance in the grid-lead. Usually its actual value will be smaller than that of the valve capacity.

With regard to actual values of the resistance, valve capacity and H.F. choke, it is impossible to say precisely what these will be in any particular case. The

effective impedance of the valve capacity, for instance, will obviously vary with the valve, but that does not affect the general principle. As regards the value of 100,000 ohms for the resistance in the grid-lead, this may really be regarded as a maximum value and in actual practice the desired effect can usually be obtained with a resistance of a much smaller value, even as low as half.

If you care to go to the extra cost of an H.F. choke instead of the resistance you

### THE PROPER PLACE FOR H.F.



Previous to the introduction of such powerful H.F. stages as illustrated here, a little H.F. in the L.F. amplifier did no harm. Nowadays, it is a matter of serious consequence.

have the advantage of the very much greater "flexibility," so to speak, and are not so much tied as regards actual inductance values. A choke of 100,000 or even 50,000 microhenries should be found generally suitable.

If you are troubled with H.F. getting into the L.F. amplifiers and have not tried the arrangement described in this article, it is well worth while to make a few tests on these lines.

### Getting the Best Value.

As I said before, sometimes the arrangement is remarkably effective, whilst in other cases it may be at first a little disappointing. But that is only a matter of getting the relative values right.

If you succeed in isolating the high-frequency oscillation entirely from the low-frequency part of the circuit, it will make a great difference to the stability and operation of the receiver generally.

## ECONOMY REMINDERS

Some Useful Wrinkles concerning Construction and Operation.

### USE THE CORRECT GRID BIAS.

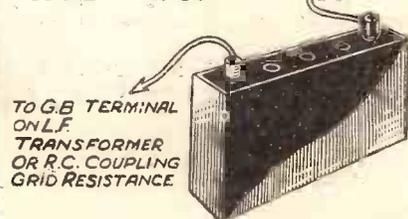
THE application of the correct grid bias to a low-frequency amplifying valve is an essential factor in achieving good reproduction.

The grid bias to use depends upon the high-tension voltage, and whenever you purchase a power valve be sure to take a look at the maker's leaflet, and see that you give the valve the recommended grid bias for the H.T. voltage you are applying to the anode.

To use too little grid bias is a very serious fault, which causes not only distortion, but also an excessive consumption of current from the H.T. supply, and in extreme cases a complete ruination of the valve.

Many H.T. batteries "grow old" before their time owing to this under-biasing fault, and it is far better to err on the side of using too much than too little bias.

### "RIGHT G. B. MEANS TO L.T. SAVED H. T."



# LISSEN MAKE POSSIBLE A PORTABLE RECEIVER WITH FULL-POWER MOVING-COIL REPRODUCTION

“An insignificant consumption of H.T. Current,” says “Popular Wireless.”

## NEW LISSEN TRANSFORMER IN THE “FERRO-B” PORTABLE

For the first time a portable receiver has been designed which has no limitations imposed upon it by the question of battery power. Immense output—superb quality—full moving-coil reproduction—all these are made possible in the “Popular Wireless” “Ferro-B” Portable by the new principle of “Class B” Amplification using the new Lissen “Class B” Hypernik Transformer.

The mighty output of this portable—“You would wager anything a big Mains Set was in action,” says “P.W.”—is achieved with an insignificant H.T. current consumption. The new principle embodied in this Lissen “Class B” Hypernik Transformer so reduces the anode current that standard size batteries are used—and used economically.

“An important milestone in the progress of radio,” says “Popular Wireless”—and so you will agree when you hear what “Class B” amplification with this new Lissen Transformer has to offer you.



# LISSEN

## CLASS "B"

# HYPERNIK TRANSFORMER

RATIO 1 to 1  
PRICE **12/6**

LISSEN LTD., WORPLE ROAD, ISLEWORTH, MIDDLESEX.



### FOR MAINS SETS

It is possible to design a mains set which can be guaranteed to be impervious to most of the ordinary forms of interference, but it would be an elaborate and costly instrument.

Further, many listeners would find it unnecessarily complicated, because the qualities of mains, and local conditions generally, vary enormously.

So, in order to keep their designs within moderate limits, designers have to compromise to some extent. While not definitely catering for only those whose conditions are good, they cannot economically "build up to the worst" all the time.

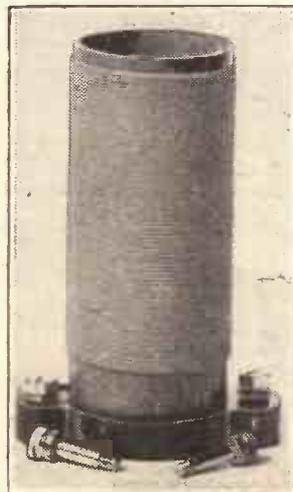
Therefore the designer's problem is to decide how much can be tolerated in the way of hum, etc., by the few! The trouble is the few are not necessarily aware that their conditions are exceptionally bad!

And they no doubt consider they have just as much right to freedom from hum as the rest. Most sets will give *moderately* satisfactory results anywhere these days, but moderation cannot be expected always to please in this age of high efficiency!

But how can that residue hum be eliminated from, say, a set using indirectly heated valves on "bad" D.C. mains? For this is an example of one of the most frequently encountered problems.

Quite often the addition of extra L.F. smoothing and the adoption of screened leads-in, and so on, make little or no difference. The reason may be that interference is getting through from the mains in the form of H.F. "ripples," superimposed on the D.C.

The obvious remedy for this is to insert H.F. chokes in series with the mains input to the set.



The Goltone Type W.H.F. Heavy Duty H.F. Choke

But special chokes are needed, because of the fairly heavy current they would have to carry, and because, unless they were of low resistance, they would cause untoward voltage drop.

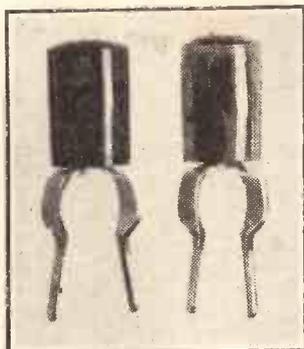
Messrs. Ward & Goldstone have just produced a

choke which adequately fulfils the requirements. It has a resistance of only three-quarters of an ohm, and it can handle up to 6 amperes without appreciable temperature rise.

It is stoutly made, and is supplied with sub-base terminals, as well as with ordinary ones.

The retail price is 3s. 6d. I will only add that while the component obviously cannot suppress interference due to other causes than "H.F. on the mains," its use is very often distinctly beneficial, for this trouble is widespread in certain areas.

Messrs. Ward & Goldstone have also



Two of the Goltone "Meteor" Wander Plugs.

recently gone into production with a new wander plug, the "Meteor," which has most attractive features.

It can be joined to bare wire quickly, and it accommodates itself to battery

and eliminator sockets snugly and maintains a rigid, efficient grip.

### A FIRST-CLASS SWITCH

A simple push-pull type of switch is useless for mains working. A quick make-and-break action is essential, or otherwise arcing is bound to occur.

One of the best of the Q.M.B.'s (quick make-and-breaks) to come to my notice is the one made by British Radiophone. It is designed in accordance with the soundest of electrical principles.

