

# BROADCASTING THE DERBY (SEE PAGE 303)

## THE SUPERHET EXPLAINED

# Popular Wireless

No. 826.  
Vol. XXV.  
June 2nd,  
1934.

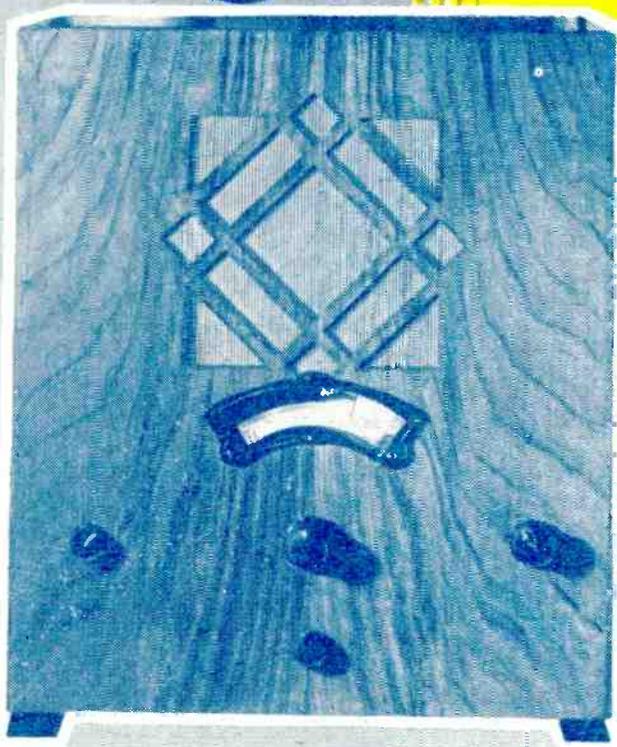
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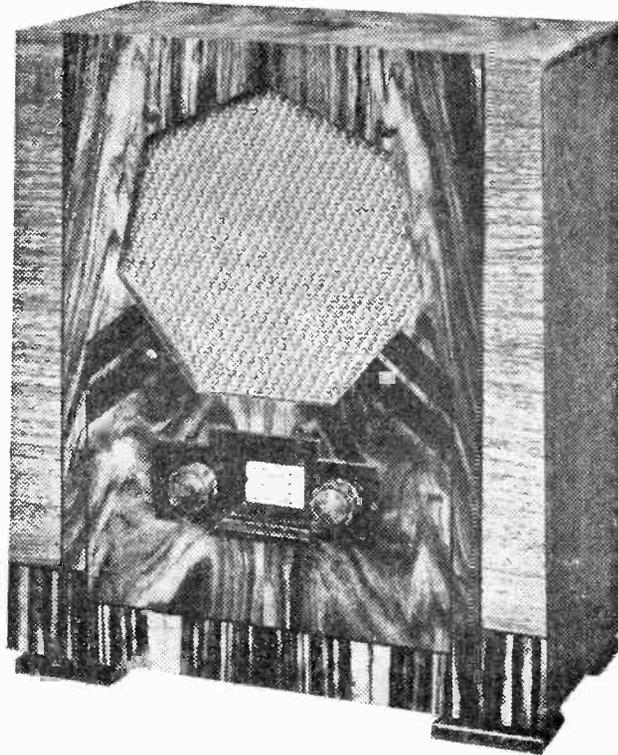
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.....

# POPULAR WIRELESS

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

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

Technical Editor: G. V. DOWDING, Associate I.E.E.

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Assistant Editor: A. JOHNSON-RANDALL.

Chief of Research: K. D. ROGERS.

**OUR BIRTHDAY  
BATTERY GOLD  
A LIVELY BOOK  
THE NOISY WORLD**

## RADIO NOTES & NEWS

**"LAYER BUMPING"  
A GRACEFUL ACT  
RADIO ON SHOW  
ANOTHER SOCIETY**

### How Time Flies!

IT was on June 2nd, 1922, that all the go-ahead newsagents of this country were displaying on their counters a new journal they had just received. It was called POPULAR WIRELESS.

Twelve years ago! And twelve hours later the said newsagents were unanimously shouting, writing and phoning for MORE, whilst their assistants were explaining for the umptyninth time, "Sorry, sir, sold out!"

I wonder how many of my present readers will remember that historic "P.W." Number One.

### From Unidynes to Heptodes.

WE have covered some ground together since then, haven't we? Unidynes and filadynes, reflex circuits and combination sets, oscillating crystals and vacillating television. We have had diodes, triodes, tetrodes and pentodes in every conceivable combination, and now we welcome heptodes and the rest of 'em with enthusiasm.

Many of our readers, starting from scratch, have acquired a remarkable degree of technical skill and a knowledge that has amazed the scientists working in the same fields.

And, best of all, our hobby hurts no one and has been a source of delight to untold thousands.

### Another School for Broadcasters.

MR. MAURICE ELWIN, who has opened studios at Steinway House, is making a speciality of training in the technique of the "mike." His studios have been fitted by Philips Industrial, a subsidiary of the lamp and valve people of that name, with amplifying gear.

The pupil sings into a "mike" and Mr. Elwin hears him (or her) through a loud-speaker. Even when accompanying at the piano Mr. Elwin hears the singer's voice through the "mike," because he then wears headphones.

### Original Thoughts.

WHY, what has happened to our Dinwiddie, Regional Director of the Scots, erstwhile student of theology, and D.S.O., M.C.? Or is Scottish reporting doing him less than justice?

In an Edinburgh newspaper I read that he told the Kirkealdy Rotary Club that the time was rapidly approaching when the wireless set would be considered an essential piece of furniture. And that broadcasting would take a very big place in the life of the future. And that broadcasting had come to stay.

### OUR RADIO PLAY COMPETITION

The result of the POPULAR WIRELESS £50 Radio Play competition, together with the judge's comments, will be published in "P.W." next week.

Well, Kirkealdy is now well informed and has reached the 1923 stage. Let us be thankful that they were not told, "Radio is in its infancy!"

### Ariel is Almost Surprised.

MY godfathers! It's well-nigh incredible. Yet here is the letter, and the man seems to be serious enough, too. Thrilled, yet incredulous, about my Note

### PASSED—WITH FLYING COLOURS!



Master Peter Dowding enjoying a programme on a model of the "Popular Wireless" Midget Portable, the description of which is continued in this issue.

on the deleterious effect of gold and platinum, radium and diamonds, in accumulator acid, a denizen of Dundee writes: "... and it's certain sure there cannot be gold and all that in the acid, else how could they vend it at the current price?"

Having pattered through the War, the Peace and Marriage, I thought that nothing could now surprise me. But I am not now so sure of myself.

### It's Not Business.

SO "In Town To-night," one of the most promising weekly features ever introduced by the B.B.C., is to stop during the summer.

The B.B.C.'s theory is that because it is popular we must not be allowed to become satiated with it. Some radio columnists agree with that, but not so Ariel. It is just darned bad business.

There is not much chance of our being satiated with good things in the programmes; moreover, this item lasts only half an hour and appears only once a week.

The decision to discontinue it will probably be maddening to all those listeners who liked it, and I should think that they are legion.

### A Joyous War Book.

A WAR book which contains no horrors of the major degree, but which is the fruit of a sense of humour combined with an observant and philosophical mind—that is "War, Wireless and Wangles," a modest paper-covered, half-crown book written by E. W. B. Gill (Major, R.E., retired).

If you were a wireless worker during the war this book will appeal to you with a special force; if you like stories of the type of that one about the War Office sending a cargo of sand to Egypt, note that this book is full of them.

If you want an hour of wholehearted chuckling, here's your chance!

### Marconi and Broadcasting.

LIKE the clear thinker that he is, the Marchese Marconi harbours no illusions about that use of his invention which is commonly known as broadcasting. Apart from having snoothed the technical

(Continued on next page.)

## "Every Omelette Requires So Many Ruined Eggs"

way for others, he personally is not responsible for what he terms "this turning our planet into a sort of barrel organ among the silent stars," and, judging from a recent interview which he gave the "Morning Post," he is a little dubious about broadcasting.

### The Indifferent Ether.

**SAID** Marconi: "Like all the inventions of man, it is put to uses noble and ignoble, noxious and beneficent. The ether absorbs indifferently music almost divine and the animal whine of jazz singers and jazz bands. If the angels can listen in they must derive rather a mixed impression of humanity. . . ."

"Mankind is apt to lose in one direction what it gains in another," he adds, and

### ON THE AIR NEXT WEEK—1

**Victor Hely-Hutchinson** (*Midland Regional, Sunday, June 3.*)

Born thirty-three years ago in Cape Town, the Director of Music to the Midland Region has been on the B.B.C. staff since 1925. For years he was known affectionately to listeners, young and old, in the London Children's Hour, as "Bunny." Hely-Hutchinson is a pianist, conductor and composer—an enthusiast of the modern school. Many of his works have been broadcast, including the incidental music to several radio plays. "Bunny" is married, and has two sons and a dislike of marmalade. He rides a bicycle whenever possible—even in London.

points out that there is a danger of loss of individual effort, such as in singing and playing, and even reasoning, as the result of too much listening to broadcast matter.

### A Veteran Passes.

**LAST** week, when I wrote of the untimely death of "John Henry," I experienced a sense of personal loss, for in the earlier days of broadcasting he was a favourite of my immediate circle, and many a quiet chuckle we had over his passages with Blossom.

I have seen it suggested that he was a "back number"—not a very kind epitaph—and even if that was true it was not through any falling off in his quality, as witness his last broadcast performance. Had he lived he would, I am sure, have confirmed his position as a first-class expositor of the sunshine and shadow of domestic life.

### Talking from "Way Up."

**INTERNATIONAL** rivalry in the matter of bumping the Heavyside Layer in balloons is hotting up. The next step heavenwards is to take place in America, late in June.

Two plucky fellows belonging to the U.S. Army Air Corps are to go up in the largest balloon ever built, a 3,000,000 cubic feet affair, and expect to rise to 15 miles, higher than ever aircraft before

ascended. Some of you may hear the broadcast voices of the two voyagers in space.



### Fees for Playing Records.

**THE** gramophone record makers and the various theatrical interests have come to an arrangement about the fees to be paid for the playing of records in theatres and music-halls.

Provincial and suburban houses which employ orchestras are to pay 6, 9 and 12 guineas a year, and where there is no orchestra 10, 15 and 20 guineas. London West End houses will pay 20 or 30 guineas a year. If it is desired, weekly licences can be taken out for 1 guinea a week.

### Our Puzzling Cousins.

**CONTRADICTORY** mortals, these Americans! Idealists to the verge of sloppiness, they harbour the worst criminals in the world.

Generous, heaven knows! Yet they scratch their palms at the thought of our ducky little surplus and say that it belongs to Uncle Sam—all along o' that debt.

Quite definitely taking no stock in monarchies and sichlike rubbish—yet their delightful ladies love to curtsy at Court!

And, by the same token, those husky fellows at "Little America by the South Pole" did a graceful thing when they broadcast our National Anthem the other week.

They sang it. That means far, far more than just playing it. I went to bed humming "My country, 'tis of thee."

### Wiring is a Serious Matter.

**MY** experiences with wiring executed—executed is the right word, too—by local radio dealers has been so full of sorrow that I felt a thrill when I learned that somewhere in the world (New Zealand) they are "out gunning" for the unskilled and unscrupulous flirter with power mains.

Two radio salesmen there have been fined for installing electrical conductors; one of them put in a radio set within two feet of an earthed electric cooker and connected it to the 3-pin socket on the cooker by 2-core flexible and a 2-pin plug top.

So may all such malefactors go through the hoop!

### The H.M.V. Show Train.

**THE** progress of this remarkable exhibition has been "royal," not only because it has been honoured by a visit from Princess Helena Victoria, but because everywhere it stops the authorities have to keep back the eager crowds lest they should derail the train by weight of numbers.

At Brighton, Councillor J. E. Hay lent for exhibition during the stop in that town

an 1877 phonograph which was the first "talking machine" brought to this country and which was the fourth made by Edison.

### A Bedtime Story.

**AS** a relief from toxic wireless waves let us turn to a report from Boise City, Oklahoma, United States of America, which deposes that a small rail motor-car was driven a distance of seven miles with energy sent by radio.

Assuming that a certain amount of energy is required to drive a train, I do not believe that it matters much whether that energy is supplied by radio or is carried on the train. Every omelette requires so many ruined eggs. Whether you place those eggs in the pan to begin with or throw them at the pan at intervals is of small import, methinks.



### New Branch of A.-A.R. and T. Society.

**THE** South Herts branch of the Anglo-American Radio and Television Society has recently been formed. This branch holds its meetings in Watford, and full particulars may be obtained from the Hon. Sec., 63, Southfield Avenue, Watford, Herts. The programme of the branch includes television demonstrations, tours of stations, etc., and should be very successful. I regret that my time for following my own inclinations is so scanty that it does not allow me to have a peep at some of these jolly conventicles in full swing.

### By the Way.

**ARIEL** wants the B.B.C. to produce a broadcast version of "Tusitala," the play about R. L. Stevenson which was recently performed at the Phoenix Theatre.

### ON THE AIR NEXT WEEK—2

**Reginald New** (*Midland Regional, Saturday, June 9.*)

More than five hundred broadcasts stand to the credit of this organist. Four hundred and sixty-eight of these came from Birmingham, where Reginald had nearly four years of broadcast recitals, and thus held the record for cinema organists. When away from his organ he delights in gardening and in flowers, and plays tennis for exercise. Reginald is thirty-two, and was a regular cinema organist before he was twenty. Next week he will be playing on a "straight" organ at Cheltenham Town Hall, a comparatively new experience both for himself and listeners.

Marie Hall's violin is a Stradivarius, and she has refused £3,000 for it.

The Blackwell Colliery Band was founded in 1893, has had only two conductors since then and has won about £2,000 in prizes.

Tom Whittaker ("Whittie Kerr") is a textile worker and the author of "Death Junction." His first play was broadcast in 1932, two months after he bought his first radio set.

**ARIEL.**

1922.....1934

# TWELVE YEARS OF PROGRESS

"POPULAR WIRELESS" CELEBRATES ITS TWELFTH BIRTHDAY

By THE EDITOR

THE first number of POPULAR WIRELESS appeared on June 1922. That was before broadcasting began in this country. Indeed, the only British radio concerts were weekly half-hour transmissions, devised, compèred and transmitted from Writtle by our Chief Radio Consultant, P. P. Eckersley.

He was then with the Marconi Co., and later he became Chief Engineer of the B.B.C., a position now held by his one-time assistant, Noel Ashbridge.

Twelve years! Over six hundred numbers of POPULAR WIRELESS to place on permanent record all the fever of those early days and all the ensuing quieter but no less important periods of smooth and steady progress!

### Always First.

And always, as now, POPULAR WIRELESS itself right in the forefront, recording events, advising and initiating!

Yes, POPULAR WIRELESS has traditions, but we don't

harp on them or rest on them. In our view, the past is mainly merely interesting, the future intriguing, but the present vital.

Nevertheless, the past has at least this great importance: It has made us what we are. Twelve years of action have equipped us with experience of incalculable value.

How well we use this the reader himself can judge. Perhaps, on such an occasion as our twelfth anniversary, we may be permitted to glance back for a very brief spell.

But let us take just the past twelve months.

Our last birthday number, dated June 3rd, 1933, was in itself something quite outstanding. In it were given the very first details of a receiver using a double-

diode pentode valve. Since then this type has appeared in a very great number of commercial sets and in many home-constructor designs.

There was also the full story of the amazing success which attended POPULAR WIRELESS's 5-metre transmissions from the top of the Crystal Palace tower. A world's record transmission distance for 5 metres was broken on that occasion.

Again, there was an article concerning POPULAR WIRELESS's Cathode-Ray Television Viewer, the first instrument of its kind ever designed for the benefit of the home constructor. Later it was to arouse intense interest at the radio exhibitions of 1933.

All this might have been expected to have left us quite satisfied with ourselves for a few months; but hardly one month had elapsed before POPULAR WIRELESS



Above is a reproduction of the cover of the first issue of "Popular Wireless," which was published on June 3rd, 1922. The principal contents embraced a glimpse into the future by the Editor (including a pictorial forecast of modern television), hints on erecting an aerial, an article on the care of crystal detectors, useful radio terms simplified and a description of "wired wireless."

introduced the first set to use No-Gap coils, with which it was possible to tune from 160 to 2,000 metres without the slightest gap.

One week later came the first permeability tuning receiver to herald a new technique in tuning adjustment.

Yet again a mere week passed before the

announcement of the first International Quality Tests. These were, of course, organised by POPULAR WIRELESS, and special schedules were arranged by the Lisbon station for world-wide reception on short waves with the object of proving the possibility of receiving at good quality on the high frequencies.

### Automatic Tone Balance.

Among the several entirely new circuit arrangements invented and developed in the POPULAR WIRELESS Research Department for use in POPULAR WIRELESS's home-constructor designs special mention must be made of Automatic Tone Balance, which was subsequently acquired for use in commercial sets by the British Licensing Pool.

And so we could go on. This last year of POPULAR WIRELESS activity has certainly been one full of achievement.

But it should not be forgotten that POPULAR WIRELESS covers more than the purely technical aspects of radio.

It also deals with the studio and listening sides of broadcasting, and it possesses a quite unrivalled service for the collection of news and views.

In the latter connection the reputation of this journal is unique. And so good are our sources of information that high B.B.C. officials have been astounded—and annoyed!—to read in POPULAR WIRELESS of developments in their own departments which were thought to be unknown to all save the few privileged participants.



1934

One of the latest mains pentode output valves, the 42 MP/Pen.

There is, of course, a grave responsibility in thus presenting to the public facts which concern the listener closely, but which for some reason or another he is being kept in the dark about. But POPULAR WIRELESS places the interests of the listener and set builder before any vested interests, and that policy is justified by our readers' unstinted approval.

