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Vol. XXIII,  
September 9th,  
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ACOUSTICS AND THE LISTENER  
FAULTS I HAVE FOUND  
FREQUENCY FAKING

and

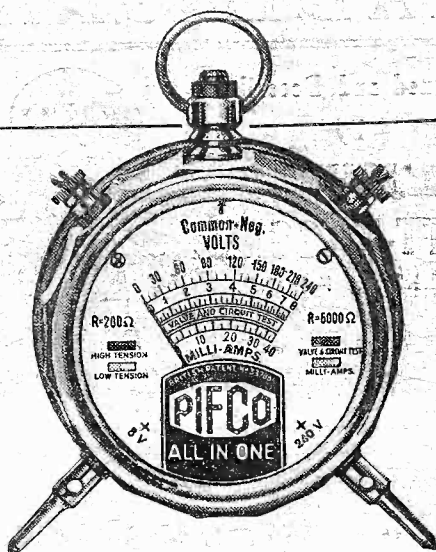
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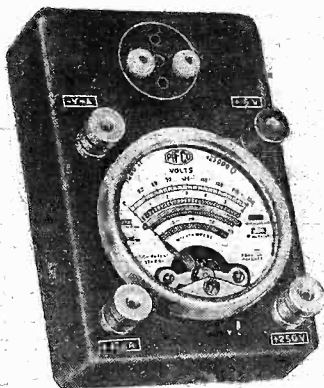
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contains, among other features of  
outstanding interest, full details of

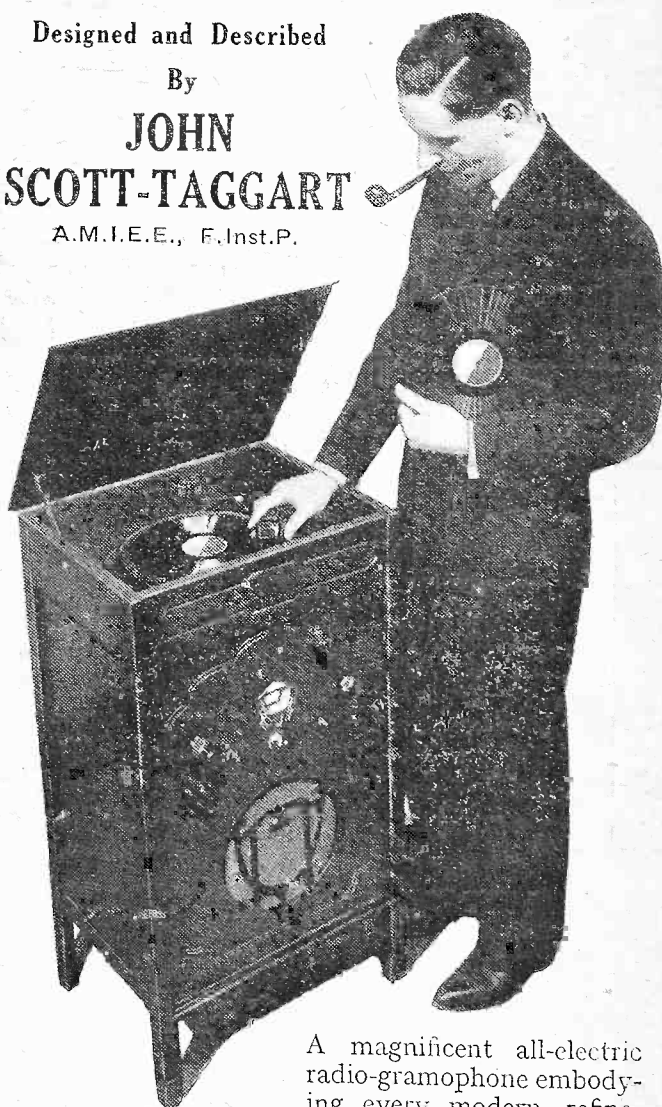
## HOW TO MAKE S.T.'s OLYMPIA RADIOGRAM

Designed and Described

By

**JOHN  
SCOTT-TAGGART**

A.M.I.E.E., F.Inst.P.