The action is all but instantaneous, half-way hang-overs are impossible, and the contacts are perfect. The operating knob and metal frame are efficiently insulated, and the soldering tags are separated by projecting guards of insulating material which prevent "flash over."

The switch is guaranteed to handle safely up to 3 amperes at 250 volts, and it is designed for one-hole panel fixing, a neat engraved indication plate being supplied.

Although primarily a mains switch of attractively neat compactness, it can, of course, be used for filament switching in a battery set. Personally, I greatly prefer a Q.M.B. for such a purpose.

Also, it is available in models for ganging, wave-changing, and for switching H.T. and L.T. simultaneously.

### A HEAVY DUTY CHOKE

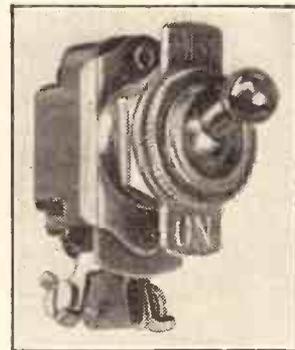
Very special considerations accompany the design of smoothing chokes for high-power amplifiers. You will have noticed how much the inductance of small chokes is affected by the current passed through them.

A choke having an inductance of, say 25 henries at 25 milliamperes might not be able to scrape up more than eight or nine at 40 milliamperes.

There is a Parmeko smoothing choke which gives 40 henries at 120 milliamperes, and some idea of the massiveness of its construction will be gained when I tell you it weighs 7½ lb.

It is suitable for a 50-watt amplifier! The resistance is low—240 ohms—and it is of the double-wound type.

A fine component, but one of interest only to those who build high-power sets and amplifiers.

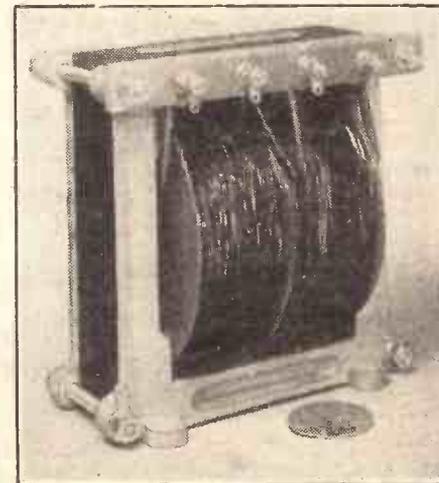


One of the British Radiophone Q.M.B. Switches.

### SOLON SOLDER.

Constructors who do their own soldering should note that Messrs. Brown Bros. are now supplying (wholesale only; you order it at your local retailer) a resin-cored solder known as "Solon."

It is said to be the only solder of its kind made to the B.E.S.A. specification. Anyway, I find it most convenient and effective in use.



A Parmeko Smoothing Choke, for high-power amplifiers.

# The R & A "BANTAM"

*Exclusively specified*

for the

**"Ferro-B" Portable**

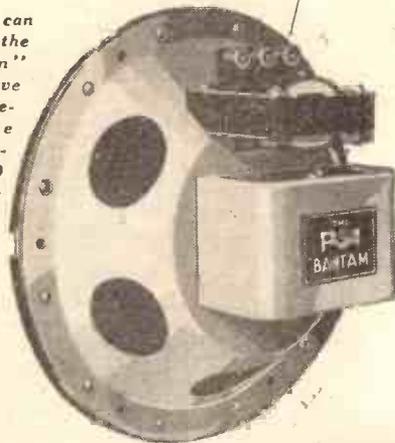
described in this issue

R & A Reproducers are specified weekly by Set Designers and the exclusive recommendation of the "Bantam" by the designer of the "Ferro-B" Portable, is a further tribute to the excellence of R & A Reproducers.

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Your dealer can supply. Insist on the R & A "Bantam" if you would achieve the maximum results with the "Ferro-B" Portables. There is NO substitute for the "Bantam."



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B.237



# VALVE VARIATIONS

by **SEXTON O'CONNOR**

**I**MPROVEMENTS in wireless reception tend more and more to centre themselves about the valve. The introduction of the screen-grid valve, for instance, set up new standards of H.F. amplification, whilst the pentode did very much the same thing on the L.F. side.

The discovery that both the S.G. and pentode can serve other purposes than straight amplification has set the ball rolling in a new direction. For example, they can both be used for "autodyning" in the super-het. circuit.

The extra grid prevents capacity-coupling inside the valve, even when the external circuits are back-coupled to produce local oscillations. Because the oscillations so generated cannot pass back through the valve, a superhet set with S.G. or pentode "autodyne" can be used, even on an outside aerial without causing the latter to radiate interference. Incidentally this greatly increases the "reach" of the set.

Again the high-amplification factor of the modern S.G. valve makes one stage of intermediate-frequency amplification equal to two ordinary three-electrode valves. All this has helped to produce the present superhet., which does better work on five valves than was possible a few years ago on ten. Further developments along the same lines point to the four-valve superhet. as a

probable "best-seller" next year. Another important factor in circuit design is the variable-mu valve, where the spiral-control grid is wound with a variable instead of a uniform pitch—or else the relative spacing of the electrodes is altered. There are various ways of getting the desired effect, namely, to produce a valve having a characteristic curve which tapers gradually, instead of having a pronounced bottom bend.

**Automatic Volume Control.**  
Here for the first time we see the possibility of a simple form of automatic volume control as an antidote to "fading." There is nothing so exasperating, when listening

to a distant station, as to have to stand by to bring the signals back when they "fade away" and then a couple of minutes later to cut the volume down as they start to "blast"

to say that this kind of thing calls for new methods of operation.

And yet the main difference simply amounts to a special way of operating the ordinary three-electrode valve—due to Barkhausen and Kurz. Instead of connecting H.T. positive to the plate of the valve, it is taken to the grid, the plate being left at the same potential as the filament.

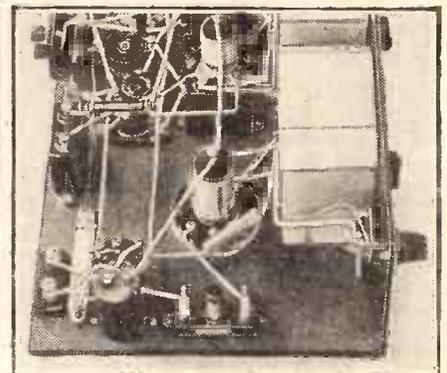
The electron stream from the filament shoots up towards the positive grid and passes through the spiral windings towards the plate. Since the latter carries no positive charge, the stream turns back, and again passes through the grid and beyond. It does not go far before it is again attracted back by the grid potential, and so it goes on dancing to and fro past the grid at an amazingly rapid rate.

## Ultra-Short Waver.

Each time the stream shoots through the grid it induces a pulse of current which is fed into the transmitting aerial and is radiated in the form of "centimetre" waves. The same principle is used in reception. It is one which may soon become familiar.

It is said that the future of both broadcasting and television lies in the ultra-short wavelengths—an opinion which is supported by the feverish activity now being manifested in this direction.