### No Easy Task!

In fact, POPULAR WIRELESS successfully attempts to be the complete radio journal for experimenter, constructor and listener, and, whatever we have been able to do in the past, our endeavours are constantly directed towards the attainment of better "P.W.'s" than the best so far produced. As radio develops, so must our presentation of it continually vary.

And, looking back over only the twelve years, it is obvious that we have no easy task!

## FROM "P.W." No. 1

Broadcasting: "An agreement has been arrived at between the Radio Communication Co. and the Metropolitan Vickers Electrical Co. whereby these firms propose to establish and jointly operate broadcasting stations. Big things are expected of these two firms."

### HOW TO MAKE A CRYSTAL RECEIVER FOR 35/-

From Radiatorial: Q. Can I really hear a man speaking by wireless?  
A. You can. Try it and see.

THE "PRINCE" SINGLE-VALVE RECEIVER, complete with valve, batteries, aerial, headphones, etc £7 17s. 6d.—Advt.

About Your Set: It has been found possible, by using special radio amplifiers, to magnify the received impulses before they reach the detector. Novices, however, are not recommended to use these amplifiers.



1922

A typical "R" class bright-emitter valve.

IF any of you who listened on Whit Monday to a broadcast from the Portsmouth road think it was a "put-up job"—you're wrong!

By the kindness of the B.B.C. I spent that Monday evening with one of the green vans belonging to the Outside Broadcast Department. I helped to conceal microphones in the long grass beside the road. I dived into deep and muddy ditches to dispose of earth wires. I watched the hours of preliminary work which were necessary to make this four-minute item in the Bank Holiday programme a success. I assure you it was all perfectly genuine!

This particular O.B. van, with its shelves of amplifiers and control gear, is seven years old. It has been all over the country—to Aintree for the Grand National, to Aldershot for the Tattoo, to Greenwich for the 1933 Pageant. The driver in charge talks of it like a favourite child. "She's the sweetest-running car I've ever driven," he told me with obvious pride.

#### Preparing for the Broadcast.

John Snagge, Boat-Race commentator, was in charge of this item. Earlier in the day he had been to Birmingham and Nottingham arranging other parts of the broadcast. O.B. men are like that!

By the time he arrived, the engineers had finished testing the lines to Broadcasting House—the microphone and control lines slyly hooked up to a near-by telephone pole. You have no idea how entrancing the crowded Portsmouth road can look from the top of a telephone pole!

We crossed the road to a convenient place of refreshment and, over glasses of (censored), laughed at the lighter side of O.B.s. John Snagge has a host of amusing stories—all of them true. If the "inside history of outside broadcasting" ever comes to be written I hope Snagge will undertake the task.

## THE LISTENER'S NOTEBOOK

### CANDID COMMENTS ON RECENT RADIO PROGRAMMES

JACK and Cyril (I didn't catch their surnames) were lucky to get that broadcast relay from the Argyle, Birkenhead. And we were just as lucky. Eric Maschwitz's fruitless quest for fresh variety talent isn't too encouraging, but while there are Jack and Cyril all there for the asking we needn't quite despair.

This pair of cross-patter comedians were new to me. Of course, I didn't hear their relay from Blackburn on the night of the Royal Command Performance. It was just bad luck for them that they should be given their first opportunity to broadcast at a time when all listeners would be tuned in to the Palladium.

So I say it was fortunate they were on the bill of the Argyle the very week the Argyle was to relay a performance. Lucky for us as well as for them.

I hope Eric Maschwitz heard this broadcast of theirs.

They must be got to St. George's and booked for a spell. I wager they could go on for a long time before we tired of them.

## AN EVENING WITH THE "O.B." VAN



An exclusive "P.W." photograph of the B.B.C. Outside Broadcast van by the Portsmouth road just before the Whit Monday broadcast.

Back to the van, where Mr. Armstrong, an A.A. patrol, is waiting to talk to listeners on his experiences of the day. Snagge produces a typewritten script and we clamber into the little soundproof (and airtight!) studio at the rear of the van. The talk is rehearsed, timed, cut and rehearsed again.

"Now I'll ask you how many cars have passed you during the day and you can produce your figures," says Snagge.

"I've got last year's census figures here as a comparison," suggests the patrol.

"Good! Then we'll work that in. I'll

ask you whether this year's traffic is exceptional, and you . . ."

And so it goes on. Making this "impromptu" talk convincing.

We move the "effects" microphones nearer to the road and test the traffic noises. Secretly we are hoping that the cars which will drive the wrong way of the roundabout keep up their activities during the broadcast. The police

sergeant on duty has a very fine command of the King's English.

A buzzer sounds in the van. We wait in the studio while the engineers listen to the previous part of the programme. A light glows over the microphone.

"I am talking from an island on Littlewood Common," says Snagge.

With typical perversity there is a break in the long stream of traffic at the very moment when the "effects" mikes are switched in! Well, it's all in the day's work!

#### It Is Very Soon Over.

A minute or two later the broadcast is over. Days of preliminary arranging, hours of testing and rehearsal—to give six million listeners a four-minute item in an evening's programme. *Per ardua ad . . .*—no, not to the stars. For the O.B. men there is no limelight—and no rest!

On June 6th the green van goes to Epsom. A fortnight or so later to Aldershot. Then Hendon and Tidworth. A nation's entertainment on wheels.

PATRICK CAMPBELL.

## The Gentle Art of Speaking - - -

Sir John Reith says a lot—but tells them nothing!

"DO you know that the question of temperance is raised every time we broadcast that classic song 'In Cellar Cool'?"

Thus Sir John Reith when he met a number of the leaders of the Socialist party at the House of Commons and replied to their criticisms.

And in such jocular and non-committal terms he dealt with all the criticisms raised against the B.B.C.

For the frequent mention of beer in the radio programmes was not the only complaint raised by this new body of critics. Oh, dear, no!

They criticised the Oxford accent of the announcers.

"It's all a myth," said Sir John kindly,

"And in any case I do not think it is correct to say that most announcers come from Oxford or Cambridge."

They complained about the Sunday programmes.

"I know there are two points of view," said the Director-General patiently.

They wondered why there were so many military and naval men on the B.B.C. staff.

"Surely there is no reason that because a man holds a military title he is naturally incompetent?" asked Sir John tactfully.

For quite a long while Sir John talked to them kindly, patiently and tactfully. He left them entirely satisfied.

It was not until a long time afterwards that the Socialist party leaders discovered to what a fine art Sir John has brought his ability to say nothing!

Jenny Howard and Percy King, in the same bill, aren't altogether strangers to listeners. Jenny is the bigger noise of the two. Their songs aren't the best part of their act, though they'll do, but the patter is grand.

Each turn from the Argyle was unusually long. This really didn't matter, though I do know a few variety turns that couldn't last out as long.

Second-hand Ike found it a bit of a strain, or rather we did. Jewish comedians, because of the speed at which they talk, don't always make the best broadcasters, and for that reason it was difficult to follow Ike at times. His songs, too, had very little merit beyond their originality.

It is a treat, however, to meet with originality in the way of songs on the variety stage. The sentimental song, of American origin especially,

has a vegue that I can never understand. Audiences seem to applaud them always to the skies. Small wonder, then, that comedians and comedienne never fail to oblige. Oh that someone would strike fresh ground and give us songs that make us laugh real laughter!

Jack and Cyril at the Argyle did do this. Let us encourage them as much as we can. Their success on the air would mean that others would follow suit, and Eric Maschwitz's mournful cry about fruitless auditions would soon be a thing of the past.

Summer changes in radio programmes are a real necessity. With the light evenings listening can only amount to hearing, in many instances; and while we are in this frame of mind the lighter forms of entertainment are the only fare the B.B.C. should consider for us. Anything more serious is just waste.

(Continued on page 313.)

# The MIDGET PORTABLE

Some detailed directions for making the case and chassis of the remarkable portable receiver described last week.

THE chassis of the Midget Portable, described last week, consists of the panel, the baseboard and the partition, and its construction was quite obvious from the diagrams and photographs. It is necessary, however, to give certain dimensions which are not so obvious.

The panel is  $5\frac{1}{2}$  in. by  $3\frac{1}{2}$  in.; the baseboard, 5 in. by  $3\frac{1}{2}$  in.; the partition,  $8\frac{3}{4}$  in. by  $3\frac{1}{2}$  in. Both baseboard and the partition are plywood,  $\frac{3}{8}$  in. in thickness, whilst the panel is, of course, ebonite and is  $\frac{3}{8}$  in. thick.

First mount the baseboard on the partition by means of two  $\frac{3}{4}$ -in. countersunk wood screws. The underside of the baseboard should be  $3\frac{1}{2}$  in. from the bottom of the partition.

### Panel Fixing

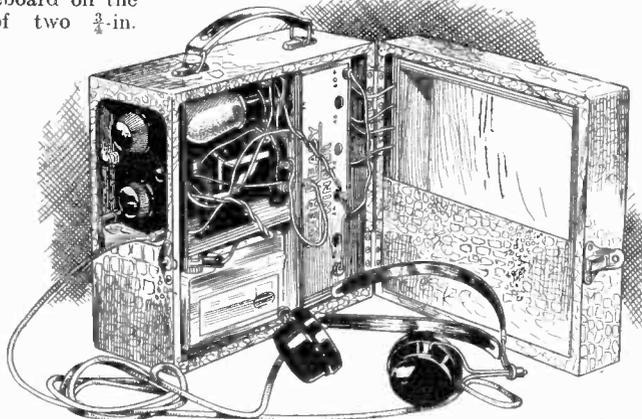
The next step is to mount all the components, including those on the panel. When this has been done the panel should be attached to the baseboard by means of countersunk screws. Round-headed screws would prevent the panel from butting the front of the case.

For the frame aerial the following wood will be required: Two pieces,  $8\frac{1}{4}$  in. by  $1\frac{1}{2}$  in. by  $\frac{3}{8}$  in., for the top and bottom; 2 pieces,  $8\frac{3}{4}$  in. by  $1\frac{1}{2}$  in. by  $\frac{3}{8}$  in., for the sides. It should be assembled with veneer

pins and glue, and the top and bottom must be fitted inside the sides.

It is absolutely essential that all windings should be wound in the same direction, otherwise the "beginnings" and "ends" marked in the diagram will be wrong. The corners of the frame are slotted to take the long-wave and reaction windings, which have to be bunched owing to lack of space. The medium-wave section is, however, a

### A NEAT ASSEMBLY



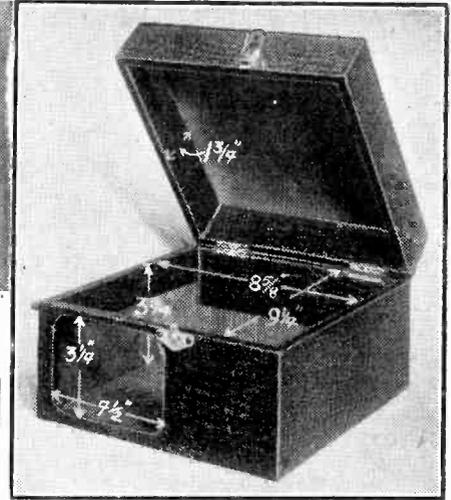
The phones pack into the space in the lid inside the frame aerial, a thin piece of wood holding them securely in place. Note also how the batteries are situated, the leads from the frame aerial being taken behind the H.T. battery.

single-layer winding. The flap which covers the bottom half of the frame will be dealt with in the construction of the case. The four flex leads, which connect the frame to the chassis, are passed through holes drilled in one side of the frame so that they come out on the inside edge. The flex leads are connected to the various "beginnings" and "ends" of the windings.

### The Wood for the Case

It now remains only to make the case. The following pieces of plywood are required: 2 pieces,  $5\frac{3}{4}$  in. by  $9\frac{1}{2}$  in. by  $\frac{3}{8}$  in., for the top (to which the handle is fixed) and bottom; 2 pieces,  $5\frac{3}{4}$  in. by  $9\frac{3}{4}$  in. by  $\frac{3}{8}$  in., for the back and front; 2 pieces,  $9\frac{3}{4}$  in. by  $10\frac{1}{2}$  in. by  $\frac{1}{8}$  in., for the sides; and one piece,  $9\frac{3}{4}$  in. by 4 in. by  $\frac{1}{8}$  in., for the frame flap mentioned previously. The handle, the fastener and the covering were actually obtained from Hobbies, Ltd.

The hinges are  $1\frac{1}{4}$  in. by  $\frac{3}{8}$  in. The covering is leather-grained paper, which is quite durable. Of course, leather cloth may be used if desired. It is very inadvisable to use black covering of any description, as the dyes used in its manufacture almost invariably render it conductive—a most



The finished case, with the essential dimensions of the wood. After completion a leatherette covering is employed.

undesirable feature for the present purpose.

Now, with regard to the construction of the case. The body and lid are made in one piece and cut through afterwards. This ensures a perfect fit;  $\frac{1}{8}$  in. has been allowed for the saw cut. Thus the body is  $3\frac{3}{4}$  in. deep (inside) and the lid  $1\frac{3}{4}$  in.

When assembling make sure that the top and bottom are fitted inside the back and front, otherwise it will be found that the chassis will not fit. Fine one-inch oval brads and glue should be used in fixing the top and bottom to the back and front, whilst the sides may be attached by means of  $\frac{3}{4}$ -in. veneer pins.

### Cutting the Control Aperture.

Having assembled the case and cut it through, the body should have its control-knob aperture cut in it; the position of this is clearly shown in the dimensioned photograph.

A piece of wood,  $\frac{1}{2}$  in. by  $\frac{3}{8}$  in., is fixed inside under the aperture, so that its top edge is  $3\frac{1}{2}$  in. from the bottom of the case. The covering process is quite simple, and only calls for one or two observations. One of the many brands of liquid glue now available is, perhaps, the simplest adhesive to use, and should be applied to the covering evenly and fairly liberally. The frame flap is also covered with the same material.

### THE COMPONENTS REQUIRED

- 1 Graham Farish 0005-mfd. mid-log-line solid dielectric tuning condenser.
- 1 Telsen 0003-mfd. differential reaction condenser, type W.351.
- 2 Telsen push-pull two-point switches, type W.107.
- 2 Clix plugs and sockets.
- 1 Telsen "Ace" 1 : 5 L.F. transformer.
- 1 Dubilier 0003-mfd. fixed condenser, type 620.
- 1 Dubilier 2-megohm grid leak, 1-watt type.
- 2 W.B. small type 4-pin valve holders.
- 1 Peto-Scott ebonite panel,  $5\frac{1}{2}$  in.  $\times$   $3\frac{1}{2}$  in.  $\times$   $\frac{3}{8}$  in.
- 1 Peto-Scott baseboard, 5 in.  $\times$   $3\frac{1}{2}$  in.  $\times$   $\frac{3}{8}$  in.
- 1 Peto-Scott baseboard,  $8\frac{3}{4}$  in.  $\times$   $3\frac{1}{2}$  in.  $\times$   $\frac{3}{8}$  in.
- 1 coil of B.R.G. "Quikon" connecting wire.
- 1 oz. Peto-Scott 36-S.W.G. S.S.C. wire.
- 2 Clix accumulator spades.
- 3 Clix wander-plugs.
- Wood, covering, fasteners, hinges and handles for case. Screws, flex, etc.

### ACCESSORIES

- BATTERIES.—Ever Ready "Winner" 60-volt H.T. Exide 2-volt accumulator, type F.O. 2. Siemens 1½-volt grid bias, type G.T.
- HEADPHONES.—1 pair B.T.H. high resistance.

### SOME SUITABLE VALVES

Make.	Detector.	Output.
Cossor . . . . .	210H.F.	210L.F.
Mullard . . . . .	P.M.1H.L.	P.M.2D.X.
Mazda . . . . .	H.L.2	L.2
Osram . . . . .	H.L.2	L.21
Marconi . . . . .	H.L.2	L.21
Hivac . . . . .	H.210	L.210
Tungsram . . . . .	H.R.210	P.D.220
Dario . . . . .	T.B.282	T.B.172

When the glue has dried out, the hinges, fastener and handle may be fitted and the frame flap fitted to the frame. The handle must be fixed in the correct position if the set is to be properly balanced. The fixing screws must be approximately  $2\frac{1}{2}$  in. from the outside of the body.

The chassis may now be inserted in its case, and, provided that everything has been carried out correctly, you will obtain the same excellent results that we did.

"ECKERSLEY EXPLAINS"

# INFRA-SONIC EFFECTS

A WORD ABOUT THE NEW REPRODUCTION METHOD, SHOWING THAT MR. DOWDING "HAS GIVEN US SOMETHING TO THINK ABOUT."

By  
**P. P. ECKERSLEY**  
M.I.E.E.

I POINTED out in my last article how the reproduction of sound might be bettered if people would study its problems in terms of its pleasantness to the ear rather than any technical criteria concerned with bands of frequencies transmitted, relative amplitudes, etc., etc.

It is, however, true that if we could transmit right up to frequencies of 15,000 cycles/sec. and right down to frequencies of 30 cycles/sec. or less, the result would be the most pleasing.

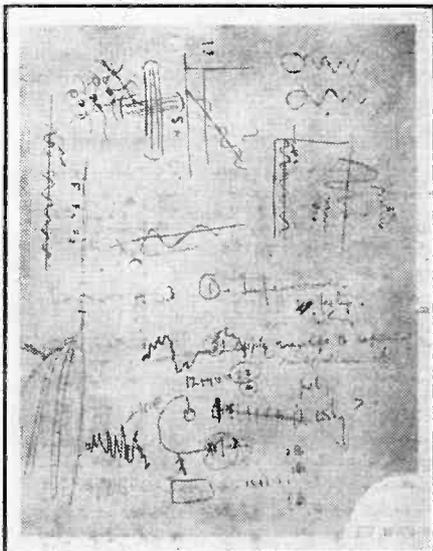
But we are forced, partly by the cost of apparatus, but largely by the limitations of transmission, to cut out a tremendously important part of the spectrum—namely, from, say, 4,000 cycles/sec. upwards. As we are forced to do this, it is my contention that it is better (to balance the lack of top) purposely to cut out an equivalent amount of bass.