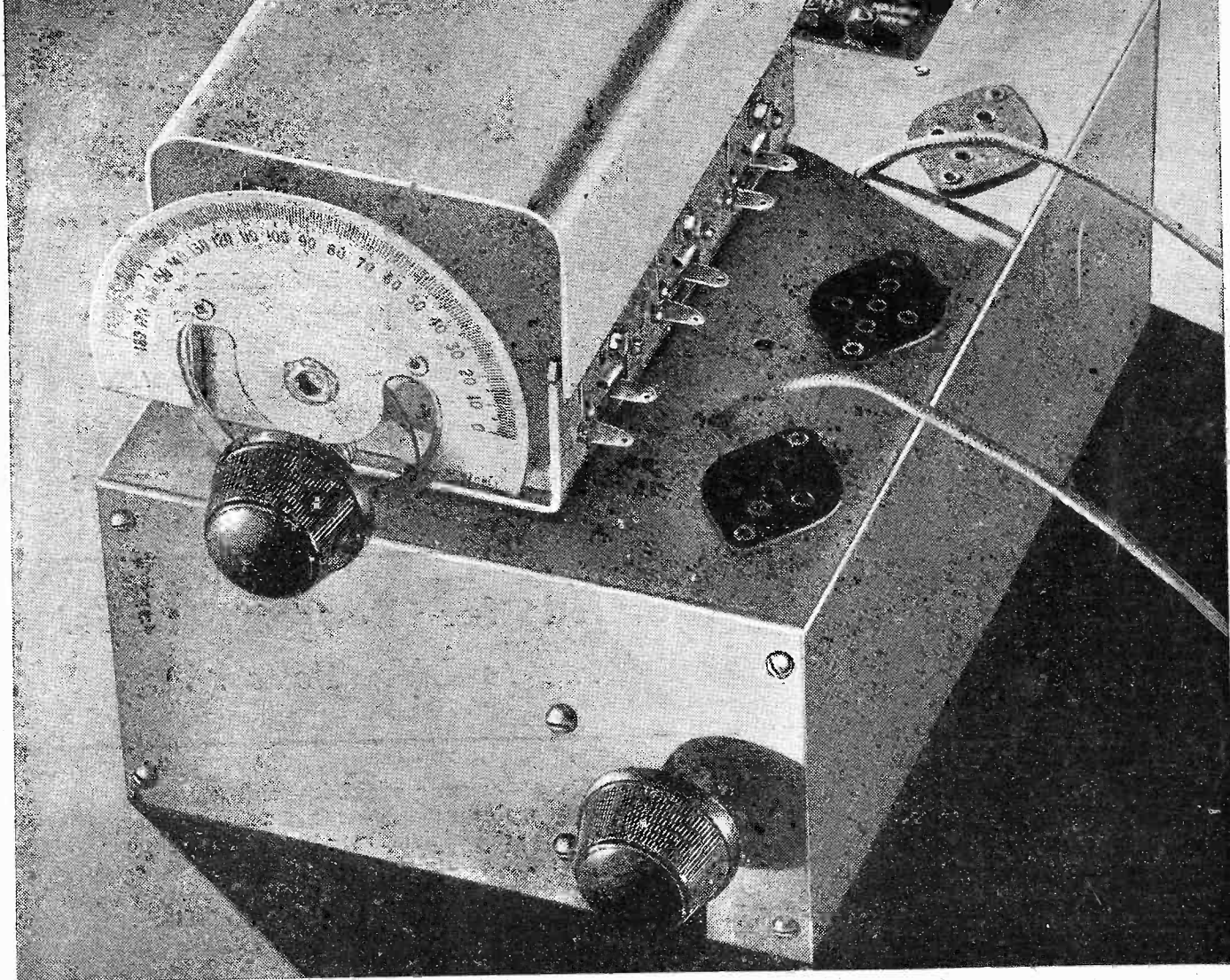
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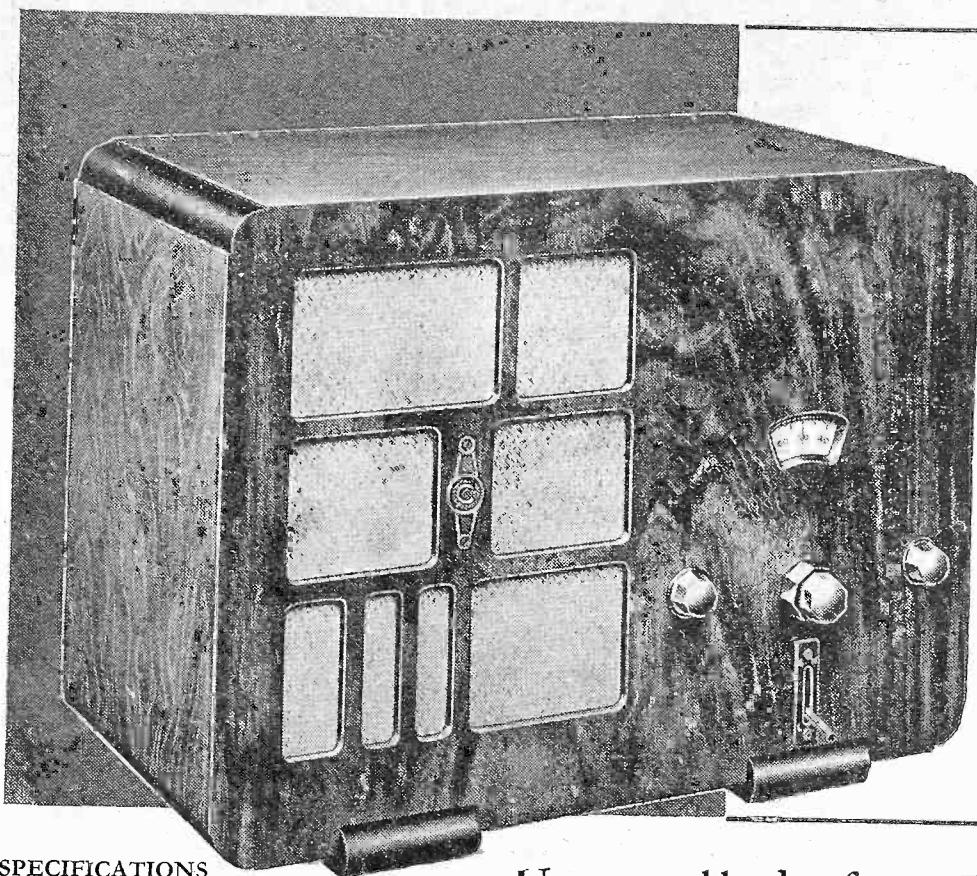


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### BATTERY MODEL 341 PENTODE OUTPUT

Balanced Armature Loud Speaker

Complete Kit of Parts for assembling Cossor Melody Maker, Model 341, similar to illustration, including Cossor Variable-Mu Screened Grid, Cossor Detector, and Cossor Pentode Valves. Fully screened coils, Double-Gang Condenser, Combined Volume Control and On-Off Switch, all-metal chassis, and all the parts for simple home assembly. Handsome cabinet 18½" x 13½" x 10", space for batteries and accumulator. Balanced Armature Speaker: provision for Gramophone Pick-up Plug and Jack.  
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- \*Battery Model 342
- \*Battery Model 344 (Class "B")
- \*All-Electric Model 347

\*Strike out those not required.

Name .....

Address .....

P.W. 9/9/33.





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The Paper that Made Wireless Popular

MORE BACH CANTATAS  
 A SPLENDID SET  
 ADVICE FOR CLUBS  
 RADIO AND FARMERS

## RADIO NOTES & NEWS

A G.P.O. FILM  
 GETTING THE BIRD  
 NEW TALKS SERIES  
 CAR RECEIVERS

### Wonderful New Radio Device.

**S**PEAKING before the Institute of Radio Engineers in Chicago, Mr. T. R. Gilliland recently described a new instrument by means of which the outer layers of the "ionosphere" 550 miles high can be explored. This marvel records automatically the ionization of the three upper layers beyond the stratosphere and determines their distances.

Over here the ionosphere is better known as the Kennelly-Heaviside layer. Amongst the interesting things which it is hoped will be done with the new gadget is the measurement of the earth's magnetic forces at heights of hundreds of miles.

Why "Man-made Static" is Naughty.

**I** DO not remember seeing any English legal decision about interference with radio reception which gave reasons for its illegality—if indeed it be illegal here. But in Germany a recent case of interference brought forth the view that the right of radio "listening" is comparable to the right of "peaceful possession" as sanctioned by the German civil code.

Hence it was decided that anyone who creates interference by using an electrical device is bound to instal a preventive apparatus.

### Rapid Rejoinders.

**T.** N. (Harrogate).—No, sir! An ampere is not a quantity; it is a *rate*. A coulomb is a quantity of electricity, and a second is quantity of time; an ampere is a flow of a coulomb per second. Get the idea?

**R. S. G.** (Bath).—No, there is no connection between your own *Ariel* and the *Ariel* of the "Daily Mirror." Two different persons, quite unknown to each other.

**L. H.** (Putney).—Sorry we do not see eye to eye about broadcasts to schools. You try to get a boy or girl a job in an office. Then you will find that business firms need business qualifications, not

earthworm lore. And, after all, it's the job which puts bread into mouths.

**L. C.** (Hove).—My favourite book is the pass-book. In these days there is not much happiness possible in a cottage, with bread and cheese, even if there is a radio set.

### Bach to Come Back!

**H**AVING purchased some more job lots of Bach cantatas, the B.B.C. plans to begin working through them on Sunday, September 17th.

In order to make them go further, they are to be broadcast on alternate Sundays, and

### Great Firm Defies Lumbago.

**A**S an expert in lumbago I was moved to admiration for the Gramophone Co. when I learned that it has installed hundreds of lifts in its works. These lifts are really platforms to hold radio sets, etc., and can be so raised or lowered that the work may always be at hand level.

No more sudden clicks in the lumbar region for the Gramophone Co.'s people! I hear, too, that although there were already 8,000 of those people, their numbers were increased by 1,000 in anticipation of the Olympia rush.

I hope the whole 9,000 are now "wearing their fingers to the bone" in their endeavours to cope with orders—in a Pickwickian sense, of course.

### Fine D.F. Rally.

**N**OT long ago the Golders Green and Hendon Radio Scientific Society held its seventh annual direction-finding competition in the neighbourhood of Berkhamstead, St. Albans, Watford, and Amersham. The transmitter was controlled by Mr. D. N. Corfield (G5CD) and the check transmitter by Mr. A. R. Gardiner (G5RD).