## PRE-DETECTOR CONTROL



One of the first of the variable-mu sets, with volume control potentiometer at the H.F. end, near the tuning circuits.

The ether is already overcrowded with medium and long-wave stations. The use of ultra-short waves for re-radiating a selection of these programmes over a limited area to listeners in the larger towns may solve the problem of selective reception free from interference. The next year or two will decide

Even apart from the very latest "cold" valves and "Class B" types, the technique of valves is rapidly advancing. And here our contributor interestingly outlines the recent and likely lines of development.

Some headway has already been made in the direction of using the variable-mu valve as a substitute for constantly adjusting the manual control. When signals are weak it automatically boosts them up, and similarly cuts them down when they get too strong.

One does this by making use of the rectified carrier-wave to vary automatically the bias on the control grid of the variable-mu valve. Obviously if the valve is to operate satisfactorily, it must be capable of applying high amplification to distant signals and low amplification to near-by signals, and to do both without introducing distortion.

## "Muting" the Loudspeaker.

In America the use of automatic volume control is practically standard practice. But the problem is not quite so simple as it may appear at first sight. One difficulty, for instance, is due to the fact that when searching for a distant station the variable-mu valve is naturally "keyed-up" to maximum amplification. When there is no carrier-wave present, the valve goes "all out" trying to find one.

The result is that near-by atmospheric come in with a fearful crash, whilst the multitudinous "noise" of distant atmospheric is amplified up to a distinctly unpleasant degree. In America they ensure "quiet" searching by using an extra control valve—or else a relay operated by a valve already in circuit—to "mute" the loudspeaker at all points of the tuning-dial where no carrier-wave is present.

These improvements are pretty sure to be very much in evidence over here next year. There is a good market for a really efficient method of automatic volume control—designed to get rid of "fading" and fitted with the associated refinements required to make its use agreeable as well as effective.

Short-wave working is another field closely bound up with modern valve technique. A lot has been heard recently of half-metre transmissions over long distances by Marchese Marconi, and of short-range sets operating on waves only six or seven inches long. It is hardly necessary

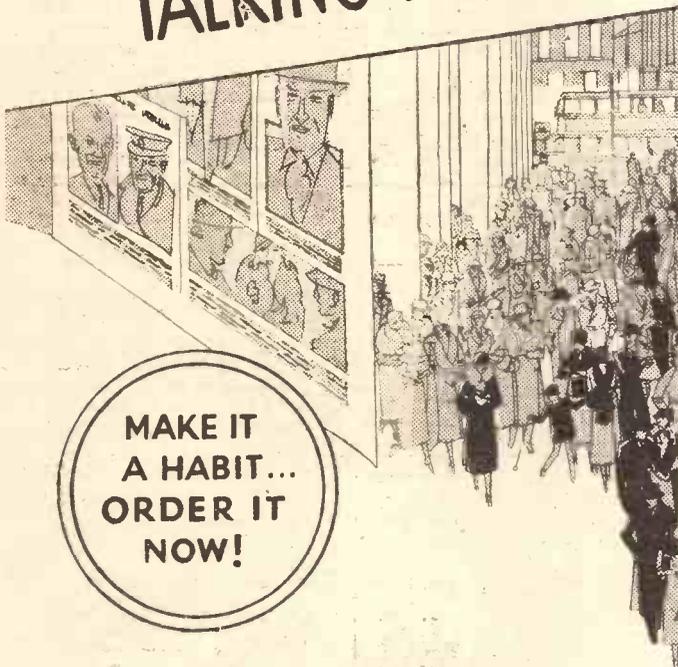
## COMPACT!



With its bulb removed the modern valve is revealed as a compact group of carefully-spaced electrodes. A close-up of a typical assembly.



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TALKING PICTURES**



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A HABIT...  
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**THE TOPICS OF THE DAY  
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## The First Super-Het

**RADIOPAK**  
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THE ONLY COMPLETE BAND-PASS TUNER



**Specially  
Chosen for the  
P.W. "WESTECTOR  
SUPER"**

The advent of the Super-Heterodyne Radiopak commences a new era in the construction of Super-Heterodyne receivers, and in specially designing the new "Westector Super" round this tuning unit, "Popular Wireless" have lost no time in taking full advantage of its tremendous possibilities for the benefit of their readers.

The "B.P.-Super" Radiopak, which is used in this outstanding receiver, consists of the necessary screened coils accurately matched to the three-gang super-heterodyne condenser; illuminated slow-motion drive calibrated in WAVELENGTHS and wave-change switch all completely wired and mounted neatly on a metal chassis.

Every constructor should build this amazingly efficient receiver which represents the latest advance in "Supers," combining perfect reproduction with highest selectivity and featuring—

- |   |            |  |
|---|------------|--|
| 1. Single dial tuning.                  | band-pass  | 4. Cold valve diode detector giving undistorted rectification. |
| 2. Perfect factory matched tuning unit. |            |  |
| 3. Wavelength scale.                    | calibrated | 5. Tone compensation on the L.F. side.                         |

### FOR THE "WESTECTOR SUPER"

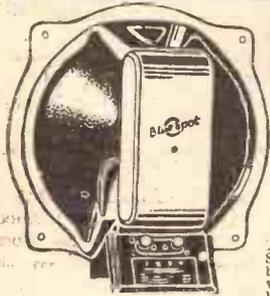
B.P. Super Radiopak 110 k.c., Type 535E, less potentiometer but with extra knob and trimming tool.

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PRICE

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Whatever the tuning circuit consult the Polar leaflet first—copy sent free on request.

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UP to the minute comes the new Amplion speaker specially designed for use with the new CLASS "B," FOUR. This speaker, known as the "M.C. 22, Class B," is fitted with a special input transformer designed to suit Class B characteristics. You will get from this new speaker all the refinement and natural reproduction that have made the name Amplion world famous.

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# RADIOTORIAL

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

The Editor will be pleased to consider articles and photographs dealing with all subjects pertaining to wireless work. The Editor cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

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

## QUESTIONS AND ANSWERS

### CONNECTIONS TO A POTENTIOMETER.

P. C. S. (Sussex).—"At present my volume control is by means of a potentiometer, with the grid terminal of the first L.F. valve holder wired to the slider terminal. One of the end terminals (the one on the right as mounted on the panel) goes to that valve's grid-bias negative and to one secondary terminal; and the left-hand potentiometer terminal goes to the other secondary terminal.

"The trouble with this is that when I turn the knob of the control to the right (same movement as the hands of a clock), it decreases

circuit, but with the slider acting in the opposite direction. In other words you will have "turned the potentiometer round" without affecting its fixing to the panel in any way.

This is exactly what you want, to give the increase-to-the-right effect, so go ahead with the alteration, as suggested.

### THE "AIRSPRITE" THREE—A READER'S RESULTS.

Writing from 46, Ealing Avenue, Basford, Mr. E. Versey says, in reference to the above set:—

Dear Sir,—I have not hurried with my report on the "Airsprite" Three, preferring to allow myself time to weigh up the for and against, taking as comparison my "Comet" Three, which I may say was often mistaken by friends for a four-valve, owing to the exceptionally high performance it put up.