### A Sort of "Super-doomp."

This may sound a heterodox principle. It is based on no surer a foundation than the results of experience. It might have been dictated by expediency a few years ago, but, now that we have moving-coil speakers and economical but powerful valves, there is no technical reason why bass should not be pumped out for all we are worth. And don't they do it!

And now comes the ingenious Technical Editor of this paper and upsets all my

### DETAILS OF DISCUSSION



Our Chief Radio Consultant reached his conclusions on Infra-Sonics after long discussion with Mr. Dowding. Here is a photograph of the sheet of blotting paper which played a prominent part in the discussions. The diagrams at the top of the sheet illustrate Mr. Dowding's contentions. Those below were contributed by "P.P.E."

theories by producing a new synthesis of sound—a sort of super-doomp.

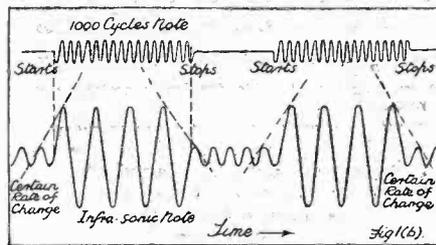
Mr. Dowding is always very frank and very sensible. In this case he doesn't say: "I have solved for ever all the problems of sound reproduction." Instead, he says: "Listen to it—what do you think?" And he (privately) thinks it grand. And so do I think I think I do, too!

Mr. Dowding takes a loudspeaker with a most floppy diaphragm and he makes it push in and out at a frequency, say, ten cycles a second. You are practically unaware of this extra sound wave rumbling round the room before he starts to do things to it.

### Change in Intensity.

This is what he does: He feeds the valve which makes the floppy diaphragm go in and out ten times a second from a certain steady voltage plus a voltage which is derived by rectifying and smoothing all the audio-frequency components in the speech, or music, or whatever it is.

Of course, the ordinary speech-and-music currents energise an ordinary loudspeaker as well. Fig. 1 (a) shows the scheme diagrammatically. Fig 1 (b) also shows what happens when you reproduce a steady



you reproduce a steady note of, say, 1,000 cycles per second.

Before we play the 1,000-cycle note the Infra-Sonic has a certain intensity. On starting to play the 1,000-cycle note, the Infra-Sonic note—may I say?—increases at a certain rate, depending upon the constants of the rectifying and smoothing system. As we continue to play the 1,000-cycle note there is no rate of change of the Infra-Sonic note, but when we stop there is.

### It Provides A New Sensation.

We gather, then, that when a programme is on, any changes in general intensity of the envelope of all the composite frequencies make changes in the Infra-Sonic intensity, but that the rate of change of intensity cannot exceed a certain amount.

When a jazz band pushes out a rhythmic set of impulses, as it does, so, in time, if not in tune (but this does not matter), the Infra-Sonic waves increase and die away and increase again.

It is a purely synthetic device to give a

new sensation—a stimulus to help imagination to remember reality.

The proof of the pudding is in the eating of it; the proof of whether you like it or not is whether you like it or not.

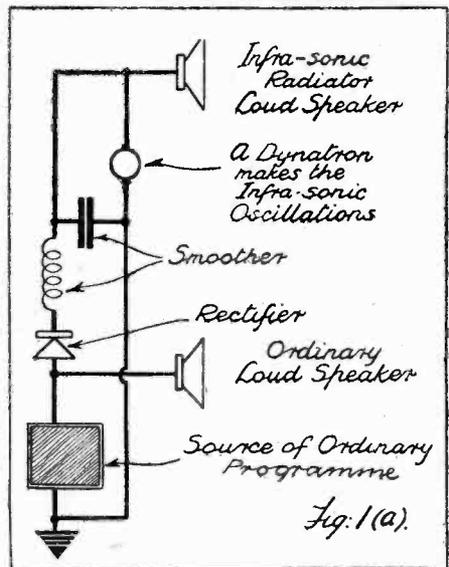
My own experience in these matters is that I have my first sensation of feeling "fullness" in reproduction, but that fullness may lead to satiation.

### No Chopping of Upper Frequencies.

If you are to "hear" (and that means appreciate sound waves in any way) an Infra-Sonic sound (!!!), you must hear its modulations. Suppose I have a "note" of 10 cycles a second, and I increase and decrease this by some amount 50 times a second, my ear records 50 and 10 cycles, i.e. 40 and 60—otherwise I shall never hear anything. I cannot be aware of changes in the Infra-Sonic note intensity if these changes take place at an Infra-Sonic frequency.

I could not hear the note if someone

### THE TWO SPEAKERS



A diagrammatic explanation of the working of the Infra-Sonic system. Note how the two loudspeakers are used for their respective purposes. On the left [Fig. 1 (b)] is another diagram showing what happens when you reproduce a steady note of, say, 1,000 cycles.

slowly increased the voltage on the valve driving the inaudibly vibrating diaphragm, and then, ever so slowly, decreased that voltage, making the vibrations feebler. When a steep-fronted transient comes along, however (caused, say, by the pistol shot), we know that such a transient is composed of many frequencies—low, medium and high. These must, I do think, modulate the intensity of the Infra-Sonic note and so cause something audible.

But the whole point to remember is that, because Mr. Dowding rectifies and smooths his Infra-Sonic modulating source, the frequency of modulation of the source is also almost Infra-Sonic, too. Thus he does not "chop" his upper frequencies.

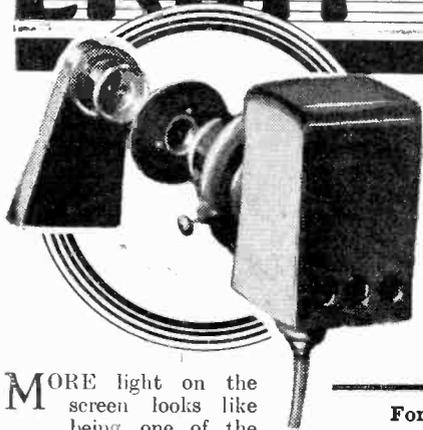
### Startling Realism Achieved.

All sound is, in the end, analysable into component, steady-state frequencies. Reproductions of transient sounds, like the crack of a pistol, the clapping of hands, the slamming of a door, are analysable into component frequencies, some very, very

(Continued on page 314.)

# LIGHT-VALVE PROBLEMS

BY G.P. KENDALL, B.Sc.



**M**ORE light on the screen looks like being one of the main problems of television for some time yet, and the principal line of attack at present seems to be in the direction of improved light valves.

Some research workers are trying to develop present types to the desired degree; others are investigating entirely new forms, and I think it may be interesting to review some of the results which have been obtained.

In all the earlier work, of course, self-modulating light sources, such as the neon tube, were used; but the natural desire for bigger and brighter pictures soon led to attempts to devise a system with a really intense, power-fed source of light, modulated by a separate device operated by the actual signals.

### By No Means Obsolete.

Considerable success was achieved on these lines, but it should not hastily be assumed that the self-modulating light source is by any means obsolete.

In Germany, for example, persevering work still goes on upon the Wolfran arc, which is such a source of great intensity. It would seem, however, that it offers great difficulty when an attempt is made to use it in a high-definition system with a large number of scanning lines.

The ultimate development of such systems is likely to put rather a different complexion on the whole question of light control, but that is a matter outside our present scope: the arrival of high-definition transmissions for general public use is probably somewhat farther off than is realised, and meanwhile there is plenty of interesting work to be done on the medium-definition systems which have been brought to a practical point.

A really efficient light valve is a key component in getting the best results from these systems, so let us see what we want and what is being done to give it to us.

### Some of the Difficulties.

The Kerr cell was at first hailed as the perfect solution of the problem, but a more intimate acquaintance with the device showed that it had certain defects which might be removed with advantage.

In the first place, it has what is called a curved characteristic. This means that the amount of light which it transmits is not truly proportional to the electrical impulses applied to it.

To minimise this defect and obtain maximum response for a given input, it is usual to apply an initial bias voltage to the cell, but even under the best conditions it is difficult to obtain anything approaching a real black in the darkest portions of the picture. A general slight falsity in the rendering of light and shade is the main objection which arises from the lack of a "linear response" in any light valve.

Another difficulty with the Kerr type is

**For effective television light control the illumination of the received picture must vary from a mere glow to comparatively intense lighting. This week Mr. Kendall tells you how the necessary "valve" action is engineered.**

found in the fact that it passes only a relatively small fraction of the light beam which is fed into it. This can be overcome, to some extent, by the use of a very powerful

*Being so largely an optical science, television has received special attention in Germany. One of the most successful pioneers in that country is Professor Karolus, seen below in his Berlin laboratory.*



beam; but there are practical limitations here: chiefly the trouble is that a lot of light is apt to mean a lot of heat, and the Kerr cell doesn't like heat.

The Okolicsanyi device, which operates on the same principle, but uses a piece of a certain mineral crystal instead of the liquid (nitrobenzol) employed in the Kerr cell, seems at first to promise the almost complete removal of these defects. Its response is almost exactly linear, it has no measurable "lag effect" and it passes a much larger fraction of the light beam.

Still, however, the light transmitted through the device remains but a fraction of the beam sent into it, and so experimenters feel that

possible screen illumination is lost, and they are seeking ways of utilising the whole of the available light.

I have just received a general account of a device which is being developed in America, and seems promising from this point of view. It appears to be a refinement of the string galvanometer light valve used for sound recording in talkie work.

As in the original valve, it contains an almost microscopically fine "string" stretched in an intense magnetic field, and caused to twist by the passage through it of the signal currents.

Attached to the string is a tiny mirror which is brought into the path of the light beam.

This is reflected therefrom to a

slit. When the mirror moves, the beam is deflected slightly, so that the whole of it can no longer get through the slit, and so the modulation effect is produced.

In its original "talkie" form this sort of valve would deal with frequencies up to about 10,000 or 12,000 cycles per second, and that, of course, is only adequate for comparatively low-definition television. The new device, it is claimed, will go up to 25,000 cycles with ease, and is practically linear over the whole range.

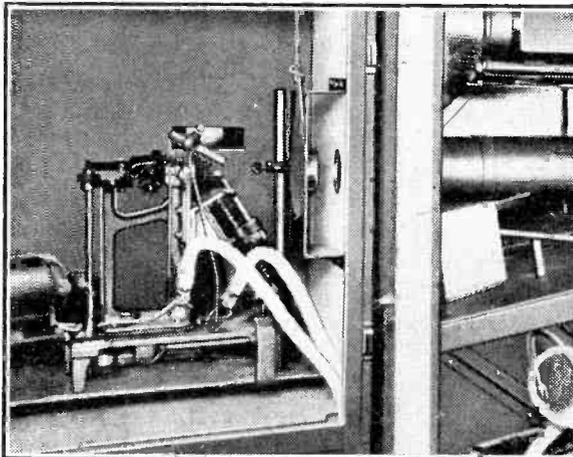
### Where the Secret Lies.

The secret appears to lie in still further reduction in the size and weight of the moving part and the application of a special system of magnetic damping which almost suppresses the natural period of the suspended mirror.

The device is interesting, but from what I know of the talkie valve of this type I find it hard to believe that it could ever be made sufficiently robust and permanent in adjustment to render it suitable for use under domestic conditions. It would seem inevitable that the television form of this

*(Continued on page 314.)*

### USING A POWERFUL ARC



A powerful arc lamp is an essential feature of this apparatus, used in a Bell television outfit. The carbons of the arc can be seen in position near the points where the two large power lead terminate on the left.

I HAVE just heard details of the actual changes which the B.B.C. will introduce to meet summer requirements as from July 2nd to September 15th.

First of all, with the exception of a weekly sports talk from 6.30 to 6.45 on Saturdays, there will be no talks between 6.30 and 8 o'clock. Secondly, between 6.30 and 8 o'clock on weekdays one programme only will be broadcast, there being no alternative.

There will be two late-evening talks each week. The late religious services on Thursdays will cease from August 2nd to October 4th.

**Money—Not Listeners.**

So far as dropping talks is concerned, these changes will probably be welcomed, but it is a great pity that alternatives are being thrown over so completely. The B.B.C. must be planning rather to save money than to do listeners particularly well this summer.

**Press Attacks Resumed.**

After an extended truce, those newspapers that found most fault with the B.B.C. early in the year are resuming their attacks, and will carry these over the summer well into the autumn period.

It is probable that on this occasion no member of the Board of Governors will escape entirely from criticism.

**Dr. Boult Still on Top.**

In addition to his ordinarily difficult work of running the music department of the B.B.C. and being permanent conductor as well, Dr. Boult has had other troubles to contend with. There were repeated attempts to undermine his authority and to divide his work, but he has been strong enough for all the opposition, and his enemies are in full retreat.

With his important American tour of next winter in view, and with the Russian visit six months later, Dr. Boult's international prestige will benefit greatly.

He is safe at the B.B.C. His friends now await with confidence his inclusion in an Honours List.

**Henry Hall's Tenth Anniversary.**

Although Henry Hall has not yet reached the second anniversary of his appointment as director of the B.B.C. Dance Orchestra, he intends to celebrate his tenth broadcasting anniversary on August 26th.

Henry gave his first broadcast on that day, 1924, from Gleneagles, where he formed one of the many dance bands for the Midland hotels. These bands were all under his control up to the time of his joining the B.B.C.

**Special Programme for August.**

Already he is engaged on compiling a special programme for August 26th, when he hopes to have the assistance of some of the members of his original band.



The Western Brothers entertaining some of the little patients in the London Hospital.

# SUMMER LIGHTENING!

## DETAILS OF THE NEW PROGRAMME ARRANGEMENTS

**"The Carlyles."**

More than usual interest is associated with the performance on June 10th of a programme entitled "The Carlyles of Cheyne Row," inasmuch as it will be relayed from Thomas Carlyle's old house in Cheyne Row, Chelsea.

Here the author of "French Revolution" and "Frederick the Great" settled in 1834, and it was here that he died half a century later.

The programme will include a play called "The Firefighters" by Laurence Housman, in which it is expected that the

### PROGRAMMES TO ENJOY NEXT WEEK

**DRAMA.**—"THE MAN WHO WORKED MIRACLES." A new play by H. G. Wells, whose "Country of the Blind" is still remembered with pleasure (*National Programme, Tuesday, June 5*).

**FEATURE.**—THE DERBY. A running commentary from Epsom by Mr. R. C. Lyle (*National Programme, Wednesday, June 6*).

**LIGHT OPERA.**—DERBY DAY. A revival—with Tessa Deane and Horace Percival—of scenes from A. P. Herbert's comic opera (*London Regional, Friday, June 8*).

**VARIETY.**—"THE ARCADIAN FOLLIES." A concert party programme relayed from Morecambe (*North Regional, Saturday, June 9*).

part of Thomas Carlyle will be played by Alastair Sim.

**"On Foreign Bookstalls."**

Those who intend spending their holidays abroad should derive considerable interest from the series of talks to be given on Sundays throughout June under the title of "On Foreign Bookstalls."

The talks will give advice about the books which are being read and talked about, and will be devoted consecutively to France, Germany, Italy and Spain.

**Extracts from Books.**

The actual broadcasts will be in English, but the speakers will illustrate their talks with extracts from the books about which

they will speak, read in the language in which the book is written.

**Sir Walford Davies.**

Melodies of all nations will be sung by a choir of nearly four hundred voices, under the direction of Sir Walford Davies, at the third festival of the Unemployed Men's Clubs in the Rhondda, which is to be relayed from the Central Hall, Tonypany, on Thursday evening, June 7th.

Stuart Robertson will be the solo artist, and a feature of the festival will be the singing of "To the Sons of Art" by Mendelssohn, which will be accompanied by brass instruments from the Corry Workmen's Band.

**A Schools Festival.**

Children from twenty schools are to sing in the massed items at the seventh festival of the Wellington and District Schools Musical Association, which is being relayed from the Anstice Memorial Hall, Madeley, on Wednesday, June 6th.

These festivals are non-competitive, but there is no doubt of their benefit to the future musical life of the nation. The festival will be conducted by Mr. Cyril Winn, H.M. Inspector, the accompanist being Mr. E. C. Bullock, of Wellington.

**The Droitwich Spa Feature.**

Every fortnight throughout the summer Mr. Victor Hely-Hutchinson, the musical Director of the Midland Region, is to conduct the new Droitwich Spa Orchestra in a series of Sunday concerts which are being relayed from the Winter Gardens.

The new orchestra, which will be heard for the first time on June 3rd, consists of the nine players of the Midland Studio Orchestra, whose conductor, Frank Cantell, is to be the leader, and about half the members of the City of Birmingham Orchestra.

The solo artiste at the first concert will be Mavis Bennett, soprano.

**Military Band Aged Ten.**

Another tenth birthday in broadcasting will be celebrated in July—that of the Wireless Military Band, the oldest music combination in the service of the B.B.C. It was originally known as the 2 LO Military Band.

**'Cellist, Pianist, and Composer.**

Under its conductor, Mr. B. Walton O'Donnell, who joined it in 1927, after spending ten years at the Royal Academy of Music as 'cellist, pianist and composer, and then a time as conductor of the Royal Marines Band at Deal, the Wireless Military Band is undoubtedly one of the finest combinations of its kind in the world.

**Accompanied the Prince of Wales.**

Mr. O'Donnell accompanied the Prince of Wales on his tour in Repulse to South Africa and South America in 1925. He is Professor of Military Music at the Royal Academy of Music.

O. H. M.

# ON THE SHORT-WAVES

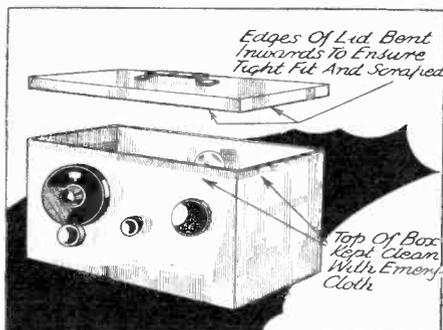
## OUR SPECIAL SECTION for SHORT-WAVE ENTHUSIASTS CONDUCTED by W.L.S.