The results showed much improvement on

previous years, over 80 per cent of the competitors finding the hidden station. The average error of the first two groups was only 0.8 per cent. The group of Mr. Maurice Child and Mr. J. C. Exerson won the first prize.

### How to Organise Radio Clubs.

**I** FREQUENTLY receive letters from the secretaries of newly-formed radio clubs asking for advice about syllabuses, lecturers, etc. As it is impossible to deal at length with this subject in these Notes the Editor has agreed that I write a short article about it.

I am a believer in clubs, and I shall place my experience at your disposal as soon as I have finished my 1933 sun-sea-bathing.

(Continued on next page.)

In these days of rapid radio changes it is worth remembering that  
 "POPULAR WIRELESS" **FIRST** News of all vital  
 always gives the developments.

It Was This Journal That Gave You

1. The FIRST "Class B" set.
2. The FIRST home-constructor's Automatic Radiogram.
3. The FIRST Multi-mu Pentode set.
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12. The FIRST Double-Diode Pentode set.
13. The FIRST No-Gap Tuning set.
14. The FIRST Permeability Tuning set.
15. The FIRST National 5-metre Tests.
16. The FIRST International Quality Tests.
17. The FIRST Short-Wave Adaptor.
18. The FIRST Automatic Tone Compensation.

"POPULAR WIRELESS" IS ALWAYS FIRST

I suppose that when in 1935 the last one is performed the time will be ripe for the first lot to be brought out again. These cantatas will be given in the Concert Hall, and the B.B.C. organ will take part in them.

### Last Word in Radiograms.

**I**N the September issue of the "Wireless Constructor" Mr. John Scott-Taggart returns to the single-knob control idea, and describes the construction of his "Olympia" Radiogram, an all-electric (A.C.) model, with every modern refinement, including iron-core coils, ganged tuning and pre-detector volume control.

Mr. J. S.-T. explains why he has gone back to the single control in producing this ideal family set. And his Armchair Talks grow more amusing, though no less instructive.



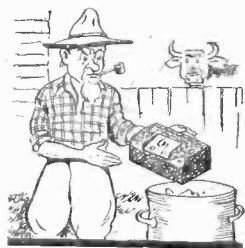
# ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

## Candid Criticism.

**R**ADIO critics in the U.S.A. seldom butter their words. Here is a joyous sample. Commenting on a certain organisation of teachers and mothers who are "raising the very dickens" about programs which "over-excite" their children," one human battering-ram says: "The aforementioned society is only one of a number recently formed to exploit parental fear for the purposes of establishing a form of radio censorship. Program producers are apt to be timid sheep, easily sent into hapless ditherings by the boos of any organised minority, no matter how small. Radio censorship is in the offing, and more uplifters will grow fat." What you might call a swift kick in the slats!

## U.S.A. Farmers Drop Radio.

**I**N 1931 about one in every two Iowa farms had a radio receiver. At the end of 1932 this proportion had dropped to about one in three, or a decrease of 29.2 per cent in the number of farm-owned sets.



As the number of sets in operation tends to increase under normal conditions this falling-off is a sad reflection of the slump, for it has been ascer-

tained that in nearly every instance of discontinuance the cause was the inability of the farmer to buy replacement valves, batteries, etc.

## I Fear the Worst.

**I** WAS afraid so! Henry Hall is going to bring back from the U.S.A. a series of new American "numbers." Why inarnation he must do that, when he began his succession to Jack Payne so well as a conductor of the more melodious type of dance music, fair beats creation!

I fear that the tom-tom has entered his soul. May I be proved wrong! But I do protest against this fluttering of B.B.C. moths round American candles. Is British broadcasting to be British—or American?

This is not a narrow nationalism, but a plea for the British composer. What do the Americans know of dance music which they have not learned from Europe and Africa?

## Wireless Relay Services.

**I**T may or may not be news to you that the wireless relay question at Bristol is being handled by the Sanitary Committee. Is that incongruous? Or is it appropriate? No prizes are offered in this interesting guessing competition.

## Interference Films.

**T**HE Pathé Company is co-operating with the Post Office in obtaining a film of the work of the famous G.P.O. detector vans. I wonder if the secret of how the authorities trace a pirate-listener successfully, even though his set isn't working, will be revealed by the camera's all-seeing eye?

Or is this yarn no longer sponsored by our enterprising P.O.?

## Is Music Dying?

**A**CCORDING to the American Society of Composers, Authors and Publishers, the "talkies" and radio are killing "the lovely art of music."



The society declares that in America the number of musicians in the theatre has dropped from 19,000 to 3,000 since 1925; that sheet-music sales during the same period dropped from \$2,639,351 to \$827,154; that the piano sales have dropped from \$93,670,000 to \$12,000,000; and that the incentive for young persons to study music as a career is almost entirely killed.

The society maintains that composers are now compelled to write "enforced, inferior music." That last is not true of this country, where a large volume of superior music is broadcast and young British composers are encouraged.

## SHORT WAVES

### MEANS BUSINESS.

The man who is visiting all the Radio Exhibitions with a set look.

### THROW-BACK.

Wireless sets are now quite common in remote South Sea islands. Natives are evidently relapsing into civilisation.—"Sunday Pictorial."

Teacher: "Bobby, will you find Madrid on the map?"  
Bobby: "I don't believe I could, teacher; but it comes in at ninety-nine on the wireless."

"Life is always changing,"  
Is a hackneyed phrase, I know;  
The—er—lemonade is not so good  
As twenty years ago;  
The miracles of Science  
Bring new beauty into life—  
You switch on your loudspeaker,  
So you cannot hear your wife.

### ON A SUNDAY NIGHT.

The B.B.C. "sausage machine" is still to grind out the old thing on a Sunday, between 6 p.m. and 8 p.m. It's the deacons without their collecting plate—though, come to think of it, we do pay for it all.

G. F. Bell. "Reynold's News."

## These Terrible Telephones.

**T**HE wordy warfare which next door's parrot engages in with their radio set when the local oscillating fiend is at work makes the following yarn, by K. R. G.

Browne, in the *Evening News*, ring true. A young politician who had to telephone to his party leader mistook the "number engaged" signal for the great man's voice, and stood for ten minutes with his hat off, saying "Quite" at intervals.



## Getting the Bird.

**O**N the other side of the world—in New Zealand, to be exact—there lives an enthusiastic listener who possesses an attractive set. Every night when he switches it on a kingfisher flies down and perches on his aerial. The bird stays there until the concert concludes, when it makes its departure. Our B.B.C. programmes usually get a different sort of "bird"!

## A Matter of Opinion.

**O**F course, there are at least two sides to everything. And while loud speakers drive some people frantic, it is interesting to note that they have their advocates. In a northern local newspaper I recently read a letter from a woman who was apparently quite angry with those who had written complaining about the disturbance caused by sets operated in gardens and near open windows.

"It is fine having music while a woman is working," she said. Personally, I always find my own radio music much more to my liking than that of my neighbours!

## This Series Will "Go."

**A**T last! A series of talks has been arranged for the autumn, entitled "Anywhere for a News Story." Fleet Street "stars" will describe some of their exploits in search of "scoops."

Come! this is the real stuff—real, healthy, true adventure stories. Photographs of sinking ships, Ladysmith, a bike ride round the world, eh? All told by rollicking gentlemen of the Press—than which there are no better, neither.