However, the "Airsprite" circuit and A.T.B. taking my fancy, down came the "Comet," and in its place I now have my ideal set, one capable of sorting out stations from the maze on the medium-wave band, and giving same clear from interference, at the same time maintaining a commanding tone.

Of course, I would not be satisfied unless every detail seemed to stand out far ahead of previous performances, and I can assure you that it is now a pleasure to tune-in a host of foreign stations, my list to date, on M.C. speaker, being 55 medium, and 12 long waves.

(The only spot of bother, which, by the way, also occurred on another set some two miles from me, was with the '0003 diff. reaction, this I found to be excessive immediately on turning from the shorting strip, and I replaced with a '00015, which gives me steady reaction all round.)

In conclusion, let me congratulate you on a real good set, at a price within range of an ordinary pocket.

Yours faithfully,

E. VERSEY.

In cases where reaction is extra lively and the '0003 mfd. capacity therefore seems too big, there is no objection whatever to using a smaller value, as mentioned. But for most conditions, the '0003 mfd. is better, so we still recommend it as being the correct value for most circumstances.

### THE FADING OF FOREIGN STATIONS.

A large number of new "P.W." readers who are now making their first practical acquaintance with foreign station programmes through building "P.W." Sets,

(Continued on next page.)

## IS YOUR SET BEHAVING ITSELF?

Perhaps your switching doesn't work properly? Or some mysterious noise has appeared and is spoiling your radio reception? Or one of the batteries seems to run down much faster than formerly?

Whatever your radio problem may be, remember that the Technical Queries Department is thoroughly equipped to assist our readers, and offers its unrivalled service.

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

A postcard will do. On receipt of this an Application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form, you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS, PLEASE NOTE: Inquiries should NOT be made by phone or in person at Fleetway House or Tallis House.

instead of increases the volume. All the other controls on the set do the opposite, and decrease when turned to the left.

"So I have schemed it out, and it seems to me that if I change over the wiring of the potentiometer's end-terminals, leaving the slider as it is, I ought to get the opposite effect on turning the control. But I don't want to do it just for the sake of making all the controls act alike, and find I am running my grid bias out, or something like that. Would it be O.K. to reverse?"

The mere reversal of the leads which go to the ends of a potentiometer will not do the slightest damage, as it is exactly equivalent to the former

### "P.W." PANELS. No. 117.—HUIZEN.

The Dutch long-wave station at Huizen operates on a wavelength of 1,875 metres with a power of 8.5 kilowatts.

As mentioned in last week's "P.W." Panel, it exchanges programmes with Hilversum every three months, but from April 1st until June 30th Huizen is working on its own wavelength, given above.

The announcement is usually "Hier Huizen," by a man, and the closing words "Wel te rusten" mean "sleep well."

Distance from London 236 miles.

## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

appear to be greatly puzzled by the fact that foreign programmes often "fade." The effect is quite a common one, and the following typical letter on the subject illustrates how the set-builder himself usually regards the matter.

### A Fine Set.

Written by a Bermondsey reader, Mr. E. W. P. it says:

"I must write and thank you for the wonderful set I have just completed, i.e. the 1933 'Four.' I have built many 'P.W.' sets, including the 'Magic' and 'Cosmic,' which were both excellent; but I think the above set is the simplest I have ever constructed or handled.

"I cannot speak too highly of it; suffice it to say that I tuned in 28 medium and five long-wave programmes within a few minutes of putting it in the cabinet (without touching the trimmer). Since then I have pulled in over 40 stations at loudspeaker strength.

"I may add that gramophone reproduction is perfect. The only fault I have to find is that now and again I am troubled with fading. Perhaps you will be kind enough to let me know how I can remedy this fault, and make the 1933 'Four' a hundred per cent.

"Thanking 'P.W.' and Mr. Dowding for the most amazing set I have ever built."

Many other letters have described these fading effects in detail—how at first the programme was heard at quite good strength,

## DO YOU KNOW—

the Answers to the following Questions?

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

- (1) What system of low-frequency amplification requires about double the normal grid bias?
- (2) Which country has recently emulated Germany in "signing off" with Haydn's hymn-tune?
- (3) What is the effect of heat on the resistance of a copper conducting wire?

and how, when a final touch on tuning or reaction had been given, it was "as strong as the local station," or "just like being in the hall in Vienna"—phrases which indicate really excellent reception.

But then fading begins. Without anything being touched on the set—and, incidentally, the same thing happens on all sets alike—the strength seems to fail, the delightful foreign programme gets weaker and weaker, and eventually, perhaps, it cannot be heard at all!

### How it Happens.

Some listeners have found, too, that if they do not then touch the set, but simply wait and leave everything adjusted exactly as before, the programme may reappear after a time. And from being just recognisable at first it grows and grows in strength until it again "comes up like a local"; and all this without any adjustment being made to account for these striking differences in strength.

The effect, aptly called fading, is one which cannot be cured, or even alleviated, except by the automatic volume control systems adopted in some of the very latest

(Continued on next page.)

## THE ECONOMICS OF RADIO

What Your Set Will Cost You  
Every Year.

By T. P. BLYTHMAN, B.Sc.

It is interesting and instructive to work out the running costs of a wireless receiver and the results will compare very favourably with any other form of entertainment. Let us see how we can do it.

In the first place, we must assume that the set will be in operation for a certain number of hours a year, and a suitable number to choose is 800—that is, a little over two hours a day.

We will not include the cost of the receiver, as that would not give us a good idea over the space of a year, but let us assume it is a typical three-valve set, run from batteries.

Costs of high-tension batteries, charging the accumulator and, shall we say, the replacement of valves after a year's use will be the principal items to charge for.

The high-tension current used for such a set we shall put at 10 milliamps. A battery to give this current will probably have a life of about 250 hours; therefore, we shall require three such batteries. Super-capacity batteries will cost us about £1 each, this totalling £3.

For low tension, we shall probably be using a 2-volt cell giving twenty amp. hours. The valves in the set will take about ½ amp. and, therefore, one charge will last forty hours. The accumulator will have to be recharged twenty times in the course of the year; this, at sixpence a time, comes to 10s. Our total cost is now £3 10s.

Two new grid-bias batteries will be needed in this time if we wish to keep up the good quality that we have to commence with; and, at 1s. a time, this adds 2s. to our total, about 250.

### The Grand Total.

The other item is the possible replacement of valves, for which we can allow £1 8s.—the approximate cost of a detector a low-frequency and a power valve.

The grand total of this is £5. For this we pay 10s. licence, and so we have 800 hours of pleasure for a cost of £5 10s. Dividing this total by 800, we have the cost per hour to be a fraction over three-halfpence.

Compare this with the cost of cinema and theatre visits. True, we should not spend 800 hours in such entertainments, nevertheless, if care regular fans we should soon spend this sum in visit to places of amusement. The figures given are, of course, only examples to show the method of working out the costs.

Readers will be able to substitute their own figures for these.

## BASEBOARD SPACING

A Reader's Experience.

The Editor, POPULAR WIRELESS.