I LIKE to go out and meet trouble half-way; it's so much easier to get the better of it if one catches it before it's developed into a full-sized monster. Whatever you may think about the best way of treating troubles in your private life, don't sit down and wait for them in your radio!

So much for the abstract. We can now get on with the concrete, as the cement mixer observed to his assistant. You may have, in your short-wave receiver, all sorts of weak spots. You may not know that they are there, because you may have been lucky.

Just because your set doesn't burst into loud crackles if you jog your elbow on the table, it doesn't follow that every connection therein is above reproach.

### LIDS SHOULD BE TIGHT



The lids of screening boxes should make firm contact with the top edges of the boxes themselves.

Some day you'll have such a feast of crackles as you've never dreamed of, and you'll wonder why you didn't have a periodical "tighten-up" instead of waiting for the nasty noise to arrive.

Crackles, the bane of the short-waver's life, are not necessarily caused even by loose connections. For instance, there are several short-wave condensers about that are equipped with beautiful pigtails and apparently faultless bearings, and yet they make nasty noises when rotated.

### Ensuring Quiet Reception.

There are, likewise, aluminium boxes which seem to be provided with a lid that is the most perfect fit. Yet it is necessary for a scribe like myself to draw two diagrams like those that appear on this page.

The lid of your aluminium box must fit so tightly that it requires a little force to remove it. This may be achieved by bending the edges inwards slightly and by scraping the top edges of the box (or

### "HUNTING FOR TROUBLE"

Don't wait till your set develops a fault; keep it in first-class order and remember "prevention is better than cure."

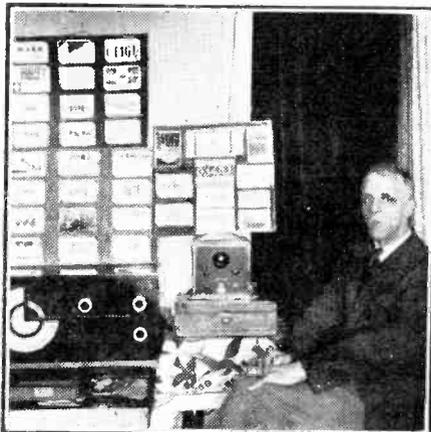
rubbing them with emery cloth) so that a good electrical joint is made.

The condenser, if it is of the brass-plate variety (and most short-wave condensers, fortunately, are), may be dealt with by installing a "super-pigtail," as shown in the other sketch. If you add a long flex connection like that—and I strongly advise you to do so—you will be well advised to remove the other pigtail by the roots and throw it away.

Uninsulated pigtails, particularly those that only form a very small coil, have a nasty habit of rubbing their turns together and producing the most horrid noises.

I have been going at this "crackle" business for quite a long time. Turn up the diagrams dealing with metal panels,

### EVIDENCE OF ACTIVITY



This photo of Mr. R. D. Everard with his short-wave receiving apparatus bears ample testimony to his enthusiastic listening.

vertical metal screens and foil-covered baseboards that appeared a few weeks ago. Two more hints appear on the next page to this.

Now for a few more! If you have a nasty irregular rushing sound in the headphones, such as one usually associates with a run-down H.T. battery, look to your L.T. Dirty accumulator connections may be to blame;

but if your set is a two-valver and the noises are still there (even though greatly diminished) when the detector valve is removed from its socket, it's ten to one that the H.T. is to blame.

Look to your wander-plugs, aerial switch, L.T. switch, phone cords—in fact, any mortal thing remotely connected with your set that may be loose or making an intermittent connection.

A "loose" wireless set, even if it works, is as nasty a thing as a "loose" motor-car. Sooner or later it will let you down.

### Those "Badly Placed" Sets.

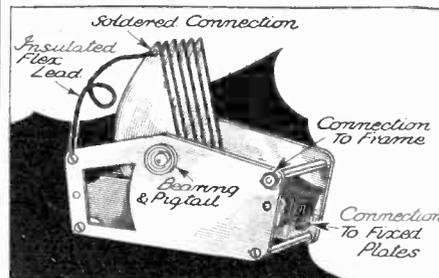
Remember always that crackles and stray noises, however slight, generally mean all the difference between success and failure on short waves. For the last few mornings I have been taking observations on a distant amateur station whose signals have never been stronger than R2 or R3. If I had been troubled by the slightest "set noise" I should never have been able to receive him at all.

I know scores of short-wave listeners who haven't the faintest idea of what a weak signal really is—simply because their sets are so noisy that they only hear the strong ones through the racket.

They tell me: "I am badly placed for Australia—I can never hear them, although America's all right." "Badly placed my foot," say I. They don't hear Australia because their set is always making a bigger noise than Australia is!

Don't forget, either, that when you have quietened down your set so that you can hear really weak signals, these same weak

### A SILENT PIGTAIL



On short waves crackles are sometimes caused by condenser pigtails. The cure suggested in this sketch is usually effective.

signals can be brought up in strength by adding another valve or valves. But there's no point whatever in adding more valves to a noisy receiver.



# On Wednesday, June 6th, listeners all over the Empire will hear a running commentary on the world's most famous horse race. Read how this will be carried out.

THE Englishman's greatest ambition may or may not be, as the "Radio Times" suggests, to own a Derby winner. What is certain is that the commentary on the year's greatest race is sure of the year's greatest audience. In house and garden, in the office or shop, millions of sets will be switched on for those few minutes during which Mr. R. C. Lyle, the well-known racing correspondent, brings us almost as much excitement as though we were actually on the course at Epsom.

### Careful Preliminary Arrangements.

But the first Wednesday in June is not all beer and skittles—that is, for the B.B.C. engineers, who have to see that the commentary goes through without a hitch. All outside broadcasts necessitate careful preliminary arrangements to ensure that listeners hear a real picture of what is actually taking place. The Derby is especially difficult.

Until last year the commentators were faced with special difficulties of their own. On Derby Day that part of the course which bends round the Hill is lined with cars and carts and vehicles of every kind and description—many of them apparently born in the ark. Consequently the commentator has been unable to see that important

part of the race. Last year, however, a new position on the grand stand was allotted to the B.B.C., and it is this stand, some thirty feet higher than the old one, which will be used on Wednesday by Mr. Lyle.

Whatever listeners may have thought, the B.B.C. itself was not entirely satisfied with the technical side of the 1933 Epsom broadcast. Very special efforts will be made, therefore, to remedy this state of affairs.

More than one microphone is used for the relay. In addition to the actual commentary, an attempt

is made to convey to listeners the atmosphere of Derby Day. It is possible, too, that, at the end of the race, we shall be able to hear a few words from the winning jockey or trainer or owner.

All this, obviously, necessitates several microphone points which lead to a local control centre on the course. From here the relay is taken through the ordinary telephone trunk lines to Broadcasting House and on to the various transmitters throughout the country.

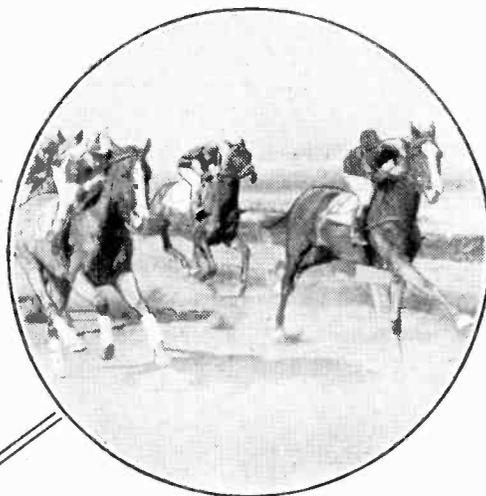
### Relayed to the Empire.

This year these transmitters will include the short-wave station at Daventry, which will allow the listeners in the Empire to hear the race, either at the actual time of running or, by means of a record which will be made at Broadcasting House, at a later and more convenient time.

At an outside broadcast anything may happen. It is not so long ago since the commentator at Aintree was knocked down by a dense and unruly crowd. There are always people who make it their one aim to put their own voices over the air. So much care is now taken, however, that it is most unlikely that this year's commentary will be marred—or, as some people would think, enlivened—by any kind of "incident."

### A Sponsored Programme?

It is also unlikely that Mr. Lyle will, this year, make any mention of a certain brand of gin. Such a mention was made—quite inadvertently—in the excitement of one of Mr. Lyle's commentaries. The commentary was recorded, and repeated not only in the three news bulletins, but also in the five Empire programmes. Whereupon a rival distiller (showing a rare sense of humour) wrote to Sir John Reith, remarking that



while one broadcast of his rival's product might be a slip, *nine* could only mean a sponsored programme—and what were the B.B.C.'s terms for the next ace!

Mr. Lyle, who has been broadcasting the Derby and other important races since 1928, will probably have a helper in the commentator's box, who will carry on the preliminary remarks before the race starts. Afterwards Mr. Lyle will take over the commentary for the two and a half minutes of the race.

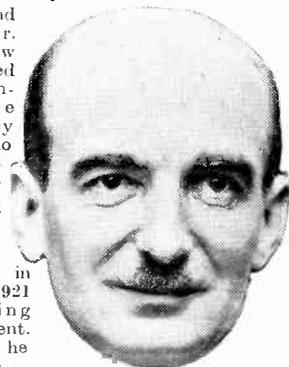
### Call Boy's Record.

Here are a few facts and figures which will help you when listening to the 1934 race. The course is 1½ miles long. The race takes just over 2½ minutes. The record on the new course is 2 min. 34½ sec., made by Call Boy in 1927.

## THE MAN IN THE COMMENTATOR'S BOX

### Robert Charles Lyle

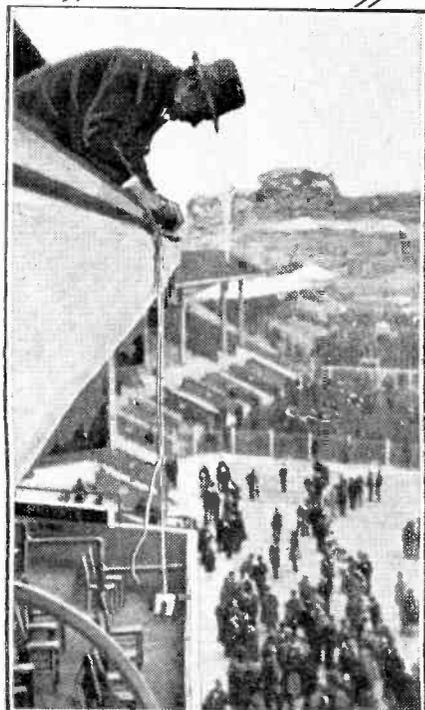
Journalist and commentator. Born at Dunmow in 1887. Played hockey for Cambridge more times than any other man who did not get a "Blue"! Appointed Sporting Editor of "The Times" when on leave from France in 1919. In 1921 became Racing Correspondent. A married man, he has six children.



One final warning: Remember the following notice which appears in the "Radio Times" on Friday, June 1st:

"The News Bulletins and Running Commentaries in B.B.C. programmes are strictly copyright. The information they contain is intended for the private enjoyment of licence holders and should not be communicated to the public by loudspeakers, written notices or other means.

"Care should be taken in shops and other open spaces to prevent the News Bulletins and Running Commentaries being made audible to the public."



Fixing one of the microphones on a stand at Epsom. The noises of the crowd will be heard as part of the commentary.

# BROADCASTING THE DERBY

A SPECIAL PAGE FOR THE ENTHUSIASTIC BEGINNER.

# THE SUPERHET EXPLAINED

TOGETHER WITH OTHER GENERALLY USED RADIO TERMS

by

**G. V. DOWDING,**

Associate I.E.E.

## SUPERHETERODYNE.

A special method of radio reception enabling great selectivity to be achieved.

It makes use of the beat principle. That is to say, an oscillation is generated in the apparatus, and this is "mixed with," or, in other words, made to beat with, the energy tuned in from the radio station that is being received.

These beats are at a relatively low frequency as compared with the fundamental radio frequency, but are very considerably above audibility, and would not actuate a loudspeaker as do the beats produced by the interference between two broadcasting stations—styled heterodyne interference—(thus the term "Super-Sonic").

They are high enough in frequency to be dealt with as a high frequency, and as such they are passed to high-frequency amplifiers known as the "intermediate stages." The reason for this name will be obvious. The frequency they handle is *intermediate* between the original high-frequency and the low-frequency modulations which are subsequently used to operate the loudspeaker, and they are also devoted to the "intermediate" task of providing H.F. amplification after "mixing" and before the final rectification takes place.

The energy from all the broadcasting stations lying within the tuning scope of the set is reduced to the same intermediate frequency, and [therefore the intermediate H.F. stages do not require variable tuning. In this way the controls of the receiver are simplified.

To improve the range of the set, and to prevent the locally generated oscillations from being radiated by the aerial and thus causing interference, an ordinary stage of amplification is frequently used to precede the mixer (or first detector, as it is sometimes styled).

Many and various are the methods of arranging superheterodyne circuits. There is variety in the method of coupling the oscillator valve to the mixer valve, and there is also a special valve known as the pentagrid converter which combines the

functions of oscillator and mixer.

And as the mixing in this case is carried out in what is virtually a common electron stream used by the two sections of the valve, but which is divided by internal screening, interference radiation is negligible even in the absence of an initial H.F. stage.

## SIDEBANDS.

These are the additional waves created in the ether when the carrier-wave of a broadcasting station is modulated. They differ in frequency from the

station heterodyning with the carrier-wave of the desired station.

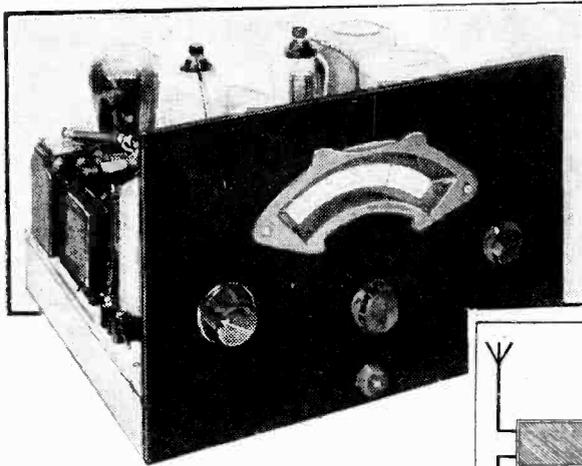
## SMOOTHING CIRCUIT.

A circuit employed for smoothing away the irregularities of current derived from the mains. In its simplest form it comprises an L.F. choke in a series position which offers a high impedance to fluctuating current values and a fixed condenser to provide a contrasting easy path.

## SOFT VALVE.

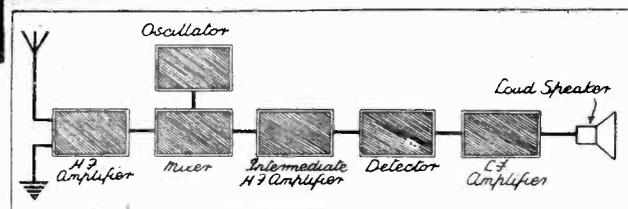
A valve in which there remains an excessive amount of

## THE SUPERHET IN PRACTICE—



The photograph shows the compact nature and simple control of a modern superhet which incorporates, in a small space, all the six different stages shown in the diagram below.

## —AND IN THEORY



carrier or fundamental wave by exactly the frequency of the modulation frequencies.

For each modulation frequency there will be two sideband frequencies, one greater and the other lesser in frequency than the carrier-wave.

It will be clear from this that in order to preserve the original tones of speech or music it is necessary for a wireless receiver to respond to a band of wavelengths and not to just the one. But it is a proportionately narrow band, and only the superselective types of set are likely to tune so closely that the sidebands of a given transmission suffer to the extent that suitable tone correction in the set itself will not give compensation.

That type of interference which has been styled "monkey chatter," and which is heard as a high-pitched, harsh background from an unwanted station, is caused by the sidebands of that

residual gas. When more than a certain amount of H.T. voltage is applied to such a valve the characteristic "blue glow" results from the collision between gas particles and electrons.

## SPACE CHARGE.

A cloud of electrons which tends to impede the flow of electrons from the filament to the anode of a valve.

## SPECIFIC INDUCTIVE CAPACITY.

Also referred to as "dielectric constant," this is the measure of the power of a substance to increase the capacity of a condenser when it is used instead of air. Thus, if the S.I.C. (the dielectric constant) of a substance is 5 (this is the average S.I.C. of mica), it can be inferred that a condenser using it in

place of air would possess five times the capacity, provided the same thickness of dielectric and sizes of plates were maintained.

## STANDING WAVES.

Sound waves set up by reflected waves interfering with those which are directly emitted from a loudspeaker. For example, the reflection may be from the walls of a room, and a cancelling effect can occur when the "original" and "reflected" waves meet and produce silent zones, equally there can be an adding effect producing an added intensity, and it is this which is called a standing wave.

The actual position in a room where they occur differs with notes of different frequencies, and it is, therefore, an effect which is noticed markedly when a steady note is being emitted. A high-pitched heterodyne frequently exhibits the effect strikingly. Moving about a room whose walls are not "damped" by means of curtains or other hangings, it is not difficult to locate places where the note can be heard more loudly. At such a point standing waves exist.

## STATIC CHARACTERISTIC.

This is a curve which illustrates the relation in a valve of various steady currents and voltages. A static characteristic to show the effect on the anode current of different grid voltages is taken merely by measuring the anode current with a milliammeter while voltages are applied to the grid by means of a battery and potentiometer.

## STEP UP AND STEP DOWN.

These terms are applied to transformers in order to indicate whether the device increases or reduces voltage. A transformer said to have a ratio of, say, 1-4 gives a voltage step up accordingly.