What with these hot yarns and the "Proms," the autumn listening bids fair to be fruity, if not golumptuous.



## Another Matter of Opinion.

**U**NFORTUNATELY, Mr. Eric Maschwitz was not a great success as the commentator," reported one of the radio critics. Funny! I thought that he was a great success, and that the broadcasts from Olympia owed a lot to his cheery efforts. The more book, film and radio criticisms I read the more I wonder why they should be written at all! At least, in so far as the majority are concerned.

## Car Radio.

**A**S I predicted some time ago, car radio is making strides. At this year's motor show at least two makes of car will be shown fitted with complete receiving outfits and three or four with aerials as standard, and there may be others.

The other day I drove a considerable distance in a radio-equipped car belonging to a friend. But he made the mistake of having the set operating too loudly; it was not at all easy to hear the horns of other cars through the music. My experience is that in cities especially the volume of a car radio set must be kept down to a pretty low level or it may become dangerous.

ARIEL.



# A SURVEY OF THE GLASGOW RADIO EXHIBITION

FOR the first time in the history of Glasgow's radio exhibitions, the one which is now being held at the Kelvin Hall is officially an R.M.A. Show, and that fact alone has made all the difference between what might have been mediocrity but what is in practice an exhibition second only to that which has just concluded in London.

The R.M.A.—or, to give it its full name, the Radio Manufacturers' Association—is an organisation composed of almost all the leading radio names in this country. It exists to protect the interests not only of its members, but of the industry as a whole, and any exhibition to which it has given its official recognition is assured of success from the start.

## All the Important Firms.

That is why the exhibition at the Kelvin Hall this year surpasses anything of the kind that has been seen in Scotland before. R.M.A. recognition means R.M.A. support, and in consequence, unlike previous years, there are very few of the larger firms who are not represented.

From the point of view of the visitor, of course, it makes a tremendous difference. It means to say that as a result of his visit, he can become acquainted with all the very latest improvements that the industry has to offer, instead of, as in previous years, only just a few of them.

This year it is true to say of the Glasgow Show that if you cannot see just exactly what you are wanting, you may safely assume that it isn't yet invented. But that is most improbable, for never before in the whole history of radio in this country have there been so many amazing developments in the course of a single year.

## Tremendous Advances.

Radical departures from what has hitherto been regarded as standard practice are to be found in almost every branch of the industry: departures, moreover, that represent tremendous advances. The introduction of iron-cored coils has inaugurated a new era in selectivity. Amazing developments in valve technique have set up hitherto undreamed-of standards of performance. The perfection of Class B amplification has solved to a large extent the great problem of the battery user.

Literally, there is something new for everybody, as will be obvious from the necessarily condensed survey which follows.

Obviously, in the course of the present article, it will be impossible to deal with everything, and it will therefore probably be best to concentrate mainly upon the present tendencies.

Not by all the literary efforts in the world can we hope to dispense with the desira-

concerned. If you can go, then by all means take advantage of the few remaining days.

But if a visit in person is impossible, the survey which follows will, at least, enable you to become familiar with the numerous ways in which your set can be brought into line with modern tendencies.

In this connection, it will perhaps be most helpful to take the case of a more or less straightforward set, and to work through from the aerial to the output in the light of all the developments which are to be seen at the Kelvin Hall. With the question of commercial sets we can deal afterwards.

## Better to be Sure.

"Safety first" is a slogan which can be applied even to wireless. Fortunately, few are the cases of installations being struck by lightning, but it is better always to be sure than sorry. To safeguard your set, it is a sound scheme to fit a lightning arrestor in the aerial lead-in circuit, and the one which Bulgins are showing on Stand 72 is ideally suited for the job. Moreover, it is very reasonable in price.

Coming to the actual set itself, the first thing, of course, is the coils. If you want to be modern and thereby to enjoy real selectivity, it is abundantly obvious from the Kelvin Hall Show that you must go in for those of the iron-cored variety. Without a doubt they are a vast improvement over the ordinary types and, suitably connected, they do give a performance adequate for modern requirements.

## High Standard of Workmanship.

A typical example is the famous Varley "Nicore" range, which can be inspected on Stand 25. The core in the case of the Varley coils is made from a secret dust alloy, and the efficiency of the coils is remarkably high.

Another notable iron-cored coil exhibit is that which is being shown by Igranico. "Igranico" coils, as they are called, are every bit up to the standard which one would expect from this old-established firm. You can inspect them at your leisure on Stand 23, and you will be impressed with the high standard of workmanship that has been put into the production of them.

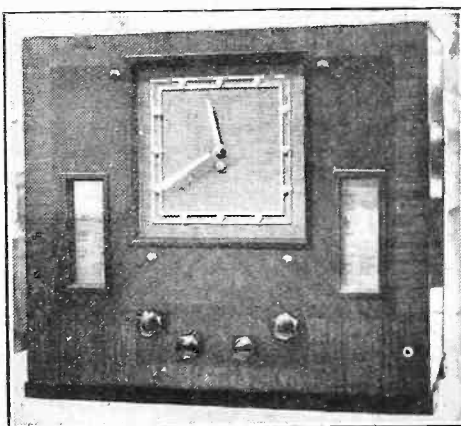
R.I. in the production of their fine range of iron-cored coils, are to be commended for the amount of attention they have given to the needs of the man who wishes to use iron-cored coils in an existing receiver.

(Continued on next page.)

Glasgow's own Radio Exhibition, which is now officially recognised by the Radio Manufacturers' Association, affords an excellent opportunity for countless numbers of our Scottish readers to become acquainted with the very latest tendencies in modern receiver design. To these, and to others not able to visit the show in person, this illuminating survey of the exhibits at the Kelvin Hall will be of particular interest.

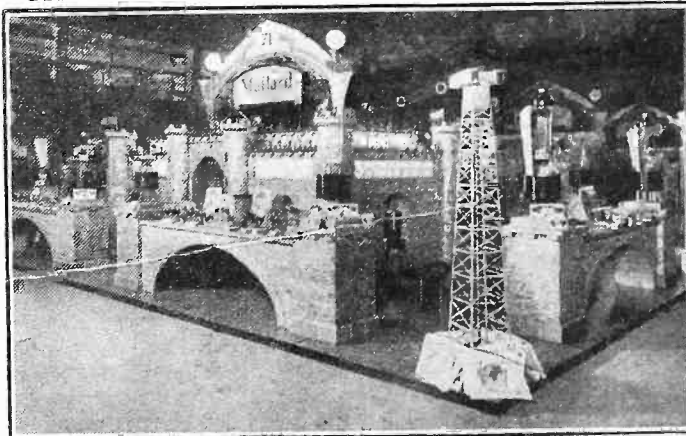
bility of a visit, for undoubtedly that is the most satisfactory way of becoming up to date in so far as radio matters are

## FIRST PUBLIC EXHIBITION



This brand-new H.M.V. model—the "Greenwich Superhet Selective Five"—is being shown for the first time at the Kelvin Hall.

## "THERE'S SOMETHING ABOUT A SOLDIER!"



Thanks to the ingenuity of Mr. G. F. Green, the "Better Radio Brigade"—Mullard's famous slogan—is strikingly represented in the design of their exhibition stand.



## A SURVEY OF THE GLASGOW EXHIBITION

(Continued from previous page.)