Dear Sir,—We all know how exasperating it is for raw beginners to lay out components as per blue print. My first set was laid out in this manner, having a full-size blue print I pinned it on the baseboard with a sheet of carbon paper beneath it and traced the various components direct on the baseboard. It was then just a matter of screwing them down in place to get perfect spacing.

Yours faithfully,  
V. H. JOHN.

P.S.—If the "Airsprite" beats the "Comet 3" for range and selectivity it must be the peak of perfection.  
Port Talbot, S. Wales.



Graham Farish says:  
**"You can't do better than follow the Technicians"**

After all, they wouldn't specify 'Graham Farish' unless they knew. They've tested my components—built sets round them, and these sets have gained world-wide renown. Unless 'Graham Farish' stood for

something superlatively good, constant approval of these Technical Editors would not be given so freely.

**S A F E MAXIMUM CURRENT CARRYING CAPACITY OF "OHMITES"**

100°F. Temperature rise. Ohms	Milliamps.
1,000	40.
2,000	35.
3,000	29.
4,000	24.
5,000	20.25
10,000	12.
20,000	8.
30,000	6.75
40,000	6.
50,000	5.5
60,000	5.
80,000	4.24
100,000	3.5

Other values pro rata.

**HEAVY DUTY TYPE APPROXIMATELY DOUBLE THE ABOVE RATINGS. PRICE**

**2/3**



For those who prefer interchangeable and convenience in mounting, holders are available, vertical and horizontal, 6d. each.

**1/6 EACH**

## Graham Farish SNAP H.F. CHOKES

Of new design, wound to give high impedance on long and medium wave-bands. Has small self-capacity with large inductance. Totally enclosed in moulded case.

The "Ferrocart B" Portable requires 1 Snap H.F. Choke.

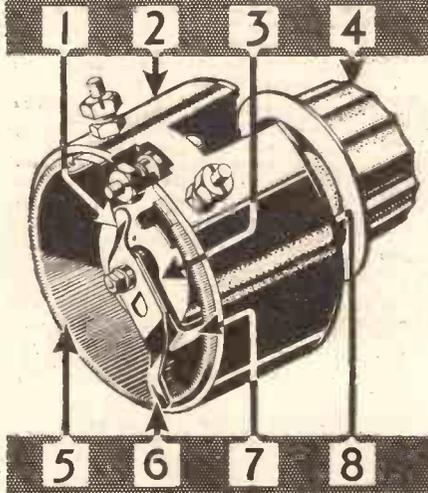


Every Wireless Enthusiast should send a postcard for a copy of the G.F. Component Book and Station Tuning Chart.

GRAHAM FARISH LTD., Mason's Hill, Bromley, Kent.  
Export Dept. 11-12 Fenchurch Street, LONDON, E.C.3.

**2! EACH**

# VOLUME CONTROL POTENTIOMETERS ARE WATMEL SPECIALITIES



THE WATMEL POTENTIOMETER TYPE I

It is obvious that if a firm concentrates on one type of component, it is going to turn out a better job of work than a firm that dabbles in many.

This year we are concentrating on potentiometers, and you may rest assured that when purchasing a Watmel potentiometer, you are obtaining the very best from a firm that specialises in this type of component.

This resistance is wound on a non-shrinkable former which gives perfect contact. Note the points:—

- 1 Back self-cleaning contact.
- 2 Bakelite case, protects winding.
- 3 Large contact plate.
- 4 Polished easy grip knob.
- 5 Wire wound former (not compound with wire contacts).
- 6 Contact finger, phosphor bronze.
- 7 Positive stop.
- 8 One hole fixing, brass bearing bush, resulting in perfect bearing.

Any resistance up to 50,000 ohms, **5'6**

If you cannot get this component from your local dealer, write to us and we will send what you require within 24 hours. Write for Catalogue.

**Watmel**  
COMPONENTS  
GET THE BEST OUT OF ANY SET  
WATMEL WIRELESS CO. LTD  
IMPERIAL WORKS, EDGWARE, EDGWARE O323

M.C.87.

## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

variable-mu type sets. On the ordinary straight forward set of reasonable price such fading is always liable to occur, but only when the set is receiving over comparatively long distances.

Therefore, listeners do not notice true fading effects occurring with their local B.B.C. stations, although South of England listeners will often notice fading on, say, the North Regional or North National, or on the Scottish programmes.

And the reason that nothing can be done about it on ordinary sets is that the cause of it lies right off the earth. The explanation is interesting. To put it briefly, at distances variously estimated at sixty miles and more above the clouds there lies a conductive layer surrounding the whole globe, and this acts as a kind of reflector, bending back to earth

### THE ANSWERS

TO THE QUESTIONS GIVEN ON PAGE 119 ARE GIVEN BELOW.

- (1) Quiescent push-pull (Q.P.P.) amplifiers are worked under conditions of this kind.
- (2) Austria.
- (3) Heat always causes the resistance to increase.

DID YOU KNOW THEM ALL?

the wireless "rays" which reach it from the stations far below. (The effect is something like a mirror reflecting a ray of light.)

This reflecting layer is not constant, but is liable to move, and consequently the strength or direction of the reflected wave, or ray, is liable to vary. And, moreover, as different rays from one station may be reaching an aerial by different routes, they may tend either to assist one another, or to oppose one another, or to alternate between these two conditions, according to how the reflection from the layer is occurring.

Thus the receiving set is in no way to blame, nor is the sending station. The effect is not under control at all, and although, no doubt, it will eventually be overcome with comparatively inexpensive apparatus, at the present state of the radio art the only thing the listener to the very distant stations can do is to be philosophic about it.

## THE LISTENER'S NOTEBOOK

(Continued from page 92.)

The "Should They Be Scrapped?" series goes on from strength to strength, each successive debate seeming to be even better than its predecessor. The series clearly shows that debating before the microphone can be very entertaining to the listener.

Whether it is the personalities themselves, or the subjects under discussion in this series, the fact remains that these debates are on a much higher plane than those of last year. Do you remember a debate on Free Trade, some time ago? The point is that we are hearing debates now.

Last year's efforts were only debates so-called, the alleged debaters hardly ever coming to grips.

I am not quite certain whether the second act from "The Middle Watch," broadcast on the Midland Regional, could be called a success. I happen to know the play very well, so I had no difficulty in following the sequence of events.

At the same time I have doubts whether anyone, hearing it for the first time, would appreciate the humour of the several situations following the Admiral's unexpected arrival on the scene. The act had to be cut, of course, but if I had had the job of cutting, it would not have been done as Charles Brewer did it. I would have cut very little of the dialogue after the Admiral's appearance.

As it was, things moved much too rapidly, far too rapidly for listeners to visualise what was happening at this stage.

I know the girls have to be pretty slick in their movements (that's where the fun comes in), but listeners must be able to follow these movements.

A little hold-up in the action by the interpolation of some dialogue would have given the opportunity necessary for taking stock of the situation and for preparing for the next stage of the development.

However, in spite of this criticism, the act wasn't a failure by any means, and I hope the B.B.C. will be encouraged to repeat the experiment and give us all three acts of a similar play (adapted, of course) next time.