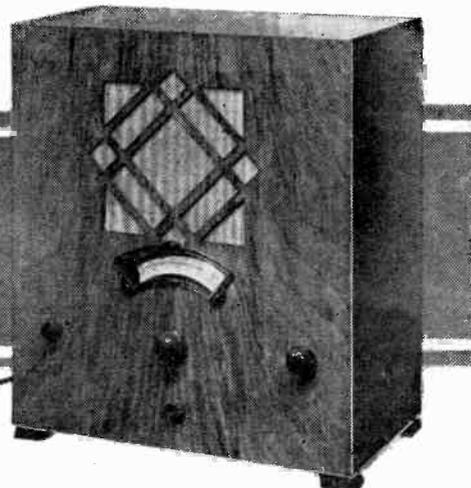
## SULPHATION.

The collection of a deposit of white lead sulphate on the plates of an accumulator. The effect of this is to reduce the working surfaces of the plates and so reduce their capacity. Sulphation is caused by neglect, and when it has developed it is exceedingly difficult to remove. An incipient attack can sometimes be successfully dealt with by means of long, slow charges and most careful cleaning.

"POPULAR WIRELESS" PRESENTS

# A UNIVERSAL THREE

Full details of an easily constructed all-electric three-valve receiver that will operate on any type of mains. No alteration is necessary whether the set is to be used on A.C. or D.C. It is completely "universal."



UNTIL quite recently it has been the custom, and in fact it has been essential, for mains receivers to be divided technically into two completely distinct types—those for D.C. and those for A.C. These sets have been similar in their results, but very different in the manner in which these results have been achieved.

**D.C. and A.C.**

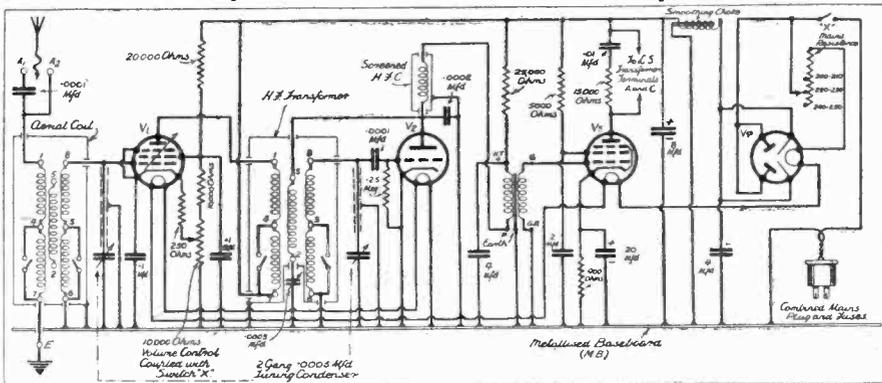
The D.C. receiver has normally made use of valves taking comparatively high voltages across their heaters, and having the heaters connected in series with one another and the electric light mains, while the A.C. set has made use of low-voltage valves and a transformer to change the mains voltage to one that is suitable for the valves.

Because of these differences such sets have been confined to the types of mains for which they have been designed, and if the owner of one or the other class of receiver moved to a district having a different type of electricity supply the set has been rendered useless.

**Completely Interchangeable.**

Now, however, it is no longer necessary to make any difference in the design of a mains set for

Designed and Described by  
The "P.W." Research Dept.



Without a mains transformer the circuit looks unusual for an all-electric A.C. receiver; but the Universal Three needs no such component, the rectifier being connected direct in circuit.

D.C. from that for alternating current, for the universal valve has been evolved in order to eliminate all need for such variation and to enable sets to be built that are completely interchangeable—sets that will work equally well on D.C. or on A.C. without any modification.

**The Rectifier.**

The latest class of universal valve takes about 18 amp. for its heater at a voltage varying in accordance with the type of valve. The voltage does not matter, for all the heaters are connected in series, and a separate resistance is added to "break

down" the voltage of the mains so that the required current flows through the valves.

A rectifier valve is used in the Universal Three, the design which we are placing before you this week, and it enables the set to be used on A.C. or D.C., rectifying the alternating current for H.T. purposes in the former case.

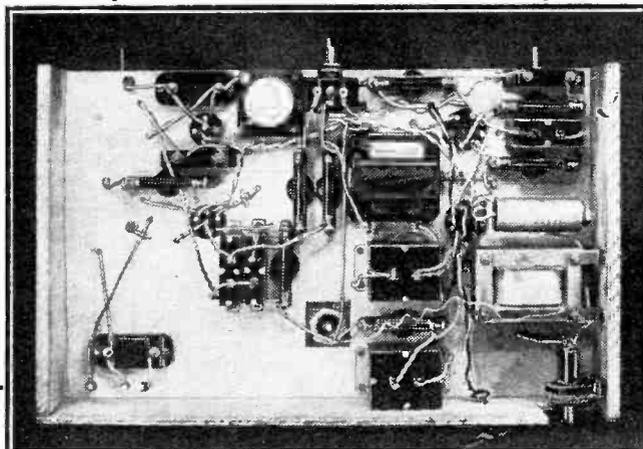
**Always In Circuit.**

This rectifier is left in circuit for D.C., too, where it assists in smoothing any irregularities that may exist in the mains supply, a state of affairs that is only too common with many of the mains in this country.

(Continued on next page.)

**ALL THE PARTS**

- 1 Pair screened matched coils (Telsen W.287).
- 1 2-gang tuning condenser (Polar Star Minor).
- 1 Slow Motion drive for above (Polar Arcuate, marked in degrees).
- 2 chassis-mounting valve holders Five-pin (Clix).
- 2 do., Continental 7-pin type (Clix).
- 1 L.F. transformer (Telsen type W.59).
- 1 0003-mfd. reaction condenser (Telsen W.354).
- 1 20-mfd. 50-volt elect. condenser (Dubilier type 402).
- 1 8-mfd. dry elect. condenser (Dubilier type 0231).
- 2 4-mfd. fixed condensers (Hydra type No. 25).
- 1 2-mfd. fixed condenser (Hydra type No. 25).
- 2 1-mfd. fixed condensers (Hydra type No. 25).
- 1 01-mfd. fixed condensers (Dubilier type 620).
- 1 0002-mfd. fixed condenser (Dubilier type 610).
- 1 0001-mfd. fixed condenser (Dubilier type 610).
- 1 0001-mfd. fixed condenser (Dubilier type 620).
- 1 250,000-ohm resistance and horizontal holder (Graham Farish 1½-watt Ohmite).



The support for the chassis is cut away to allow space for the mains plug to protrude slightly, while a layer of the plywood is removed round the fixing nut of the 8-mfd. electrolytic condenser to permit the nut to start on the thread.

- 1 20,000-ohm resistance and horizontal holder (Graham Farish 1½-watt Ohmite).
- 1 25,000-ohm resistance and horizontal holder (Graham Farish 1½-watt Ohmite).
- 1 10,000-ohm resistance and horizontal holder (Graham Farish 1½-watt Ohmite).
- 1 5,000-ohm resistance and horizontal holder (Graham Farish 1½-watt Ohmite).
- 1 400-ohm resistance and horizontal holder (Graham Farish 1½-watt Ohmite).
- 1 250-ohm resistance and horizontal holder (Graham Farish 1½-watt Ohmite).

**YOU WILL REQUIRE**

- 1 15,000-ohm resistance and horizontal holder (Graham Farish 1½-watt Ohmite).
- 1 Mains resistance (Bulgin M.R.27).
- 1 Mains plug and fuse (Bulgin F.15).
- 1 L.F. choke (Bulgin L.F.21S).
- 1 Screened H.F. choke (Graham Farish H.M.S.).
- 1 10,000-ohm potentiometer and mains switch (Cosmocond).
- 1 Terminal strip, 3-socket aerial type (Clix).
- 3 Brackets (B.R.G. Nos. 21, 22 1, 21 1).
- 6 ins. of screened sleeving (Goltone).
- 210-ft. hanks insulated wire (B.R.G. Quikon).
- Flex, screws, etc.
- 1 Loudspeaker (Blue Spot Star type).
- 1 Cabinet (Peto-Scott Universal, complete with 16 by 10 in. Metaplex chassis, with 3-in. runners).
- VALVES. Tungram 1 H.P.2118, 1 R.2018, 1 P.P.4018, 1 P.V.4018.

# A UNIVERSAL THREE

(Continued from previous page.)

No mains transformer is required, so that the sometimes quite large expenditure of cash that is required for such a component is saved—no mean item.

In the design of the Universal three-valver (there are three, not counting the rectifier) which is illustrated in these pages we have taken the Tungram valves as typical of the latest types of these special valves, and have built a really up-to-date set in console form.

### Voltage the Only Thing That Matters.

The result is a receiver that can be used on any mains having a voltage of 200 to 250, without any adjustment being necessary for change of mains other than a tapping on the heater resistance that controls the amount of current that flows through the heaters of the valves.

In operation the set is exactly the same as any ordinary three-valver with multi-meshscreen-grid volume control and single-dial tuning. Reaction is employed in a normal manner, and selectivity is adjustable by means of the two terminals for the aerial.

### The Baseboard is Not Earthed.

As the set is constructed on a metallised wooden chassis it is easy to wire up, the metal surface of the board being used for the negative mains return (in the case of D.C.) and the negative H.T. side (in either D.C. or A.C.). The actual earth connection of the set is separate from the metal chassis, so that there is no possibility of getting a difference of potential between the earth lead and the set should the mains not have the chassis connection earthed.

The earth socket is, therefore (as are the two aerial sockets), insulated from the baseboard, while all other

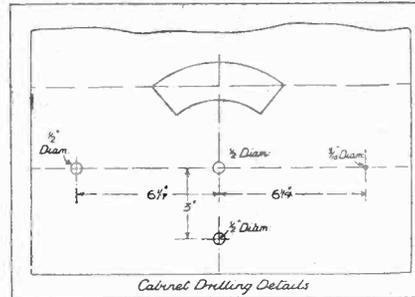
“earth” (or H.T. —) connections in the set are taken to the metal chassis. This includes such things as the moving vanes of the reaction condenser, which is automatically connected to the chassis by means of the metal bracket on which it is mounted, and the 8-mfd. electrolytic condenser which is “earthed” by its casing.

In mounting this condenser a layer of the plywood on the underside of the baseboard must be cut away (see photograph). otherwise the thread of the mounting will not protrude sufficiently to allow the fixing nut to be started.

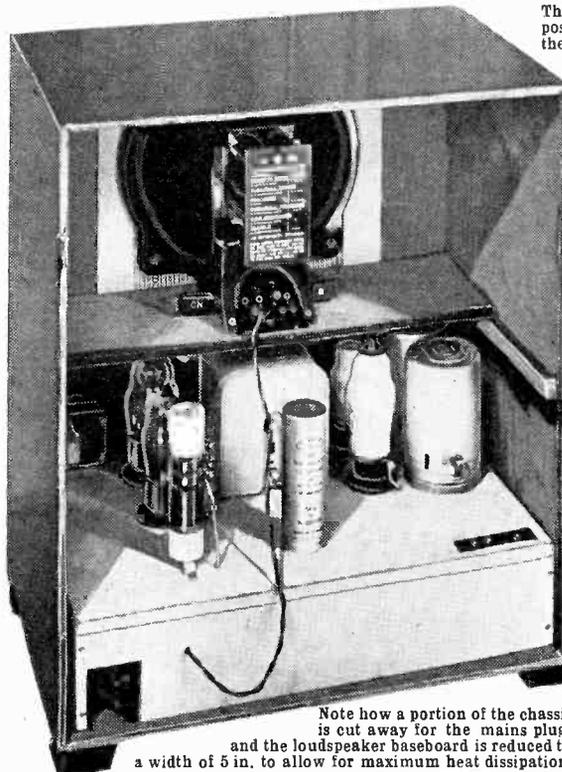
The smaller Dubilier electrolytic condenser is mounted on a metal bracket and is automatically “earthed” by means of this.

The various screened leads are also connected to the chassis by means of clips that pin the casings down to the chassis, and other points marked “M.B.” are connected to the metal surface by means of screws and washers.

### RELATIVE POSITIONS

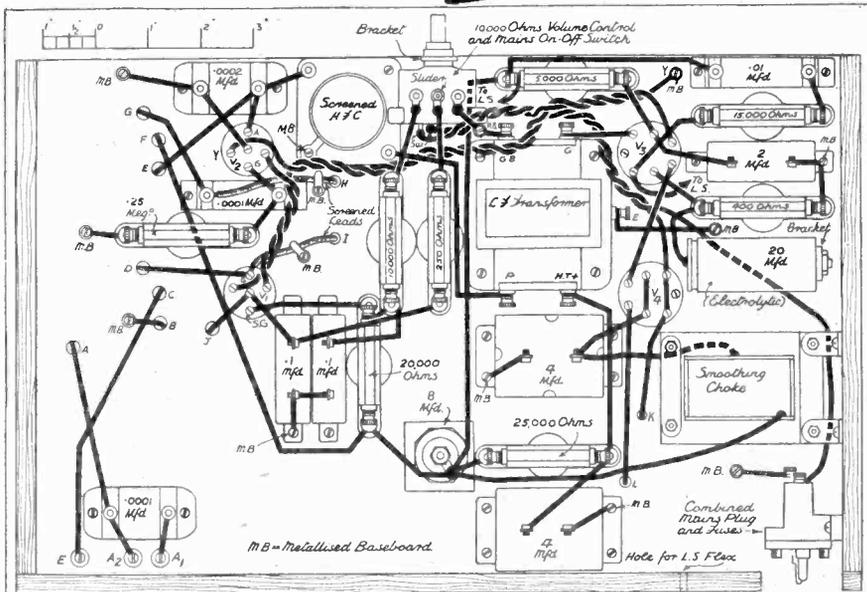


This little sketch shows the positions in the cabinet of the holes for the controls.



Note how a portion of the chassis is cut away for the mains plug, and the loudspeaker baseboard is reduced to a width of 5 in. to allow for maximum heat dissipation.

### WIRING DETAILS



baseboard. This point should be watched when the holes through the chassis are drilled. On no account must the terminals of the valve holders touch the baseboard. The terminal of V2 marked Y is connected by its lead to M.B. at point Y, all heater wiring being carried out with twisted leads.

### The Only Adjustment.

The on-off control is operated automatically by the volume control, which trips a switch when it is moved to or from its minimum position. This switch is placed in the positive or unearthened side of the mains between the fuses and the resistance. The mains resistance is marked with various voltages indicating the tapping to which the lead from the rectifier must be taken. This is the only mains adjustment that has to be done to make the receiver suitable for any supply within the 200/250 volts limit.

The construction of the receiver is not difficult if care is taken throughout that the various connections are made securely and accurately. It should be checked over

at frequent intervals during construction, however, for it is not easy to see exactly how the circuit runs when the set has been finished, and any fault made in the wiring may easily result in a most trying time spent in fault finding after the set has refused to function as it should.

### Keep Them Clear.

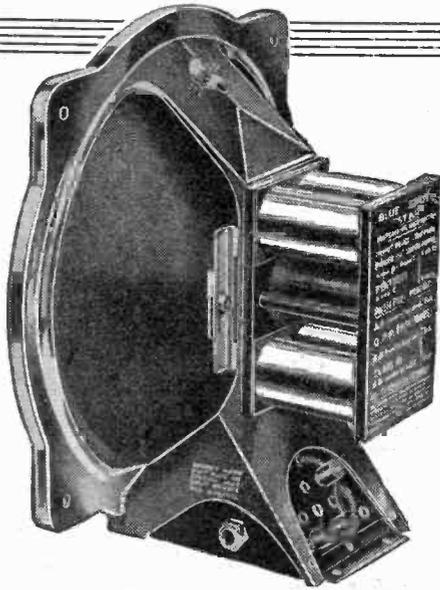
It is advisable to place pieces of thin card under all the horizontal resistance holders to obviate any possibility of short circuits between the terminal heads and the metal baseboard, should the former protrude farther than they ought.

H.F. transformer coupling is employed for the S.G. valve, giving a high degree of selectivity, and the pentode output ensures

(Continued on page 308.)

This wiring diagram should be used in conjunction with the diagram on page 309. The two flex leads marked “To L.S.” are brought through the hole in the back of the chassis and then up to the speaker, as seen in the photo above.

# BLUE SPOT "STAR"



## SPECIFIED for the P. W. "Universal Three"

because it is the best Moving Coil Speaker obtainable and the "P.W." designers require the best.

The Blue Spot "STAR" is specified for this new "Popular Wireless" set solely because its performance and construction is better than anything previously known.

Prove this for yourself by asking your dealer for a comparative demonstration. No matter how severe the test, the Blue Spot "STAR" will not fail to prove its superiority.

A fully descriptive catalogue is sent post free on request.

Chassis Price  
**70/-**



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Tel.: Clerkenwell 3570. Grams: Bluospot, Isling, London.

Distributors for Northern England, Scotland and Wales: H. C. RAWSON (Sheffield and London), Ltd., Sheffield; 22, St. Mary's Parsonage, Manchester; 177, Westgate Road, Newcastle-upon-Tyne; 37, 38, 39, Clyde Place, Glasgow.

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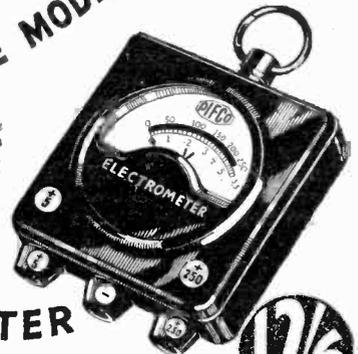
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A radio testing instrument in a class by itself. Makes any test on any radio, battery or electric. Moving Coil, 125,000 ohms resistance. Finished in mottled bakelite, complete with handsome case and leads. Price £2-2-0

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An instrument of endless use in radio and electricity testing. A.C. or D.C. double range reading, 0/50 volts and 0/250 volts. Sturdy construction and absolute accuracy. Diameter of dial 2 ins. Price, with leads, 12s. 6d.