Normally, a coil change of this description would completely upset all your tuning dial readings, and you would have to start afresh to calibrate the set. But not so with R.I. "Micron" coils, for an adjustment is provided on the coils themselves which

featured on their Stand (36), together with two new A.C. types, the V.P.4 and the S.P.4. They are both designed to give a very high stage gain, the V.P.4 being of the multi- $\mu$  type.

On Stands numbers 34 and 35—those of Osram and Marconi respectively—prominence is given to the new unbreakable valves, the first details of which were revealed exclusively in "P.W." An S.G. Catkin valve is included in both ranges.

The Mazda contribution to up-to-date H.F. amplification takes the form of a high-efficiency H.F. Pentode for A.C. mains receivers. It is styled the A.C./S.2/Pen, and it gives a very high stage gain.

Most of the commercial receivers this year incorporate the anti-fading scheme known as automatic volume control. Home constructors, too, can take advantage of this development by incorporating in the detector stage one of the new Marconi M.H.D.4 valves, which has been specially developed for A.V.C. circuits.

### A New Transformer.

On the L.F. side, the year's most outstanding development is undoubtedly that of Class B amplification, but it isn't the only channel along which progress has been made. R.I., for instance, have made an important contribution to the science of low-frequency amplification in the form of an entirely new Auto-Parafed transformer. It is a nickel-iron transformer with internal shielding, and it has a voltage ratio of 1-4. The primary inductance, incidentally, is 85 henries. Employed under the maker's recommended conditions, the response

curves of this new R.I. production are exceptionally good.

The tremendous success of A.T.B., the scheme that was invented by "P.W.'s" Technical Editor, has prompted Varleys to produce a compensating R.C. coupler for use in A.T.B. circuits. It is to be seen on their stand at the Kelvin Hall, and it is the only one of its kind on view at the show.

Input and output transformers and output chokes for Class B amplification are now obtainable in almost all the leading makes. From the point of view of performance, there is not a great deal to choose between them. Some are slightly more expensive than others, and the question of which ones you should use is absolutely a matter for individual preference. In any case, whatever make you select, you cannot go very far wrong.

Noteworthy examples to be seen at the Kelvin Hall are Ferranti (Stand 38), R.I. (Stand 63), Bulgin (Stand 72), Varley (Stand 25), and Igranic (Stand 23).

### The Question of Economy.

A great deal of experimental work has been devoted to the question of suitable valves for Class B output, and as a result almost all of the leading valve makers are now producing one.

The 240B on Stand 31 is the commendable effort of Messrs. Cossor, and as a matter of passing interest it was one of the first Class B valves ever to be produced in this country.

Mazda, in the design of their Class B valve, have closely studied the question of economy of operation. The Mazda P.D.220 is very economical in use, and it gives an undistorted output of one and a half watts with 135 volts on the anode.

One of the features of the Mullard Class B valve which is exhibited on Stand 36 is the fact that it can be used with a low-power "driver" valve. Used in conjunction with a Mullard P.M.2 R.X. for the "driver," the Mullard P.M.2B gives an excellent performance.

Reference to valves for the output stage naturally leads up to the question of suitable

speakers. Here again, from the various models which are being exhibited at the Kelvin Hall, it is obvious that tremendous progress has been made.

In general, the prices are not appreciably lower than last year, but in view of the remarkable improvements which have been effected, it is even more remarkable that prices have not been increased!

New and improved principles of both production and reproduction feature in almost all the ranges exhibited, and there is roughly a dozen of them.

W.B. (Stand 70) are giving prominence to a range of speakers incorporating an entirely new system of construction which is termed

(Continued on page 594.)

## REELS OF ANOTHER KIND!



Miss Dorothy Ward, the famous pantomime "star," lends a hand at the Marconiphone coil-winding machine. All the coils made on this machine during the Glasgow Show will be used in actual Marconiphone receivers now in production.

enables you to match them up with any existing circuit. A clever idea, and one for which you should make a special point of looking when you visit Stand 63.

The *pièce de résistance* in the realm of tuning circuit developments is undoubtedly the Permeability Tuning Unit which Varleys are showing on their stand. "P.W." had the pleasure of first introducing it to the public in the "Nu-Tu," a receiver design which appeared exclusively in this journal about nine weeks ago.

Permeability tuning is destined to play an important part in the future of receiver design, and, for the time being, it is a development which can only be enjoyed by the home constructor.

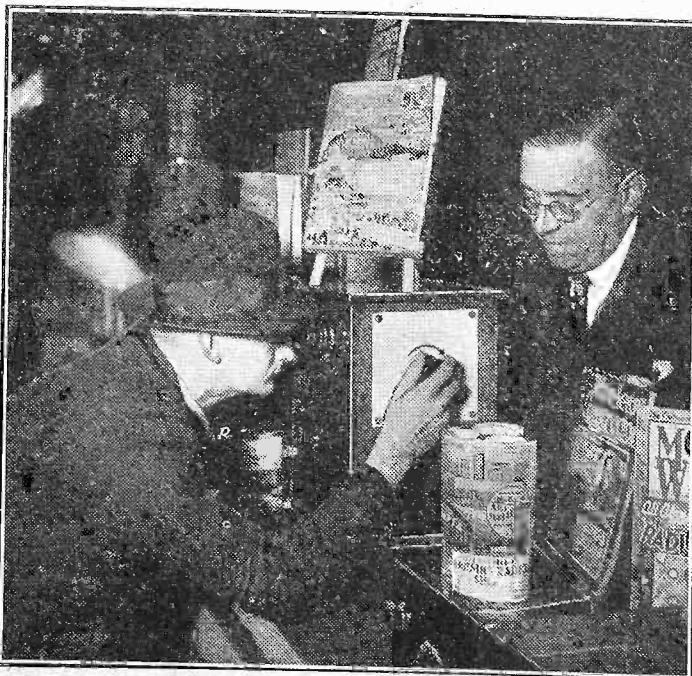
### Astonishing Progress.

From the question of coils and tuning circuits we pass on to H.F. valves, and here again the progress that has been made is little short of astonishing. The present tendency as reflected in the exhibits at the Kelvin Hall is definitely towards valves with very high stage gains.

On Stand 31, for instance, which exhibits the products of Messrs. A. C. Cossor, is shown the 220V.S., a relatively small consumption variable- $\mu$  S.G. valve of particular interest to the battery user. It is something quite new, as also is the M.V.S./Pen., an H.F. pentode for mains operation.

One of the most notable Mullard advances is a new multi- $\mu$  S.G. valve requiring a grid bias of only  $4\frac{1}{2}$  volts. The P.M.12M., as it is designated, is

## IN THE PUBLIC EYE



Taking a look at the construction of the "Popular Wireless" Catkin Three, as seen in the stereoscopic viewer, one of the popular features of our stand at the Scottish Exhibition.



# "CLASS B"

GREAT POWER WITH H.T. ECONOMY

IDEAL FOR BATTERY USERS

A "P.W." Research Dept. Product.



# SPEAKER UNIT

MADE IN AN EVENING

ADDS ON TO YOUR SET

Designed by K. D. ROGERS.

"POSITIVE grid drive," or "Class B" amplification, during the last few months has swept the whole country as the popular method of obtaining output power with economy in battery-operated receivers.

The number of "Class B" sets and amplifiers is rapidly increasing as new ones are built or old ones are modified.