I suppose it is only to be expected that religion should share the fate of the many other things that are discredited these days, and in its turn be publicly attacked. I don't know how many converts Professor Julian Huxley hoped to gain as a result of his lecture on "The Future Life."

Personally, I think it will take more than one lecture to cause the masses to abandon beliefs that have been such a blessing and a consolation to man down the ages—and still are. People may come to believe the truth (whatever that is) eventually, but I fancy it will have to be something at least as comforting as that to which they pin their present faith.

## MIRROR OF THE B.B.C.

(Continued from page 92.)

has also about 4,500 wireless plays in the Dramatic Library.

### Flowers for B.H.

A glimpse of Broadcasting House from Upper Regent Street, or from a side turning, inevitably leaves one with a vivid impression of the floral decorations and window-boxes. Sometimes the boxes appear as a streak of red, sometimes a line of pink or yellow, according to the flowers which are used. A little while ago I noticed people stopping in the street to admire the magnificent array of hyacinths. At the same time some of them remarked on the latest decoration of all—Prospero and Ariel—which reminded me that Eric Gill, who hewed Prospero and Ariel from a half-ton lump of rock, is the brother of Lady Allen of Hurtwood, who chose and arranged the display of hyacinths.

Lady Allen, as a matter of fact, regularly attends at Broadcasting House to select and order the floral decorations, but at the moment there is no further scope at the B.B.C.'s headquarters for her brother's talent.

## NEXT WEEK

"P.W." Presents—

### THE FIRST HOME-CONSTRUCTORS' AUTOMATIC RADIOGRAM

#### More Parades.

Even those who swear by as well as those who swear at Philip Ridgeway and all his works will be surprised at the statement that sales of five consecutive gramophone records made by Mr. Ridgeway reached a total of nearly 774,000 over a period of thirteen months.

This is certainly proof of the popularity of the type of entertainment which Mr. Ridgeway has developed, and it will also please his many enthusiasts to learn that further Ridgeway Parade programmes are to be broadcast on Monday and Tuesday, April 24th and 25th. That on April 25th will be heard on the Regional wave-lengths, and it will go at the same time in the Empire programme for the African Zone.

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**50% CHEAPER  
25% BETTER**  
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**D.C.1** 25 mA. OUT-PUT. For 150v. or 230v. Mains **22/6**

**10/-** Deposit and balance monthly, will secure any Bullphone Eliminator. Ask your local dealer for particulars or write direct to address below.

### UNSOLICITED TESTIMONY.

14, Stamford Close, Southall, Middlesex.  
Dear Sir,  
I have received the A.C.2 Eliminator quite safely. It is very satisfactory and the Trickle Charger works excellently. It has made a big difference to my Set, and is good value for my money.  
I thank you for the attention you gave my order and will recommend my friends to use Bullphone Products in the future. I might add that there is no trace of Hum in the Unit.  
Thanking you, I remain, Yours sincerely,  
Mr. W. Lounton.

43, Portland Street, Norwich, Norfolk.  
Dear Sirs,  
I purchased one of your Eliminators, model A.C.1, to run my S.T.400 Set, and I have yet to hear a smoother and better Eliminator even at double the price. Four tappings and enough power to work a large power valve is a splendid example of real value for money.  
Thanking you, I remain,  
Mr. E. J. Parkinson.

11, Aldborough St., Blyth, Northumberland.  
Dear Sirs,  
The A.C. H.T. Eliminator arrived intact, and having fixed up on my 3/1 Valve Set, find it in good order. It has done all that you claim for it, being very smooth and silent, with ample reserve power. Thank you for an excellent unit.  
Yours faithfully,  
H. Budd.

The Technical staff of "Popular Wireless" highly recommend Bullphone Eliminators and components for all their circuits.  
Don't be put off with any other make. There is no other as good, not at double the price. If your dealer cannot supply send direct.

# BULLPHONE DRADIO

NEW NORTH RD. BARRINGSIDE, ESSEX  
PHONE CHIGWELL 162

## THE LINK BETWEEN

(Continued from page 96.)

"P.W." readers can obtain copies of the blue prints free of charge on application to Messrs. Radio Instruments, Ltd., Croydon, Surrey, but kindly note that a 2d. stamp must be enclosed with every application to cover the cost of postage. Do not forget also to state definitely the set in which you are interested.

In passing, it may be of interest just to mention that similar conversion blue prints are also available from R.I., for the Osram "Music Magnet," the Cossor "Empire Melody Maker" and the Mullard "Master Three."

### For Overseas Readers.

Las piezas componentes de Graham Farish no necesitan presentación alguna al constructor de radio experimentado.

Quite so. But do not be unduly alarmed at my lapse into a foreign tongue! It is just an old Spanish custom, or at least, it is the Spanish way of telling the world in general that the experienced radio constructor needs no introduction to Graham Farish components.

I could tell you the same thing in German or French, not because I am an expert linguist, but because I have just received copies of the Graham Farish catalogue in four different languages.

To have gone to the extent of having their catalogue printed in four different languages is a most enterprising effort, and I am confident that the firm's increase in export business resulting from this move will amply justify the effort. Anyway, best of luck, Messrs. G. F. A splendid idea.

### A Changed Name.

In order to avoid confusion with the similarly named products of another company, a change has just been announced in the name of a famous Telsen Kit Set.

In a statement issued by the company, the position is clearly set out as follows:

"In view of the fact that we find that the words Astral, Astrala and Strala, which we have used in connection with our kit sets, may be confused with

### OUR POSTCARD SERVICE

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

the trade mark, "Astra," of the Emkabc Radio Co., Ltd., we have discontinued the use of these words, and the kits to which these words were formerly applied will, in future, be known as "Telsen 325 Star."

Will "P.W." readers kindly note?

### Everybody's Doing It.

Roughly about fifty per cent of my trade correspondence this week bears some reference to "Q.P.P.," from which I deduce that the interest is by no means falling off. On economic grounds, it is safe to assume that the manufacturers would not have gone so wholeheartedly into the matter unless the public demand justified such a course.

One letter in particular that I have singled out for attention comes from Messrs. H. Clarke & Co. (M.C.) Ltd., and it contains the news that a special "Atlas" eliminator has recently been produced for use with sets employing "Q.P.P." output.

Frankly, I could not at first see the use of a special mains unit for a scheme that is successful mainly because it enables a "mains" output to be obtained from batteries. Why use "Q.P.P." if you are fortunate enough to have mains on the premises?

But now I see that there is an application in which such a unit might have a wide appeal, and "Atlas" as usual, have jumped to it.

I believe there are still a number of people who use battery sets by choice rather than through force of circumstances, and it is in this respect that the new "Atlas" eliminators are likely to find a ready market. Incidentally, interested readers can obtain further details of these new "Q.P.P." eliminators (for A.C. and D.C.) under "Q.P.P.'s" postcard scheme. (No. 29)

### Q.P.P. Reproducers.

As this issue goes to press I learn that R. and A Ltd. are producing special permanent-magnet moving-coil reproducers for "Class B" amplifiers, the transformers having been correctly designed to meet the individual requirements of the valve concerned, not modified from existing types.