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**PIFCO**  
*Trouble Trackers*

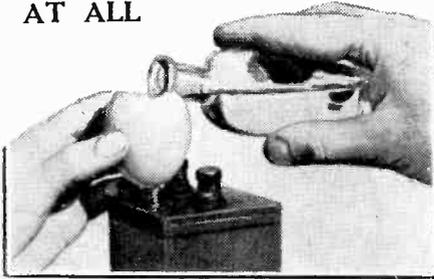
## AN EGG-SHELL ACID FUNNEL

A novel idea for a makeshift funnel for use when topping up accumulators, and also a few suggestions concerning old-type cone speakers.

If you happen to possess an accumulator whose filling, even with the use of a funnel, is not particularly easy, but which, without the aid of a funnel, becomes almost impossible without spilling the liquid around, the picture which you see herewith will be of service to you.

When "topping up" an accumulator of this type, or, indeed, when dealing in any manner with this type of accumulator,

### IT COSTS YOU NOTHING AT ALL



Not a drop of liquid need be spilled when using this improvisation.

you may, on occasion, find that you have mislaid or broken your funnel.

An egg shell, however, will get you out

of the difficulty in an admirable manner. Get someone to hold it lightly but firmly with its end in contact with a block of wood. Then, by means of a hand drill lightly applied, drill an  $\frac{1}{8}$ -in. or  $\frac{1}{16}$ -in. hole through the end of the shell.

You will now have an improvised funnel for accumulator topping up and for many other workroom uses. Hold the egg shell over the accumulator vent in the manner shown in the illustration, and pour off the required quantity, which will result in a steady stream. Not a drop of liquid will be spilled. Indeed, apart from its fragility, an egg-shell funnel is often as satisfactory in use as the real article.

### ADJUSTING YOUR SPEAKER.

If you employ a cone speaker of one of the earlier patterns you will, no doubt, have observed that this instrument has its "on" and its "off" evenings. At times it may give you every satisfaction, but on other occasions it may produce distortion of one sort or another.

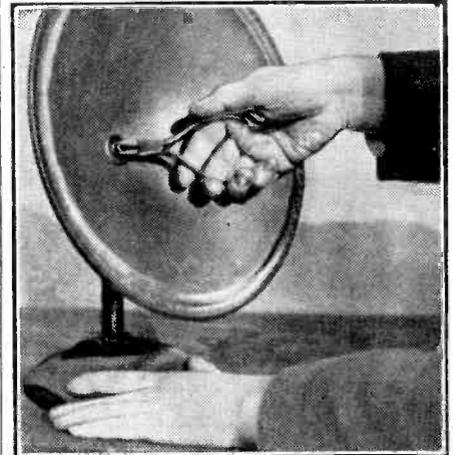
The fact of the matter is that speakers of this type are often very sensitive to atmospheric conditions and to temperature changes. The cone contracts or, alternatively, expands, and so results in the

actuating mechanism either touching the magnet or moving a little out of its normal position.

The trouble may usually be cured by very carefully manipulating the adjusting screw of the reed mechanism. Perform the necessary adjustment very carefully, turning the screw *very slightly* in the one direction and then in the opposite direction until the best result is obtained.

Some loudspeakers of the type mentioned above require a separate adjustment every evening during a period of changeable weather, particularly when they are moved from place to place.

### ALLOWING FOR WEATHER



Loudspeakers of this type are frequently affected by the weather, and a slight adjustment of the armature fixing is often advisable for best results.

## A UNIVERSAL THREE

(Continued from page 306.)

full loudspeaker reproduction from a number of stations.

The loudspeaker is fitted above the set in the cabinet and has its own transformer on the chassis. If a Blue Spot speaker is used it has the additional advantage of a distant control of volume by means of the flex and resistance shown in the photograph in the heading to this article.

The flex leads to the loudspeaker are taken through a hole drilled in the back support of the chassis, and are connected in the set to the two points marked on the wiring diagram: i.e. one end to one terminal of V3 and to the end of the 15,000-ohm resistance, and the other to one end of the 5,000-ohm resistance near to the volume control, etc.

### Some Important Points.

The piece of baseboard support cut away is to allow clearance for the female portion of the mains plug. The two plugs protrude till they are about flush with the outside surface of the support, and the piece of bakelite incorporating the two sockets pushes on the plugs.

To remove the fuses the two screws near the plugs have to be taken out, when the plugs and their moulding will come away and the cartridge fuses can easily be withdrawn. They are kept firmly against the backs of the plugs by means of springs.

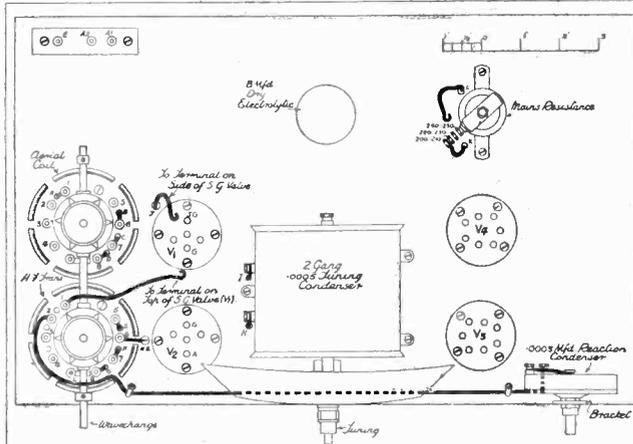
The operation of the receiver is perfectly

normal, the usual trimming having to be done while the set is on test before being placed in the cabinet. During this it is best to use a piece of sharpened wood rather than a metal screwdriver, and care must be taken that various points on the set are not touched by the hands while the operation is in progress.

the receiver to the electric light supply should be inserted the other way round to change the polarity of the mains as applied to the set. With A.C., of course, this does not have to be done.

After the trimming and the first tests have been carried out the set should be placed in its cabinet, the final connections made to the loudspeaker, and things tidied up generally.

### THE CONNECTIONS ABOVE THE CHASSIS



As this diagram shows, there are few connections to be made on top of the panel. The lettered holes enable the wires which pass through the baseboard to be followed in the other wiring diagram.

On connecting up to D.C. mains it is essential that the set be plugged in the right way round, or it will not work. If, therefore, nothing is heard to denote that the receiver is "alive" after it has been switched on for a minute or so, the mains plug from

### Remember Reaction.

In most localities it will probably be found that the set gives best results with the aerial on terminal A1; but if more sensitivity is required and a high degree of selectivity is not needed (as may be the case where a poor, short aerial is the best that can be achieved), terminal A2 should be used. In all cases as good an earth as is possible should be employed.

With every receiver fitted with reaction and H.F. volume control it should be realised that a very fine control of selectivity is available by decreasing sensitivity at the H.F. end and replacing the lost strength by reaction. We get the same power to pick up programmes, but with the added sharpness of tuning due to the reaction.

# TESTED AND FOUND?

Being Leaves from the Technical Editor's Notebook

## THE DE-LUXE CONTROLATONE

I HAVE often enough argued that tone controlling by the listener should not be necessary. Nevertheless, it very definitely is an essential to good listening in view of (1) the present condition of the ether; (2) the impossibility of achieving perfect tonal balance with the average radio receiving outfit; and, sometimes, (3) shortcomings on the part of the B.B.C. and other programme providers.

But that type of tone control which gives you only a control of the higher notes, and that to the extent of merely cutting more or less of them down in strength, is really only half a tone control.

And it has been left to our old friends Messrs. Bulgin & Co., Ltd., of Abbey Road, Barking, Essex, to produce what is, I believe, the very first top and bottom control which can be connected straight across the output of any set.

Alternative positions are possible in special cases, but the majority of requirements are met by the above extremely simple application.

### Very Wide Range of Control.

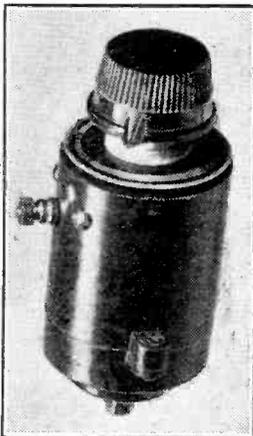
The device is very small in size, and it has just the two terminals for connecting purposes. The pointer on the neat, milled knob runs around a clearly marked scale which bears the words "Normal," "Deep Tone," "High," which are quite self-explanatory.

By the movement of that small knob the pitch of any item can be changed within extremely wide limits. There are those who like to adjust the pitch of every musical item to suit their own tastes.

While I, personally, rather shudder at the idea, I can see no reason why they should not do so if they want to, and they will no doubt be pleased to learn that this new Bulgin De-Luxe Controlatone enables an orchestral item to be changed from "normal" to either a "mellow" result free from practically all "top," to a thin piping free from bass, or to any intermediate condition between these extremes.

That is one use for an efficient tone control of this kind, but there are others, and, to my mind, much more important ones.

For instance, a particular gramophone record may be scratchy, or recorded squeakily, or the pick-up may have a treble resonance which comes



Deep, normal and high tones are all available by a turn of the knob on the Bulgin Controlatone.

out prominently on certain passages. This Controlatone enables a satisfactory adjustment of tone to be made.

There might be a heterodyne whistle or "monkey chatter" on a radio transmission. A touch of the Controlatone knob and it is at once cut out. On the other hand, the speaker may have a nasty bass resonance which is played upon noticeably by particular types of programme items, or speech brings with it a bass resonance. The De-Luxe Controlatone can deal equally well with these.

Of course, there is some slight diminution of volume accompanying these various effects, but it is not such that would upset the average set.

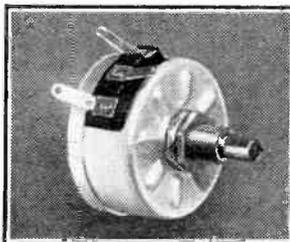
I consider that this new Bulgin Controlatone is a fine production, and one that ought to attain a wide popularity.

It retails at the most reasonable price of 7s. 6d., and is undoubtedly a most useful and easily fitted device.

THE whole plane of component construction appears to be on a distinctly higher level these days, and it is seldom that one encounters "throw-backs" to "muck-it" days. You will note that I say seldom, and I do so advisedly, for, rare though they may be, there are still occasions when a manufacturer will hopefully send me a piece of pure junk. You may remember a case in point not so very long ago!

So one keeps an open mind when something new arrives bearing a name which, however well known it may be to the world in general, has not figured on any apparatus that one has previously tested. But I received a pleasant surprise when I removed the dust cover of a Kabi Wire-Wound Potentiometer sent me by F. W. Lechner & Co., of 61, Spencer Street, Clerkenwell, London, E.C.1.

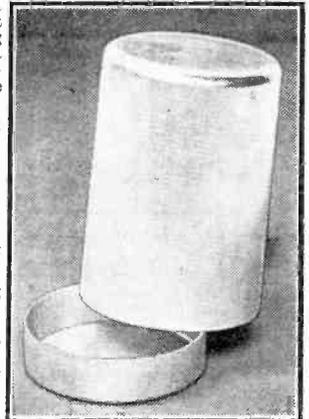
I could see immediately that here was something right on top of modern standards. You have heard that phrase "made like a watch." Well, that aptly



"Made like a watch" is the Technical Editor's description of the Kabi Potentiometer.

## THE KABI POTENTIOMETER

describes the design and construction of this potentiometer. It may not have the many tiny wheels and levers of such an article, but it bears the same clean, precision finish. And there is at least a spring which ensures a positive connection to the



One shilling is the cost of this coil screen, complete with base, for home-wound coils.

moving element!

The resistance wire is embedded in bakelite and the spindle is insulated. The action is smooth and quite free from any mechanical fault whatever. Electrically, the component is just as satisfactory, for it is silent in operation and able to take its optimum current load without any sign of design weakness.

The Kabi Potentiometer is made in two types: the "plain" in values up to 50,000 ohms and the logarithmic in values up to 25,000 ohms. In each case the price is 6s., and I should mention that the maximum dissipation is 3 watts. For 2s. extra, any value of either type can be supplied fitted with a mains switch.

MODERN sets, in cases, demand rather more advanced components than the earlier ones. And, therefore, constructors often find it difficult to make as many of the parts as they might wish.

## MAKING YOUR OWN COILS

For example, it is frequently highly desirable, if not absolutely essential to use screened coils. The actual coil itself may be easy enough to construct; it is the "can" that presents the difficulty. However, Mains Power Radio, Ltd., Broadway Works, Eastern Road, Romford, Essex, are making coil screens complete with bases which retail at the reasonable price of 1s. each.

EVERY week for the last few months my post has contained news of some important new development in the commercial-receiver world. The present week is no exception. I have just been having a glance through my "trade-news" basket, and right at the top are two letters announcing the early release of new models by two very famous firms.

### That "Slack" Time of the Year.

A year or so ago we used to regard this as the slack time of the year, for it was the practice of manufacturers generally to save all their new ideas until show time. The practice certainly tended to provide a greater number of surprises at the exhibition, but in all other respects—at least, in my opinion—it was fraught with disadvantages. Think of the confusion caused to the potential buyer by being confronted at Olympia with so many new sets—sometimes hundreds of them—and each one the very last word, etc.

The rational basis to which the industry has now settled down is undoubtedly a great advantage from every point of view, for, apart from removing the seasonal idea, the evening-out process results in all-the-year-round employment for thousands.

### Don't Wait Till August.

I'm sorry for this long-winded introduction, but I am particularly anxious to impress upon you the fact that, if you are wanting a new set, there will be nothing to be gained by waiting until the exhibition. There is little doubt that the exhibition this year, so far as commercial receivers are concerned, will largely consist of the models which are being introduced now—so why wait?

As a matter of fact, as I have hinted before in these notes, if you are waiting in anticipation

of still lower price levels, you may have a very unpleasant surprise in the autumn. I am in possession of certain information which gives strong grounds for thinking that prices can never be appreciably lower than they are now—at least, not for some long time to come—and that the chances are that before long they will actually go up.

It's my job to advise you on the buying side, and all I can say is that if you are thinking in terms of a commercial set, well—buy now!

### Two Important Releases.

Apropos of my introductory remarks, the two firms to come into the limelight with new models this week are Cossor and Ekco. The actual release date and price of this latest

Cossor effort are not yet announced, but I can tell you that it is a table-model battery receiver with Class B output and a moving-coil speaker, and that it is to be known as the "435 B." The appearance will be very similar, I understand, to their famous "435" A.C. model, but it is to have several novel features. I shall be giving you further details in an early issue.

## THE LINK BETWEEN

Notes of interest to buyers

By G. T. KELSEY.

to their famous "435" A.C. model, but it is to have several novel features. I shall be giving you further details in an early issue.

### Ekco's Latest.

Meanwhile, a few words about Ekco's latest. This, too, is a battery receiver; but, from my cursory examination of the technical specification, it seems to me to be one of the most ambitious battery designs that has ever been produced.

This particular set, which is already on the market, is to sell complete for 10 guineas, and it will also be available on hire purchase. It strikes me as being such an excellent proposition that I propose to make the literature concerning it available through the medium of our post-card literature service.

(Continued on page 314.)

# RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped addressed envelope must be sent with every article.

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

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.  
The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

## QUESTIONS AND ANSWERS

### PLAIN OR DIFFERENTIAL REACTION ?

S. F. D. (Howarth).—"When should a plain and when should a differential reaction condenser be employed ?"

Under ordinary circumstances there is never any advantage in a plain reaction condenser as compared with a differential; but when a design is out of the ordinary it may suit the designer's purpose better to use a plain reaction condenser and to get the by-pass effect which is ordinarily provided by the differential in some other way.

So, if the designer says a plain type of reaction condenser is necessary, use it for that particular design. But as a general rule the differential is preferable, as its moving and one set of fixed plates are, in effect, doing all that can be done by a "plain" condenser, whilst the additional set of fixed plates gives definite advantages in the ordinary set.

### STATIC NOISES PICKED UP VIA THE MAINS.

Listeners who suffer from electrical interference have been greatly interested in the "P.W." series of articles on "Man-Made Static," and already the hints given are proving of assistance in overcoming the annoyance of interrupted programmes.

## ABOUT YOUR CONTROLS

### USING REACTION

Although a set becomes more sensitive when reaction is applied, too much reaction makes it oscillate. Oscillation is an undesirable feature, and with many sets will cause interference with other listeners.

Oscillation may begin with a "plop," and is denoted by a rushing sound in the loudspeaker. If the fixed vanes of the tuning condenser are tapped with the finger, each tap produces a double click when the circuit in question is oscillating.

The most sensitive adjustment is when the set is nearly, but not quite, at the oscillation point.

The reaction control should be adjusted simultaneously with tuning, because more reaction is usually required for the top-of-the-dial positions than for the shorter-wavelength stations.

As correct reaction adjustment is capable of greatly increasing the range of a set, further details will be given in the next of this series.

A point that has emerged in correspondence about mains-operated sets is that there is considerable uncertainty about how H.F. currents in the mains themselves can find their way into the set when there are chokes and smoothing apparatus separating the set from the mains.

The accompanying sketch will help to make the matter clear. It will be seen that the mains (to the right) are joined via the H.T. eliminator to the set's H.F. wiring. But the H.F. interference in the mains does not stop at the eliminator, although this contains "choking" and smoothing apparatus; the interference passes straight on through the chokes, etc., to the set, where it is rectified and produces audible disturbance.

It is not obvious why the eliminator chokes are ineffective until we remember that the interference first appears in the form of high-frequency currents, on which are superimposed the low-frequency impulses which ultimately result in the noise heard. The H.F. thus acts as a "carrier," and low-frequency chokes will be ineffective in stopping the trouble because their impedance may be quite low to the high frequencies on which the interference is carried to the set.

### USING A SHORT-WAVE ADAPTOR.

J. E. (Barnsley).—"I have been rather against having a short-wave adaptor (not superhet), as I thought it would be difficult to handle the extra tuning condenser as well. But now I am told that when the adaptor is being used you do not have to adjust any of the other controls on the set, as these then have no effect on reception.

"If I have to bother about only the two dials on the adaptor itself, do you think I should get America, in spite of the fact that short waves are new to me?"

Yes, there is no reason why you should not get American and far more distant stations, especially after you have had a week or two's practice.