The modification of a set having two stages of L.F. is usually a simple matter, being merely the substitution of different components and valves in the L.F. section.

Where one stage of L.F. is employed, such as in a screened grid, detector and output receiver, the conversion is not so conveniently carried out as a rule, owing to the fact that there is generally not sufficient room on the baseboard or chassis to accommodate the necessary additional parts and valve.

## No Alterations to Set.

There are two ways out of the trouble: one is to use a "Class B" adaptor as an addition to the set, a rather clumsy method, and the other is to use a special "Class B" speaker unit. This is the method we are about to describe, employing a simply-built unit that can be constructed in not more than half an hour or so.

The advantage of "Class B" is so great that it is well worth every owner of a one L.F.-stage battery set to consider very seriously the prospect of converting in the manner to be described.

Powerful loudspeaker reproduction, from a valve output of up to 1,000 or 2,000 milliwatts, can be obtained with an average H.T. consumption of absurdly low proportions, while the alterations to the set are absolutely nil.

This is achieved by the simple expedient of fixing all the "Class B" components on a baseboard at the back of the loudspeaker baffle, the only connections to the set being those to the output terminals and the L.T. supply.

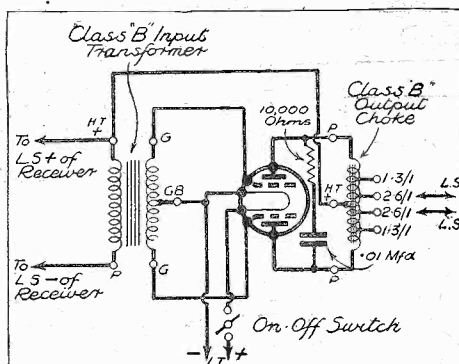
## Using an Ordinary Speaker.

The speaker can be your own moving-coil speaker, or it can be a new one with a special "Class B" transformer incorporated. We have taken as an example an ordinary speaker, so that, in addition to the "Class B" input, or driver, transformer, we have on the baffle baseboard an output transformer and on the speaker its own input

transformer—three transformers in all. If a special "Class B" speaker is used the output transformer is obviated.

The maximum power output of the "Class B" stage is determined by the valves and

## EXTREMELY SIMPLE



The fundamental simplicity of the unit is well illustrated by this diagram of the circuit.

the transformers employed, and this should be decided by the constructor before he chooses his components. We have taken the full output of 2,000 milliwatts as our

output, which is the maximum obtainable with the parts and valve mentioned in our list of components.

If less than 2,000 milliwatts is required (with somewhat less H.T. consumption, of course) a slightly smaller "Class B" valve can be used, with different driver-transformer ratio and careful choosing of a driver valve.

Should the constructor decide to cater for a different output he should get in touch either with the valve manufacturer whose valve he is to use, the transformer manufacturer whose transformer he favours, or with ourselves, so that he may be quite certain that the team of components and valves he uses shall be in perfect order.

## Connecting to Set.

This is a desirable state of affairs in all radio sets, but it is absolutely essential to success where "Class B" is concerned. Without accurate team choosing "Class B" amplification cannot be wholly satisfactory, either in the power developed or in the quality of reproduction achieved.

The actual construction of the unit is merely the fixing of a small baseboard behind the baffle and the mounting on it of two transformers (only one if the speaker is of the "Class B" type) and a seven-pin valve holder.

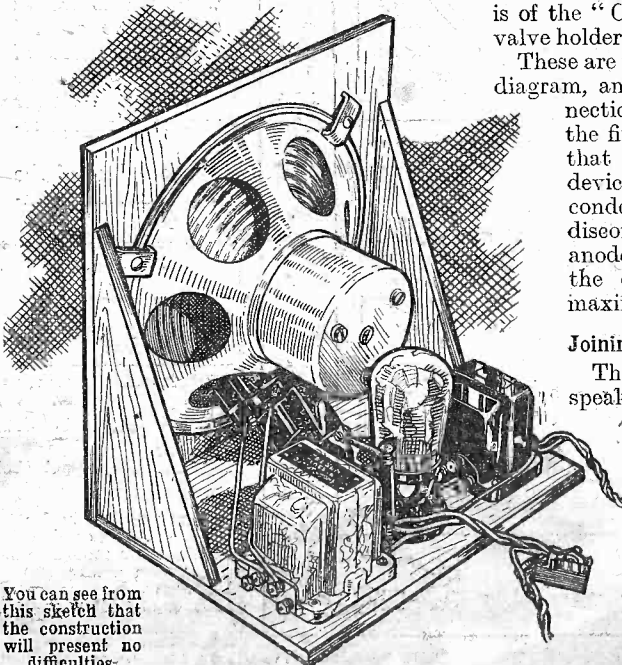
These are wired up in accordance with the diagram, and the unit is ready. The connections to the set are simple. In the first place, it must be made sure that the set has no output filter device, and if it has the choke and condenser comprising it must be disconnected, and the output valve anode taken to one output terminal, the other going to H.T. positive maximum.

## Joining Up L.T.

Then the input of the "Class B" speaker unit is connected to the two output terminals of the set, and with the joining of the filament leads to the L.T. battery the linking is complete.

In the unit illustrated we have included an on-off switch for the L.T. supply. This is useful if it is desired to connect the L.T. leads of the unit

(Continued on next page.)



You can see from this sketch that the construction will present no difficulties.



## A "CLASS B" SPEAKER UNIT

(Continued from previous page.)

to the L.T. battery instead of to a point internal in the set.

If the switch is omitted the flex leads from the unit to the L.T. must be connected to points on the L.T. supply that are controlled by the switch on the set. Suitable points are the positive and negative sides of one of the valve holders in the receiver.

### Selecting a "Driver."

The output valve of the set will probably do as the driver valve, for it is likely to be of the L.P.2, or P.M.2A type. The suitability of the valve should be queried with the manufacturer of the "Class B" valve, or with us, to make sure that the team is properly arranged.

There is nothing further to be done now but to mount the speaker with its small baffle and baseboard either in a suitable cabinet or on a large baffle. Place the "Class B" valve in the seven-pin holder, make the maximum H.T. of the set about 120 volts, and everything is ready.

A few words should be said about the matching of the loudspeaker to the "Class B" valve. This is achieved by means of theappings on the output choke and the transformer on the speaker, provided a special "Class B" speaker is not used. We are assuming that an ordinary speaker is used, such as that shown in our model of the unit.

### High-Note Control.

The twoappings on the output choke should be tried, together with the various ratios obtainable on the speaker transformer, the combination that gives the best quality being used as the final arrangement. In the case of the speaker employed by us the middle and one of the outside terminals on the speaker transformer, together with the 2:6 ratio on the "Class B" choke, proved most satisfactory.

Where other loudspeakers

are concerned it is

possible that the 1:3 ratio on the choke might be more suitable, so this should be tried as well as the 2:6 ratio when the various taps on the speaker are tested.

Across the output of the set is a resistance-capacity load which assists in suppressing any tendency of the "Class B" valve to oscillate and thus cause distortion, while it also acts as a high-note control to prevent excess of "top" over the middle and lower musical reproduction.