I hope to give further details in a forthcoming issue of "P.W."

# Easy Terms

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  - TELSEN "325 STAR." Complete Kit of Parts with Blueprint and Instructions, but less valves and cabinet. Cash Price, Carriage Paid, £1/19/6. **With 5/6 order.**
  - TELSEN "SUPER 6."—Complete Kit of Telsen Parts in Sealed Carton. Cash or C.O.D., Carriage Paid, £5/18/6. **With 10/10 order.**
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P.W. 1/4/33

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**IGRANIC COMPONENTS**

**WILL TELL YOU HOW GOOD THEY ARE**

**TECHNICAL NOTES**

Some diverse and informative jottings about interesting aspects of radio technique.

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

**Where Does Earth Start?**

I HAVE often noticed a tendency amongst experimenters, even those who have had a good deal of experience, to regard the earth lead as though it were all at zero potential and as though it didn't matter what sort of wires came into proximity with it.

Now this is quite wrong, because in point of fact the earth lead is really part of the aerial-earth system. In fact, it is quite an arbitrary definition to say that if you insert the wireless receiver, or more accurately the aerial coil, into the aerial at a certain point, then the part on one side of the coil is to be considered as the aerial, carrying oscillating electrical currents and potentials, whilst the part on the opposite side of the coil is to be considered as the earth, all at zero potential.

Obviously this is quite wrong, and what actually happens is that the oscillations of potential and the oscillatory surges of current take place throughout the whole of the aerial from the upper end to the part which is buried in the earth. You are, therefore, getting electrical oscillations in what you call the earth lead, just as you are in what you call the aerial proper.

**D.C. and High Frequency.**

In the ordinary way, if you were dealing with direct current and the earth lead consisted of a thick copper conductor of very low resistance, then the difference of potential between one end of it and the other might be so small as to be entirely negligible. But in radio work you are dealing with oscillatory currents which must oscillate throughout the whole length of the aerial-earth system, and it doesn't do to assume that the earth conductor is always at zero potential at the part in the region of the set itself.

The need for caution in this matter is still further emphasised by the fact that most earth leads, so far as I have seen them, consist of wires of not particularly low resistance.

**Long Earth Leads.**

I mention all this because the other day I came across a case where a set was used with rather long earth lead and this earth lead was running parallel with the mains leads to the set. In fact, it was tacked down by means of the same staples.

The set was picking up mains hum, crackle and all kinds of things and the owner of it was puzzled because, as he explained, there could be no possible harm in putting the earth lead in proximity to anything else because it could not possibly pick anything up.

**Those Mains.**

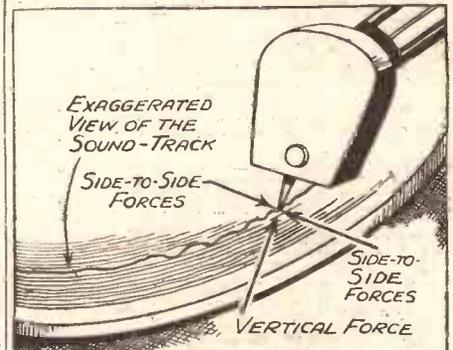
When, however, we removed the earth lead away from the mains lead, made it shorter, and used thicker wire, the trouble disappeared entirely, showing once again that the earth lead is to be regarded as a "live" part of the aerial circuit.

It is for reasons such as these that you are always advised to use a good earth and to make the earth lead as short as possible and of good stout conductor. A long earth lead, of fine-gauge wire, trailing about all over the place before it reaches earth, will get you into all kinds of trouble.

**Gramophone Record Wear.**

There are still many people who seem to be under the impression that a pick-up causes more wear and tear on the record than an ordinary acoustic soundbox. I often get letters from readers about this, but I must say that I never can quite understand how the impression continues because, of the two, it would seem that the pick-up ought to be lighter on the records than the soundbox.

Remember that an ordinary soundbox, quite apart from the question of the actual weight bearing on the record, derives the whole of its energy from the motion imparted to its diaphragm by the movement

**FROM SIDE TO SIDE**

The question of record wear is an important one to all pick-up owners, who will find Dr. Roberts' remarks under this head of special interest.

of the needle in the track; in other words, the whole of the work of producing the sound (and also a great deal of work which is wasted in the process) has to be done by the poor old record. Now with a pick-up this is not the case.

**Wagging the Armature.**

All the record has to do is to waggle the armature system of the pick-up, in accordance with the waves of the sound track, and the work involved is (or may be) very much less than in the case of a soundbox.

Once the movement of the pick-up armature system has been established and is giving rise to signals which are fed into the amplifier, the amplifier does the rest, and I think it is fairly true to say that by far the greater proportion of the energy of the output from the loudspeaker in this case is supplied by the amplifier, and not by the pick-up at all.

**Pick-Up or Soundbox.**

So you see it is rather important to distinguish between the wear and tear which

(Continued on next page.)

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## TECHNICAL NOTES

(Continued from previous page.)

is due to the *direct* pressure of the needle perpendicular to the record, and the wear and tear which is due to the rubbing of the needle against the sides of the track—or, to be more exact, the rubbing of the sides of the track against the needle. The former type of wear is *likely* to be less with the pick-up, but the latter type is almost *certain* to be less with the pick-up than with the soundbox.

I think the idea really dates back to the earliest forms of pick-up, which were rather cumbersome and heavy affairs, when no doubt a good deal of wear and tear on the record took place. But some of the better class modern pick-ups are well designed and beautifully made, and it is difficult to imagine any device for picking out the sound from the record which will cause less deterioration than these.

### Crackles.

I was saying something the other day about trouble with crackles and other interference in a radiogram, and I have had several letters from readers on the same point. Only a day or two ago I had another instance of the same kind with an all-mains receiver with a change-over switch for long and short waves. This set sometimes worked perfectly and at other times gave rise to most frightful crackles which were extraordinarily hard to trace. Sometimes it would do it and sometimes it wouldn't: you know the sort of thing.

By the way, when you get that kind of effect, where the trouble is sometimes definitely present and at other times definitely absent—that is, where you do not get any half-and-half effect—you can almost invariably suspect bad contacts, especially in switches. That is fairly obvious when you come to think of it.

Sometimes the switch will make good contact, when you get no trouble at all, and sometimes it will make bad contact, when you will get any amount of trouble.

In the particular case I refer to we found after fiddling about for quite a long time that the trouble was due to the wave-change switch which was making bad contact when pushed over to the long-wave position. I have several times found wave-change switches to give this sort of trouble, so if you experience anything of the kind you will know where to look.

### Absorption Effects.

I am often told by my readers that they get "absorption" effects, owing to a powerful set in a neighbour's house mopping up all the signal energy in the vicinity. This is a sort of converse effect to the re-radiation which you occasionally experience where a set will re-radiate and make it difficult to cut out some particular transmission.

There seems to be no doubt about this absorption effect and, in fact, I have even noticed it with different sets in the same room. If you have two different indoor aerials in the same house operating two different receivers you can often notice pronounced absorption effects. As you tune one of the receivers the volume from the other receiver will die away quite noticeably.