It was part of the merit of the "adaptor" idea—as introduced to the world by "P.W."—that the set's controls should be unused, all the tuning, etc., being done on the adaptor's own controls.

In these circumstances, and provided you handle the controls properly—as so often emphasised by W. L. S. in "On the Short Waves"—there is no reason why even the complete novice should find difficulty in using an adaptor successfully.

### A METAL PANEL THAT CAUSES A TINGLE IF TOUCHED.

G. M. (Edgware).—"A friend of mine, a lady, recently moved to another house in the same neighbourhood (an Essex suburb),

and as the same electric company's light supply was laid on she took her wireless set to the new house, complete with loudspeaker, etc.

"It was fitted up by the dealer she got it from (or rather by one of his men), but she now gets scared because sometimes she feels a tingling when tuning it.

"There is a metal panel, which sometimes cannot be touched without a distinct 'tingle' of the fingers.

"Is it all in order, or does this mean something has gone wrong in the move? It was never this trouble before."

Apparently what has occurred is that the new house is wired in a rather different way, and the positive is now the "earthed" wire, instead of the negative, as before.

This would show up a fault which did not disclose itself at the old house, but which is due to deficient set design. The set should have had condensers in the aerial and earth leads, and the metal panel should be isolated to prevent such tingling effects, which are potentially dangerous.

The dealer should be able to put it right straight away if his attention is called to it.

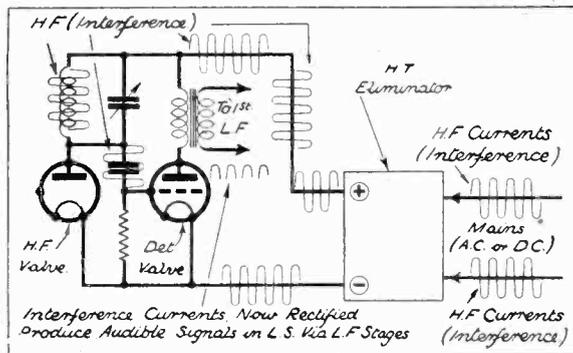
If, however, he makes objections or says it is unnecessary we should get in another man who knows the right method of preventing this trouble.

### INSTABILITY DUE TO LONG LOUD-SPEAKER LEADS.

W. N. (Sherwood, Nottingham).—"About eighteen months ago I put in loudspeaker extension wires from the front room downstairs to a bedroom immediately above it and to two other rooms on the ground floor as well.

"In all I must have used between forty and

## HOW INTERFERENCE GETS THROUGH



The thin wavy lines around the black wiring show how interference, entering from the mains at the right, penetrates to the set through the mains unit.

fifty feet of wire, so it was a fairly big job. With the three-valve set I was then using it was perfectly satisfactory in every way.

"At the beginning of May I had a new set, and to my disappointment I find I cannot use the extra loudspeakers with it.

"There is ample power, of course, it being a five-valve superheterodyne. But it goes weak and distorted when I put the extra loudspeakers on.

"Without them it is perfect, and in quality and power is far beyond anything the old set could do. Moreover it has a pair of sockets fitted specially for additional loudspeaker leads, so that would point to the fact that there must be something wrong with my wiring to the loudspeakers in the other rooms.

"But how can that be when the old set, which was much inferior, worked perfectly with the same leads in use? It has got me beaten.

"The new set stands in the same position that the old one did and uses the same earth. I have tested that, and it is in tip-top condition.

"Instead of having the outdoor aerial I now use a wire round two sides of the picture  
(Continued on next page.)

## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

rail, and with that I can get as many stations as I want, provided I don't put in the plugs for the extra loudspeaker leads. With them in place it is hopeless, and sounds like a set with too much reaction—very unstable.

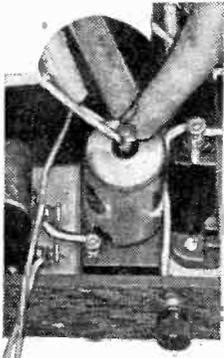
"If you can suggest the cure for this very peculiar sort of fault I shall be more than glad to hear of it."

It would seem to be a clear case of feed-back, the symptoms suggesting that magnified high frequency is getting back into the input of the set in some way.

This fault used to be fairly common a year or two ago, until it became standard practice to prevent H.F. from straying into the L.F. side of the receiver. But your set seems to be a little deficient in this respect—a fact that might easily pass notice and be of no importance at all unless that stray H.F. finds its way back to the set, where it gets magnified again, and so produces instability.

The likeliest place for the feed-back to occur is between the output extension leads and the new aerial.

Make sure that all the aerial wiring is kept really well separated from all the loudspeaker wiring,



### FOR BETTER RADIO

The importance of securing good contact sometimes leads to too much enthusiasm, resulting in the over-tightening of terminals on components by means of the pliers.

It is bad policy to over-tighten the nuts on chokes.

components by means of the pliers.

If the pliers are large the whole fitting may turn and break the thin wire attached to it inside. Such terminals are perfectly satisfactory in service if made a little more than finger-tight.

So the pliers employed should be small ones, used carefully.

and use screened wire for the latter. An H.F. choke filter in the leads at the set end might help.

You may find it necessary to shift the aerial altogether, so the other side of the room could be given a trial.

That picture-rail wiring may not be good enough if the walls contain conductors; but you can get thin and inconspicuous wire, which is practically invisible against a ceiling, so there need be no unsightly alterations, even if it becomes necessary to space the aerial a foot or so away from wall or ceiling.

Working on these lines, you should find it possible to stop the feed-back without much trouble.

### ADDING AUTOMATIC VOLUME CONTROL.

The frequent requests for details of how to add automatic volume control to existing sets indicate that it is not yet generally known that such additions are not easily made. In fact, to add automatic volume control to an existing receiver that was not designed with this specific possibility in mind is distinctly difficult in many cases and impossible in others.

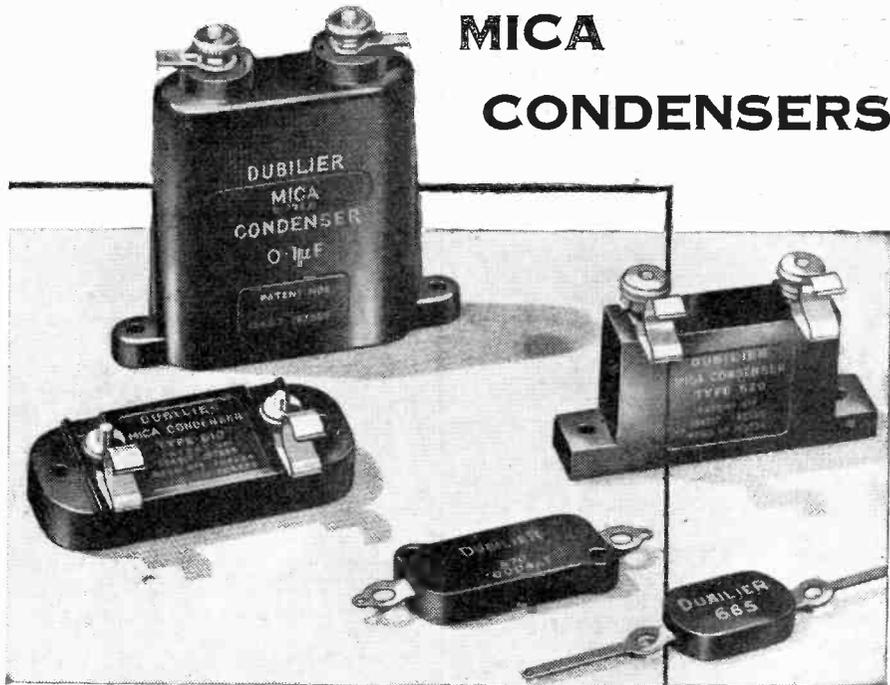
The following request is a typical one. It comes from Mr. William Simms, but the address given in his letter was insufficient for a direct reply to be sent.

(Continued on next page.)

## OUTSTANDING

## MICA

## CONDENSERS



MICA condensers are as essential to the radio receiver as the 'small wheels' are to a watch. They perform a meticulous job in an unobtrusive fashion—yet the strength of the whole set is measured by their strength, its efficiency, by their efficiency.

How important that you should choose mica condensers which are famed for their reliability—Dubilier, the 100% British Mica Condensers! The name Dubilier is a guarantee of trouble-free reception to the listener and a minimum of servicing to the manufacturer.

Set Manufacturers should apply for Special Terms.

Type 665.  
Capacities '0001 to '0005.  
Prices from 6d. each.

Type 670.  
Capacities '0001 to '01.  
Prices from 1/- each.

Types 610 and 620.  
Capacities '0001 to '01.  
Prices from 1/3 each.

Type B775.  
Capacities '01 to '1.  
Prices from 3/- each.

# DUBILIER

## MICA CONDENSERS

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, NORTH ACTON, W.3.

**H.T. FRESH AS THE DAWN EVERY MORNING**—recharges itself overnight! Install a Standard Wet Battery, and H.T. troubles for good. Lasts years. Annual replenishment—that's all! 120-v., 12,500 m.a. £2 carr. paid. All Standard H.T. spares. Write for details—**WET H.T. BATTERY CO., 26, Lisie Street, London, W.C.2.**

### G.P.O. ENGINEERING DEPT.

(No experience required.) Commence £4 per week. Age 17-23. Excellent prospects. Free details of entrance Exam. from **B. I. E. T. (Dept. 568), 31, Oxford Street, W.1.**

## WHAT! NO AERIAL?

### WIRELESS THAT IS REALLY WIRELESS

No more aerial wires or poles. Merely hook this 3 x 5 in. precision instrument on back of set. *Tunes to individual radio.* Gives excellent tone and selectivity. Reduces static, ends danger of lightning and shorts. No wires, no mess, no upkeep costs. Simple to fix. 7/6 post free. *Satisfaction or money back.* "I am more than delighted," writes Mr. J. McO.

**E. M. BERRIMAN**  
(Dept. 8), 7, Broadway, Ludgate Hill, London, E.C.4.

## 1000 ELECTRADIX BARGAINS

Electradix Radios offer 1000 bargains at sacrifice prices in radio components, meters, dynamos, microphones, switches, chargers, valves, etc.

**ELECTRADIX RADIOS** Send for Sale List 'P.' It will save you pounds.  
**218, Upper Thames Street, E.C.4. Central 4611.**

PLEASE be sure to mention "Popular Wireless" when communicating with Advertisers. Thanks!

## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

Mr. Simms says: "I built your 'Cosmic Four' in January, 1933, and have found it to be a wonderful set.

"Selectivity and power are beyond speaking about. I am working it off an Atlas mains unit.

"I would like to know if it is possible to fit automatic volume control to this set. And, if so, would you send details of the alterations to the wiring?"

We cannot do this, because for automatic volume control to be effective it needs a "two H.F." input, and this set has only one H.F. valve. The degree of control on such a set would therefore be insufficient.

In fact, as stated above, we do not recommend any such attempt as an addition to the ordinary household set, as even practised experimenters find difficulties in making such additions. If A.V.C. is to be tried at all it should be done properly, in a set which incorporates sufficient H.F. amplification to give it a fair chance to prove its merits.

### CHANGING OVER TO GANGED TUNING.

J. L. (Bradford).—"Will you please give me your advice on the following problem?"

"I have a four-valve wireless battery set, with aerial and anode tuning. I am considering changing this over to a gang condenser.

"Would this be any advantage to the present tuning? Should I lose any stations in carrying out this alteration?"

"As I do not know much about the technicalities of wireless, would this be easy to carry out?"

The actual change-over need not be specially

difficult. But to get the advantage of ganged tuning you *must* use matched coils.

Unless this is done the equal changes of capacity will not result in the necessary equal changes of wavelength, because the coils will be different. (As wavelength depends upon inductance (coils) as much as upon capacity (condensers), the coils must be matched as well as the condensers.)

Failing this, one circuit will tune differently from the other, and you will therefore lose stations.

When both the coils and condensers are properly matched and ganged you have the equivalent of two separately tuned circuits—neither loss nor improvement resulting except the convenience that it is now necessary to turn only one control knob instead of two.

### FAULT FINDING

If you are up against a radio problem remember that our Technical Query Department is thoroughly equipped to assist our readers, and offers you its unrivalled service.

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

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

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

### "THE PEN-DET" SHORT-WAVER.

Numbers of readers have recently been inquiring for a short-wave set employing a pentode as detector. It was only a couple of months ago that such a set was described by "W. L. S." under the title "The Pen-Det."

This was in the April 21st number of "P.W.," and, if unobtainable locally, application should be made to the publishers, The Amalgamated Press, Ltd., Bear Alley, Farringdon Street, E.C.2. The price is 4d., including postage.

## WHY WEAK LONG WAVES?

If your long-wave results are not so good so those obtained on medium wavelengths, try some of the tips suggested here.

By BERNARD BARNARD.

THERE must be many thousands of radio sets in use to-day which do not give full satisfaction on long waves. In every other particular they may be perfectly pleasing, but no amount of effort on the part of their owners or builders will produce results on the upper waveband that are comparable with the medium-wave reception.

Amateurs who are experiencing this kind of trouble should, if in any way possible, make the following conclusive test before suspecting any particular part or parts in their installation, for it will save an enormous amount of time and trouble, to say nothing of the possibility of unnecessary expense.

If the delinquent receiver is coupled up to another aerial in the same neighbourhood some really valuable observations can be made.

We will suppose that you find that your receiver gives satisfactory performance on long waves under these conditions. Obviously, you can now place the blame either upon your own aerial as being insensitive on the upper band, or—a rather remote

(Continued on next page.)

£120

# IN CASH

AND OTHER

# PRIZES

## EASY-TO-WIN

## AND Free TO ALL

**MILLIAMPS**

0-6 milliamps.  
0-30 "  
0-120 "

**VOLTS**

0-6 volts.  
0-120 "  
0-300 "

**OHMS**

0-10,000 ohms  
0-60,000 "  
0-1,200,000 "  
0-3 megohms.



### WIN

## £1 A WEEK

### FOR A YEAR

10/- a Week for a Year

### £10 CASH

or one of 25 other Prizes.

**40/-** Complete in case with pair of leads and interchangeable crocodile clips and testing prods. DEFERRED TERMS IF DESIRED.

If you had a rich uncle, and he died, and (good old chap) left you a windfall, that would be fine. But as things are, here is an equally opportune and much surer way of winning some welcome extra cash. By simply being a radio man—interested in radio—you can win £1 a week for a year, 10s. a week for a year, £10 cash or one of twenty-five other useful prizes, easily and very enjoyably.

Just as long as you are normally interested in radio and radio results, there is a prize awaiting you in a novel competition that anyone can enter and win without cost or difficulty, without technicalities or cleverness.

Ask your nearest radio dealer for full particulars and Free Entry Forms for the AvoMinor competition—and win an easy prize. Ask to-day! All radio shops have Entry Forms.

But, if you have any difficulty, write for them direct.

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# AVOMINOR

TRADE MARK

## TEN TESTING INSTRUMENTS IN ONE

## WHY WEAK LONG WAVES?

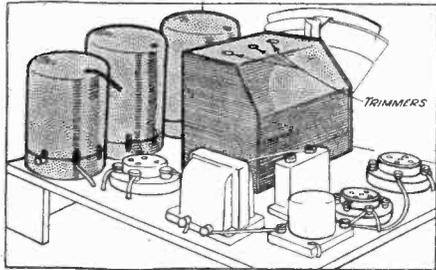
(Continued from previous page.)

possibility—local conditions are bad in this particular detail.

It is quite possible to have a really good aerial that gives all that is required on medium waves, but which fails lamentably as soon as the wavechange switch is pushed in.

The most likely reason for such a state of affairs is as follows: There is a strong tendency to-day to cut the aerial down to the minimum length compatible with good signal strength in order to obtain a high degree of selectivity, and, as most of the

### CHECK THE GANGING



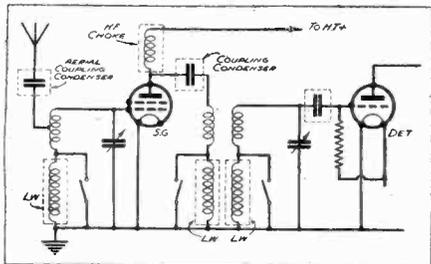
The trimming condensers, if set for medium waves, may not be right for long waves, due to improperly matched coils.

station crowding is on medium waves, the aerial length is cut down according to the results obtained on that band.

Now, good long-wave reception *does* necessitate a fair length of aerial wire, and for this reason it is often found that an aerial length that gives the best combination of signal strength and selectivity on medium waves is too short to be satisfactory on long. The cure in these cases is to increase the aerial by about 15 ft. and put up with a slight increase in "over-lap."

Now let us turn back to our original test again and suppose that the results obtained

### SOME VITAL POINTS



Some of the places where long-wave losses can take place are indicated in this circuit diagram.

were quite different. We should find that the set gave no better results on long waves on the new aerial than it did on the "home" arrangement, and also that the results were definitely below those obtained on a friend's set. This leads us to suspect some form of trouble in the receiver itself.

Before starting to unravel the fault it is as well to ask ourselves what it is that is *different* about a receiver when it is switched to long waves and when it is on the medium band.

Obviously, we have brought one or more extra coils into the circuit. And there are also several less obvious "differences"

which must be taken into account. There are, for instance, several fixed condensers in the H.F. portion of the receiver whose duty it is to pass the received energy into the succeeding receiver stages. The values of these condensers are carefully chosen by the designer so that they will deal adequately with all the received frequencies.

As you probably know, the "resistance" offered by a condenser to an H.F. current varies inversely with the frequency of that current.

### Incorrect Condenser Values.

Suppose there is a fault in one of these condensers so that its capacity is considerably less than its rated value. The capacity may still be sufficient to pass on the medium waves (high frequencies), but it will probably offer considerable resistance to the long waves (lower frequencies).

The likely places for trouble of this sort are clearly shown in the accompanying circuit.