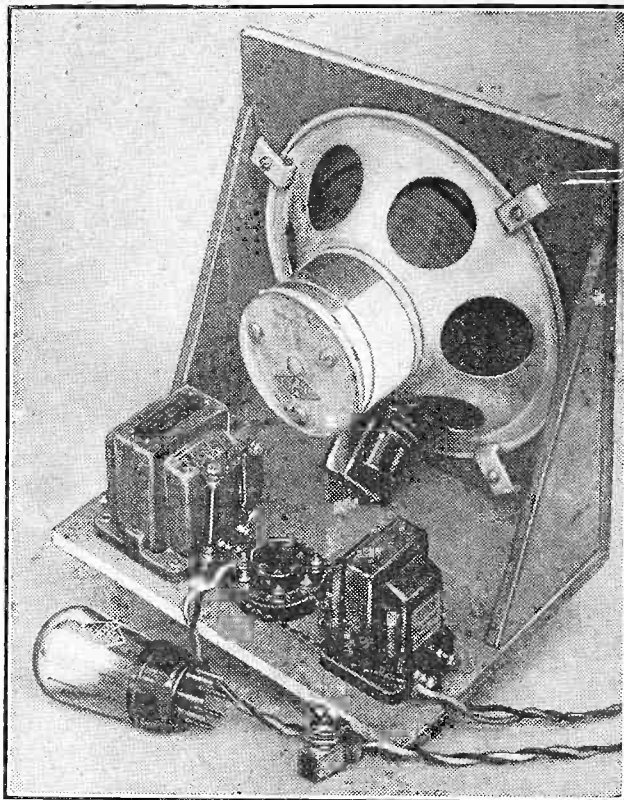
The values of the resistance and con-

denser chosen are those most suitable for average operation, but the amount of effect that the filter has on the reproduction can be determined very easily.

If the high-note response is too much the balance of the reproduction can be restored by increasing the value of the condenser or decreasing that of the resistance. Conversely the amount of "top" can be increased by reducing the capacity of the condenser (using a condenser of less capacity) or by increasing the value of the resistance.

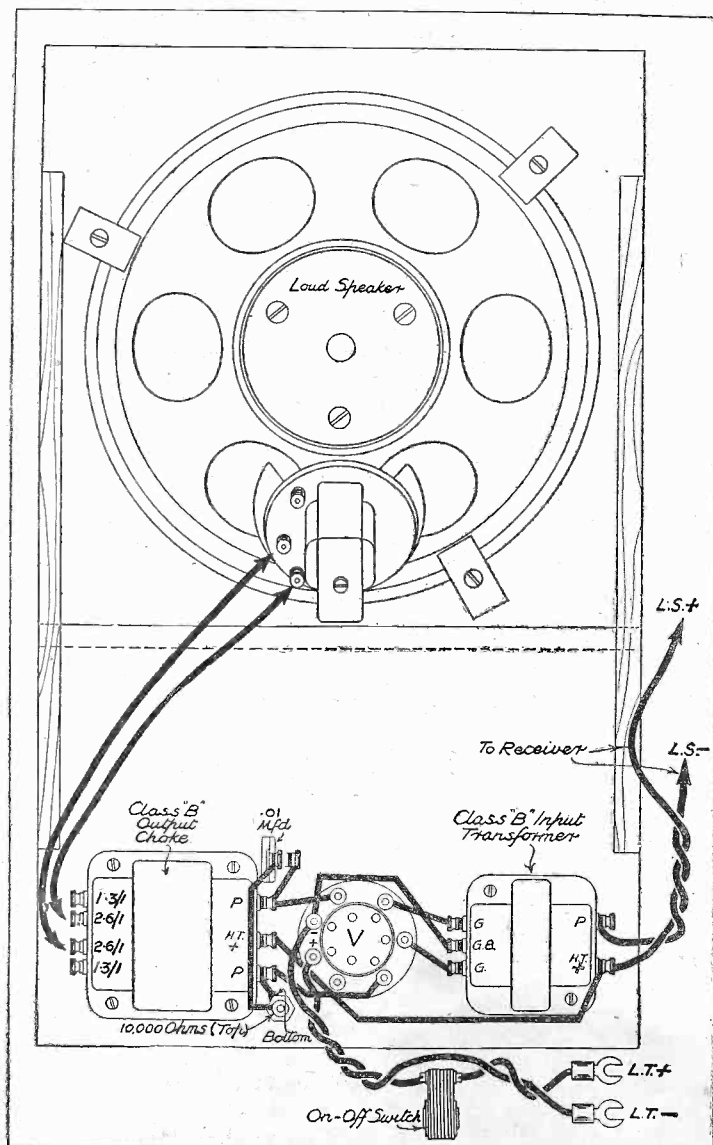
### Using Grid Bias.

We have stated earlier that with suitable alterations in the component ratios different "Class B" valves can be used. It must be made clear, however, that, should it be desired to use the Marconi or Osram "Class B" valve (B.21), provision must be made for biasing it with 4.5-volts negative grid bias. In this event it will be most convenient to use a separate bias battery on the speaker unit rather than to carry leads to the set to employ the bias battery already in the receiver.



If the unit's low-tension supply is taken from one of the valve holders inside the set a separate on-off switch need not be used.

## HOW THE UNIT IS WIRED



When the L.T. connections are taken direct to the accumulator an on-off switch should be joined in the L.T. + lead, as shown here.

## FULL DETAILS OF THE PARTS TO USE

Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.
1 Permanent magnet moving-coil loudspeaker, with wooden chassis	Peto-Scott	—
1 "Class B" input transformer	Lissen	Ferranti, R.I., Telsen Varley, Wearite, Benjamin
1 "Class B" output choke	Telsen	Varley, Benjamin, Wearite, R.I. or Ferranti transformer
1 Seven-pin valve holder	W.B. Dubilier 670	Benjamin, Ferranti, Wearite
1 .01-mfd. fixed condenser	Graham Farish "Ohmite"	Dubilier
1 10,000-ohm resistance with terminals or wire ends	Bulgin S.80.SB	—
1 Snap switch	Radiophone "push-back"	—
10-ft. connecting wire	Cossor 240B	See text
1 "Class B" valve	Peto-Scott	—
Flex, screws, etc.	—	—

# ECKERSLEY EXPLAINS-



"I HAVE," says G. W., of Reading, "been reading an article in which the word 'transient' appears. What is a 'transient'?"

I'll try to explain what I think is meant by the word as best I can. There is some confusion of thought on the subject. Mine is not confused, but it may be different.

Supposing I had a pair of copper wires reaching from here to there. Suppose the ends of the copper wires were joined through, let's say, a loudspeaker at the far end. At the near end I have a battery, and I join this, through a switch, to form a complete series circuit as: battery, switch, "go" wire, loudspeaker, "return" wire, and battery.

## Effects From Sudden Causes.

Now I close the switch. If the speaker and the wire were quite non-inductive the current would grow from zero to its maximum value infinitely quickly—i.e. at the same given moment of switch closing there would be no current and full current. If there was any inductance in the circuit, then the current would grow more slowly, at one moment no current, at the next fraction of a second some current, until after a very short time had elapsed there would be all the current.

## HEARING IS BELIEVING!



P. P. Eckersley writes: "Hearing is Believing," but so adept has broadcasting become in faking the real thing that many people did not believe those nightingale broadcasts were true.

In either case, I have sent a "transient" down the wire because there is a transient change of current and then a steady state of steady current flow.

When people in the effects studio let off a loud and sudden noise which interrupts a stillness, then they make a "transient" out of the sudden sound impulse, this growing from zero to maximum very quickly.