(Continued on next page.)

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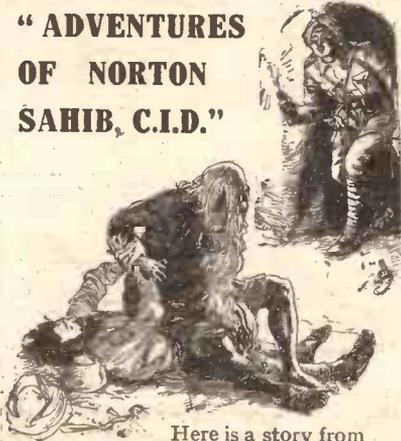
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## TECHNICAL NOTES

(Continued from previous page.)

Of course, in this so-called "absorption" effect must be included the inter-effects of tuning, capacity effects and no doubt many other things. At any rate, whatever name you may give to it, the fact remains that it acts as an "absorption" effect inasmuch as it robs the second receiver of its output volume.

### With an Observer.

By the way, if you are making tests of this kind with two receivers in the same room you will find it necessary to have another observer standing close against the loudspeaker of the second set because it is impossible, when you are adjusting one receiver with a loudspeaker close by your ear, to judge variations in the volume of another speaker some distance away.

## MAKE YOUR OWN SLOT MACHINE RADIO

(Continued from page 95.)

insulated from it by drilling a fairly large hole in the tin and placing a cardboard or fibre washer each side as shown. A terminal is passed through the whole and tightened up, making sure no contact is being made between this terminal and the tin.

Insert a penny and see if it can fall so that it is held by the two guide pieces securely and can press the two contact pieces tightly together.

### Sets Itself In Use.

If the penny falls in between the guides and drops to the bottom of the tin, or if it is held by the guides, but they will not allow it to put its weight on the contact pieces, bend the guides towards or away from each other slightly until correctly adjusted. This will, of course, have to be done only once, as afterwards it will set itself correctly after use.

Now push the lever over and "C" will come back away from the other guide and allow the penny to drop through and break the contact again.

Another hole is drilled where shown, and a terminal is mounted directly to the tin, no insulation being used in this case.

All that now remains to be done is to solder a short flex lead to the shaft or axle of the movable contact piece and solder the other end to the tin as shown.

### Connecting Up.

To connect up, disconnect the wire that goes to the negative terminal of the accumulator and join this instead to one of the terminals on the relay. Then join the other terminal on the relay to the negative terminal of accumulator. The switch on the set must be put in the "on" position, although the set will still remain off unless a penny is put in the slot.

If the set goes on without any penny in the slot the terminal "K" is not insulated from the case, and must be properly insulated.

If all is in order, however, when a penny is inserted in the slot the set will be put on, and when the lever is pushed over the set is put off.

It is a good idea to make a practice of dropping the penny every night before retiring, but, of course, the penny can be dropped at the end of each programme if desired.

Do not, however, be tempted to leave the penny in day after day, or nothing will be saved towards the batteries!

### Without Any Attention.

If the foregoing instructions are carried out with reasonable care there is no reason why any difficulty should be experienced when making this relay, or why it should not work for a very long time without any attention whatever—except putting the money in, of course!

## THE "AIRSPRITE" THREE

An extremely interesting letter from  
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Dear Sir,—I am pleased to report that the "Airsprite" is working excellently, and I can now support without any reservation the encomiums which have, from all quarters, been deservedly showered upon the "A.T.B." circuit.

The trouble was due to a cause I should never have expected. The fact of volume dropping practically to inaudibility when the .01 condenser was switched into circuit caused me to suspect either the transformer or the condenser. Your very helpful letter confirmed this idea, and upon testing the condenser I found a direct "short" through it. A 9-volt grid-bias battery in series with the condenser and a voltmeter showed the full 9-volt reading on the latter! The temporary substitution of a .002 fixed condenser immediately rectified the original trouble. I have since experimented with condensers of different values from .0005 to .01. With one speaker (roed type, which has a decided tendency to "boom") I found a .005 gave the best result, but with the moving-coil speaker the .01 as specified is best.

I was particularly pleased with the results from the pick-up, the quality being excellent and the volume tremendous. Volume control on "gram." work is absolutely essential.

This is my first venture with high-frequency amplification since the early days of "neutralisation," and I am now convinced that the answer to the old controversial question, "Is H.F. worth while?" is a decided affirmative.

The number of foreign stations obtainable on the "Airsprite" (three-valve), without any reaction, is truly amazing, and I am afraid to tell any one of the total number of stations I have logged for fear of losing my reputation for veracity!

I found a difference of about 12 degrees (average) between the readings of the two condenser dials, the H.F. tuning condenser showing the higher reading. I overcame this, however, in a simple manner which I am describing separately and submitting as a "Wrinkle."

I am afraid this letter is becoming somewhat lengthy, but before I close must pay a tribute to the rock-like stability of the "Airsprite." I have, for convenience sake, made a departure from the blue print to the extent of bringing on to the front panel both the "on" and "off" switch and the jack (instead of terminals) for the pick-up; placing them in a line with, and on each side of, the wavechange switch.

This preserves the symmetry of the panel layout, and makes the lead from the jack to the grid of the detector valve only half an inch in length. Moreover, as I have only two variable tappings available on my H.T. eliminator, I have connected the screening grid to one and the anodes of all three valves to the other, breaking down the voltage to the detector valve from 140 volts to (what?) by means of a 30,000-ohms resistance in series between H.T. and transformer, and with a 2-mfd. condenser to act as a by-pass to earth, in order to prevent any unwanted coupling.

Despite these liberties with the wiring, however, the set is perfectly stable, even with the screening covers of the coils removed!

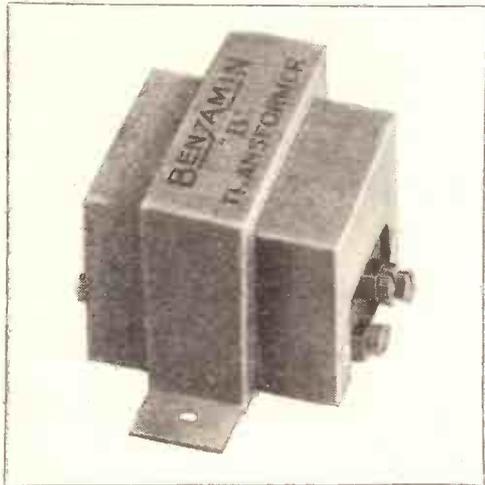
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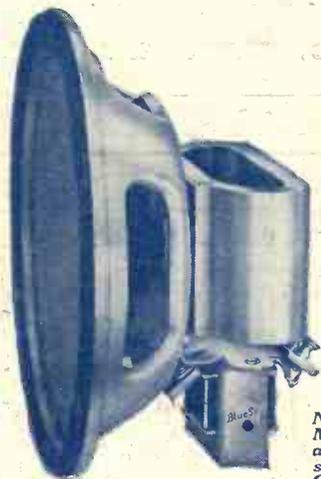


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## 59/6



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