Another probable seat of trouble—although it hardly comes under the heading of "differences"—is the H.F. choke in the anode lead of the screened-grid valve.

The duty of this choke is to offer the maximum possible "resistance" to the H.F. signal currents so that they are fed without loss to the tuning circuit.

A slightly faulty choke in this part of the set may very easily give excellent medium-wave results, but fail completely on long waves.

## THE LISTENER'S NOTEBOOK

(Continued from page 296.)

I hate waste of any sort. That's why I was glad to see on one evening variety entertainment from the stage being broadcast by all Regional stations. And more than this: during the rest of the evening all the Regionals' features were for the most part musical. There were orchestral music, dance music, city band music and singers—a mixture that catered for all tastes.

I am not quite so enthusiastic about singers as I used to be. Some of them have the most impossible repertoires. To include a foreign song or two in a group is quite the correct thing nowadays. It doesn't seem to matter how dreary the tune is. The words are all that matter, although we never understand one of them.

A French or German song is the hall-mark of excellence. At any rate, that seems the argument. I think it's just rubbish.

I am unwilling to single out any particular individual as an illustration, since the practice is so universal. But no one who heard "Sur l'eau" (On the Water) by Pedrell, followed by "Mon Cœur est las" (My Heart is Heavy) by Doret, can honestly say he was pleasantly entertained. It was just painful to me.

This may be a bit hard on Pedrell and Doré, the composers, but there it is.

Every now and again the Foundations of Music produce something which, for me, justifies their exalted position in the programmes. This time it is the madrigals of Monteverdi.

First, I'm fond of the Wireless Singers, and secondly I'm particularly fond of these 16th- and 17th-century compositions. I like their uncommon harmonies. I appreciate their difficulty also.

The Wireless Singers sang with perfect smoothness, except for an occasional rough phrase or two during the earlier part of the week.

The final concert in the London Music Festival has now been given. Summer or no

(Continued on next page.)

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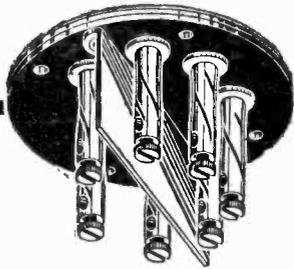
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## THE LISTENER'S NOTEBOOK

*(Continued from previous page.)*

summer, this is an occasion of regret for many listeners.

The concerts of Contemporary Music, however, will go on for some little time yet. But to me there's a world of difference between the two. I do not regard the latter as a consolation.

With the tang of sea air in my nostrils, only through seeing the words "Fol-de-Rols" in print, my revolt against serious mid-winter fare is now complete.

I'm not afraid that I shan't return with the same zest to the talks in the autumn. No one is a greater lover of talks than I when they, like pork and oysters, are in season.

But at the present moment I'm all for the great open spaces. This is the point I've been leading up to. Just as I have a liking for talks in winter, so I have an insatiable thirst for outdoor broadcasts in summer.

I love news. The season of outdoor activities has begun. I love those sound pictures the B.B.C. has given us in the past, but it hasn't tapped anything like all the sources yet. In my opinion, it has only touched the fringe of them.

An outside broadcast per day is the minimum the B.B.C. should aim at. If we had this, those of us who can't afford a holiday needn't really take one. C. B.

## THE LINK BETWEEN

*(Continued from page 309.)*

Full details of the Ekeo "B.54," as it is called, will be sent to every reader who cares to send me a postcard. (No. 87.)

### The 24-Hour Clock.

Is the radio industry as a whole about to become 24-hour-clock minded? Following the adoption by the B.B.C. of the 24-hour-time-keeping system, I am interested to note that the example has been followed by Ferranti Limited. Ferranti's tell me that they find it particularly useful in connection with the teleprinter system which joins their Hollywood head office with the London branch at Bush House.

Will they, I wonder, go a stage farther and introduce the twenty-four figures on the faces of the clocks they manufacture? I rather

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imagine that they will. Ferranti's are usually well to the fore, and I think, from present indications, that we may safely assume that the time is not far distant when the continental system is adopted universally in this country.

### For Gramophone Enthusiasts.

At last a new pick-up! I began to think that the manufacturers had forgotten that there were such things as pick-ups—or was it that all the existing ones were up to such a high standard that they could not be improved upon?

The new one is a product of B.T.H.—Ediswan. It is of the needle-armature type, and is to sell, complete with tone arm and volume control, for £2. At the time of writing I have not had an opportunity of trying this new pick-up, but, judging by the response curve, I should imagine that it is remarkably efficient.

In view of the present interest in the electrical reproduction of gramophone records I propose to make the literature concerning this new pick-up available through the medium of our postcard literature scheme.

The leaflet, which will be sent to all readers making application in the usual way, shows a reproduction of the response curve. (No. 88.)

## LIGHT-VALVE PROBLEMS

*(Continued from page 299.)*

valve would be even more delicate and liable to get out of adjustment as a result of the paring down of its moving parts.

Another device, also under development in America, utilises a peculiar and little-understood property of certain crystalline substances which exhibit the phenomenon of a change in their physical dimensions or shape when submitted to an electro-static field.

### For High Definition.

If a mirror surface is deposited on one of the faces of such a crystal a beam of light reflected therefrom will be diverted, to some slight extent, when varying electric fields are applied, and so again a modulation effect can be achieved.

The effects so far produced appear to have been rather small, and there is some difficulty in preventing the disintegration of the mirror surface, or even of the whole crystal, if the input is made at all strong. These, however, are difficulties of the kind that one expects to encounter in developing any new principle, and it is obvious that if they could be overcome we should have here the basis of a modulating system which would be extremely permanent in its adjustments. It should also be capable of dealing successfully with very high frequencies.

## INFRA-SONIC EFFECTS

*(Continued from page 298.)*

low indeed, some higher and some remarkably high.

The accurate reproduction of a steep-fronted wave involves the equal reproduction of thousands of different frequencies, even from the lowest audible to the highest audible—because electrical and electro-acoustical systems have poor-frequency characteristics, they transmit transients very badly.

Mr. Dowding's invention has this ability: that it throws in a lot of the missing important super-bass frequencies, a jumble of them which gives the impression of reality more strongly than a normally super-bass deficient loudspeaker. I do not know—I am thinking aloud and, I hope, accurately and coherently.

### "Something to Think About."

May it not be, however, that the idea has particular reference to transient transmission—and to supplying just that steep-fronted wave that gives naturalness?

The subject is one which bristles with snags for the unwary and difficulties for the non-technical. I can say that, when I heard the device, I was startled at the realism it gave to jazz. I can add that we all should admire and be grateful to those who explore these questions with imagination and ingenuity. Certainly Mr. Dowding has given us something to think about.

## READ THE WIRELESS CONSTRUCTOR.

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# TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

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

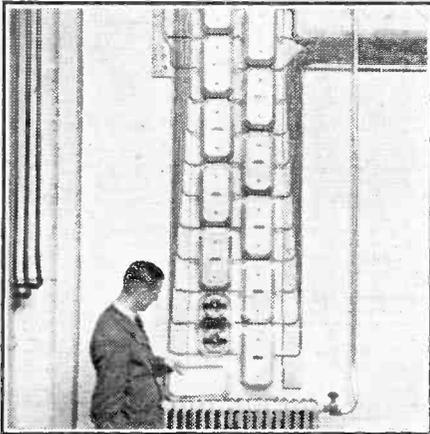
## What Resonance Will Do.

I HAVE more than once been asked whether it is really true that a very loud sound will break a tumbler or ornament. I dare say, to some people, this sounds a bit of a tall story, but, strangely enough, it is perfectly true.

I have seen it done several times and have done it myself. It is simply an example of what we may call resonance or, more familiarly, "tuning."

You know that when you tune the receiving circuit of a wireless receiver you are "setting" it so that its "natural" frequency of vibration (that is, the frequency of its vibrations if set in "vibration" and left to itself) is the same as the frequency of the incoming carrier-wave. When so adjusted it will respond to the incoming waves with enormously greater amplitude—that is, its sensitivity or receptivity is enormously increased (at that particular frequency).

## FOR SILENT WORKING



H.M.V. have equipped their new research extension at Hayes with special apparatus for the elimination of electrical interference. The incoming cables, of which there are seventeen, are fitted with choke-condenser filters, designed and supplied by Messrs. Belling & Lee, Ltd., who are specialists in the suppression of "man-made static."

## Sympathetic Vibration.

In the same way, if a glass tumbler is subjected to vibrations which correspond to its own natural frequency (easily ascertained by tapping it and observing the pitch of the note) it can be set into very violent vibration, and if the applied vibrations are powerful enough the vibrations produced in the glass may be sufficient to cause it to fly in pieces.

## The Influence of Class B.

One of the many effects of Class B amplification is its influence upon battery sets in their relation to mains sets. Ever since mains receivers arrived—or ever since they became a really practical proposition—there has been a tendency to regard the battery set as a sort of weaker

brother—all very well for those who hadn't electric light or, for some other reason, couldn't go to the length of having the real thing—the "real thing" being, of course, the all-electric set.

## Battery and Mains Sets.

Well, even if this view were ever really justified—which I very much doubt—it is certainly so no longer, now that Class B has arrived to put that extra pep into the battery set and to reduce running costs. Indeed, one might well go farther and point out that the battery set, now its output volume and so on have been brought up to scratch with the mains set, has the great advantage that its "background" is really silent: this is more than can be said of a good many mains sets.

Actual running costs with the battery set will be higher than with the other, but in these days of efficient H.T. batteries (and bearing in mind the small H.T. current under the new conditions) the running costs are not worth talking about, anyhow. A battery set can be used anywhere, if sufficiently portable, and has many things to recommend it.

The coming of Class B has certainly brought it back into the limelight, and no one need have any fears about going in for a reputable make of battery-operated set these days.

## Detector Adjustments.

A few years ago it used to be the practice to adjust the detector conditions constantly, but nowadays, with the tendency to have everything fixed and set, comparatively little attention seems to be paid to this important point. If, however, you want to get the last ounce out of your set, there is perhaps no part of it that will better repay attention than the detector.

## The Grid Condenser.

The first point is the grid condenser. This may have a value from, say, 0.0001 to 0.0003 mfd., but as a rule you will find that varying the value of this condenser, although it will probably affect the tone or quality, will have little effect on the sensitivity.

A much more important point, so far as sensitivity is concerned, is the grid leak. For this you may try values from 3 megohms down to 0.5 megohms.

It is a good plan to join a potentiometer across the low-tension battery and to connect the leak between the grid and a point on this potentiometer. On shifting the slider of the potentiometer from one end to the other (that is, from L.T. negative to L.T. positive) you will find noticeable differences in the performance of the set.

The beauty of the potentiometer is that it enables you to find just the right amount of bias for the grid, and this leads to smooth reaction and high sensitivity. For the potentiometer you may use a resistance of, say, 200-300 ohms, and this may have

(Continued on next page.)

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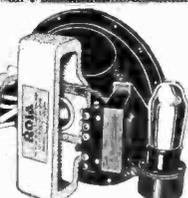
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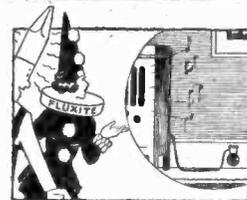
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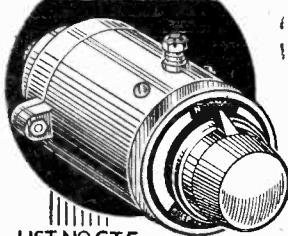
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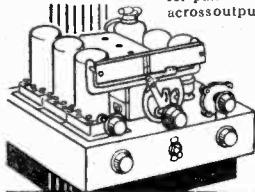
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## TECHNICAL NOTES

(Continued from previous page.)

a slider, or it may be tapped in four or six places. A tapped potentiometer is sometimes cheaper than a sliding one, as it has no working parts, and it should be quite suitable for the present purpose.

### Try Different Values.

Another point which is worth mentioning is the by-pass condenser, connected between the anode of the valve and negative low tension: different values should be tried for this.

It is well worth while to adjust and "tune up" the detector stage in this way, as by so doing you may easily improve the performance of the set a hundred per cent. If, after you have got things nicely adjusted, you find you have to change the valve, remember that a readjustment will be necessary for the new valve, as it is very unlikely that the two valves will be identical.

### Pentode Output and Tone Control.

The pentode valve, as you know, is apt to emphasise the high notes, and in order to overcome this it is usual to connect a resistance and condenser across the output circuit. Many people have the idea that the effect of this arrangement is to bring up the bass, but really this is only a *relative* effect; what happens is that you cut down the high notes, and so the bass by comparison appears stronger.

Increasing the capacity of the condenser reduces the strength of the high notes still farther, and the same sort of effect is produced by lowering the value of the resistance. In fact, if you go to the limit and cut out the resistance altogether or reduce it to zero (that is, short-circuit it) so that only the condenser is effective, then you may cut out the high notes entirely.

### A Good Combination.

In actual practice the best way is to adjust the relative values of the resistance and condenser to suit the particular characteristics of the valve and loudspeaker. Average values which you can start with are, say, 15,000 ohms for the resistance and 0.01 microfarad for the condenser.

Starting from these values you can then try variations of the resistance and capacity until you get the best results. In actual practice you will find that the arrangement will stand quite wide variations in the values.

I should mention that the condenser should be one which is rated for a voltage at least two or three times the ordinary value of high tension which is used.

### The Question of Voltage Drop.

When you have a resistance in the anode circuit of the detector valve it is, as a rule, best to apply the maximum voltage available to the detector so as to make up for the drop in the resistance. The actual voltage applied to the anode of the detector will, of course, only be a part of the total voltage available.

With an anode circuit resistance of, say, 25,000 ohms and a current of two milliamps the voltage drop in the resistance will be

50 volts. If the battery voltage is 120 this will mean that the voltage actually applied to the anode of the detector will be about 70.

In some cases the detector works best with a lower voltage than this, but it is a good thing to adjust the detector voltage pretty carefully, as it is often by way of being rather critical.

### A Point to Remember.

In a resistance-fed transformer circuit the decoupling resistance should, of course, be added to the anode resistance.

If the voltage applied to the detector is too low, not only will the output volume be reduced, but also the valve will not be able to handle a normal signal without distortion.

A point to remember is that when the anode voltage on the detector is relatively low, although the stage may be extra-sensitive in a sense, if you can increase the

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voltage and still keep the detector stage in proper working order you will find that it will then be able to deal with larger inputs.

### Quality and Class B.

When using Class B amplification you want to remember that the quality depends very greatly upon the special input transformer required for the last stage. The secondary of this transformer carries grid current, and so in order to avoid distortion it is necessary that the resistance of the secondary should be very low.

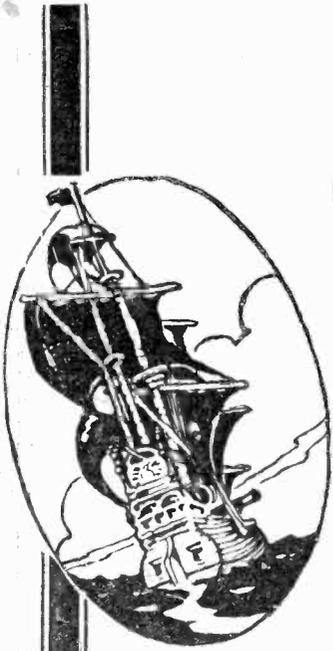
You cannot just use any old cheap transformer for this purpose, not if you want to get really high-class results.

The transformer carries current in both the primary and secondary windings, and is one which calls for special design. If you use a cheap and unsuitable transformer you will get distortion.

If you want to get a large and really undistorted output, then it is essential to use a high-class and suitable transformer. This is not at all a serious matter, as transformers for this purpose are now available at very moderate prices.

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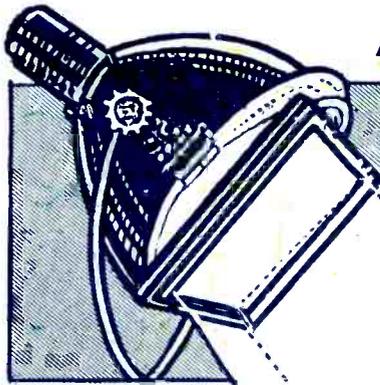
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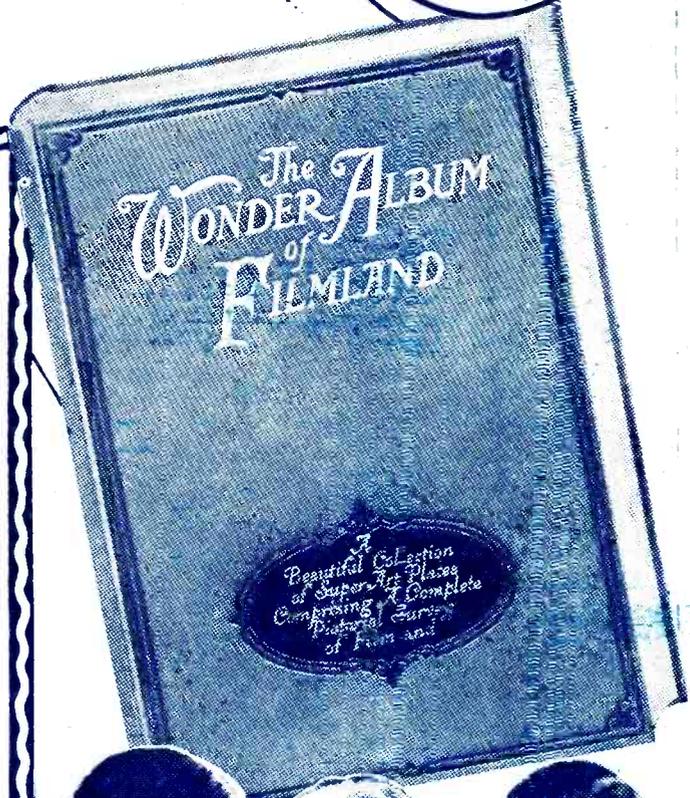
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