This "steep-fronted" wave of sound, this sudden change of state, would be repre-

"What is a transient?" This question forms the basis of our Radio Consultant-in-Chief's explanation this week. He illustrates its importance and also has some interesting remarks to make on obtaining first-class quality.

sented in a diagram which plots intensity against time as a square thing, as in Fig. 1.

We have to make an electrical system which will transmit the sudden steep-fronted sound-wave, which must, in fact, be able to deal with transients.

A very clever man (Fourrier, I expect) showed that the diagram of Fig. 1 could be formed out of the resultant of an enormous number of sine waves having different phase and frequency. If, in fact, we could close a switch in the effects room which simultaneously made contact with thousands of alternating-voltage machines, each giving a different frequency between, perhaps 20 cycles and 20,000 cycles a second, we could, without bothering about microphones at all or without shattering the nerves of temperamental artists by firing off revolvers, reproduce exactly the sound of the revolver in a perfect loudspeaker connected to these alternators via a perfect amplifying system.

## Do Iron Cores Distort?

So far as I can see, then, the conclusion is obvious. If the amplifier is able to magnify every frequency equally it will magnify in effect all the different frequencies which comprise the transient! Nor will it, if it amplifies every frequency equally, distort the phase relationships in the component frequencies of the transient.

I held for some time that any iron in any circuit gave transient distortion because it messed up the phase relationships in the different components of a transient. Now, in spite of the non-agreement of distinguished colleagues, I must see that the theoretical arguments set out above are incontrovertible. It is inconceivable that anything which amplifies equally at all frequencies distorts phase relationships—

none of the formulae dealing with this question tell me that this can be so.

Nevertheless, up to some time ago I was convinced, purely by aural tests, that the insertion of the best transformers available in any amplifier did seem to do something nasty to quality. On the other hand, I heard the only really satisfactory quality I have ever heard in New York, and the Bell Laboratory people, like good telephone engineers, had an apparatus simply covered with iron-cored transformers. But their amplifier had equal response between 30 and 12,000 cycles per second! And that's the point, isn't it? I had used a transformer which probably "cut top."

## Loudspeaker Deficiencies.

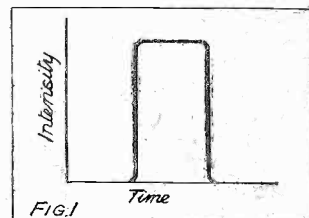
Transformers are inclined to cut top, and might for this reason have spoiled quality (not that it matters in broadcast receiver or gramophone-amplifier design, because in neither of these cases can you get real top without either heterodyne or sideband spitting or needle scratch).

When it comes to loudspeakers I am more diffident about transients than I am when setting out my theory—no, not mine, but my interpretation, anyway—as I have done.

But again it seems to me you cannot get away from the fact that a uniform response will give a uniform reproduction of the component parts of a transient. But then I ask myself, Is it possible to

## TRANSIENTS ILLUSTRATED

The instantaneous change of intensity in current coincident with a sudden sound is what really constitutes a transient.



conceive of a loudspeaker, with its wide and "breaking-up" paper cone, giving such a uniform response?

Again, some people argue that you can buzz phases round and round and round in ever-whirling vectors and make no difference to the reproduction; but the particular

(Continued on page 893.)



## THE MIRROR OF THE B.B.C.

By O. H. M.

## THE B.B.C. AND ITS CRITICS

Henry Hall's American Reception—Counting the "Lookers-in"—A  
Welcome Return—Frowning on Mothers

STRANGE to relate, the B.B.C. threatens to relent a little of its attitude of stony indifference to critics. At least, this much I presume one is entitled to infer from the proposal that the music critics are to be given an opportunity of meeting Dr. Boulton and his principal assistants before the beginning of the next symphony season.

I shall be interested to see whether the jealousy plus bureaucracy entrenched in the higher circles at Broadcasting House manage to kill this proposal yet.

## Henry Hall in America.

Henry Hall has had something like a royal reception in America. All the dance band and music kings were en fête. Paul Whiteman was his particular host; but there was eager competition from Rudy Vallee.

Of course, it is not generally recognised in this country that Henry Hall is credited, and rightly so, with the introduction here of some of the most successful recent American dance-band hits, including "Stormy Weather." He has therefore indirectly added substantially to the incomes of the American dance-music industry.

There is also the fact that Henry has definitely set himself against plugging, and this has gained him a great reputation even among those who practise the art.

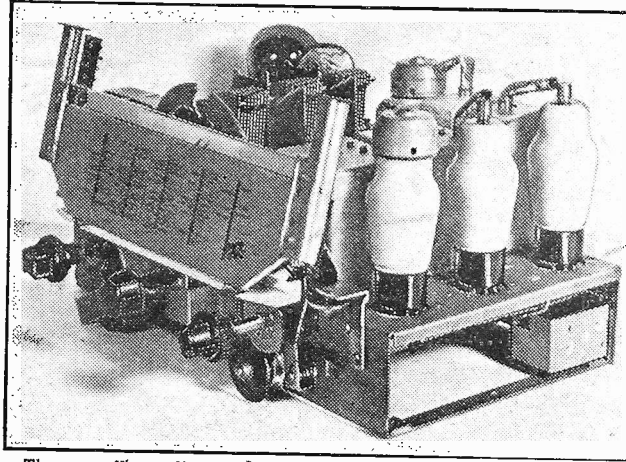
## The Television Rumpus.

There are still echoes of the great tele-

vision rumpus caused by the B.B.C. asking "lookers-in" to write in and say they did so, the idea being to find out, if possible, how many, if any, did "look-in." Of course, the announcements were badly timed. If nobody should be looking-in early in August, that was no proof of the uselessness of television transmission.

Also it was a mistake to give the

## AMPLIFICATION OF ONE MILLION



The overall amplification of this superhet receiver shown at the German Radio Show is 1,000,000. It has full automatic volume control and shadow tuning.

announcements in such a hole-and-corner way, as though the authorities rather hoped nobody would hear them or of them. In the end, therefore, this incident reacted against the policy of eliminating the Baird 30-line transmissions, but I look to see the attempt renewed with greater determination.

## A Plethora of Producers.

Even the generous duplication of staff made possible by the new "output" and "input" regime of the B.B.C. has not yet managed to absorb the whole army of producers, dramatic and otherwise.

The truth is that the B.B.C. has about a dozen well-qualified and extremely competent producers, all specialised. But with the steady contraction of alternative programmes there is less and less to do.

The lot of those who are bound to be weeded out is anything but enviable, unless they can get squeezed into one or other of the new Overseas broadcasting concerns.

## The Interlude Again.

I am glad to acknowledge that my campaign for the restoration of the interlude has already borne fruit. Miss Cecil

Dixon's return to the microphone was not celebrated by any flare of trumpets, but it was generally welcome, all the same.

I hope, therefore, we have seen the end of the tiresome and needless silent gaps with the pounding beetle "foretelling doom" to all and sundry.

## Married Women Employees

The B.B.C. seems to be taking a strong and original line about married women employees having children. While there is supposed to be no general rule, it is the fact that the practice of combining the raising of a family with the conduct of duties at Broadcasting House or elsewhere in the B.B.C. is frowned upon.

It is rumoured that there has been at least one case in which the official who tried this on lost her job. I could understand and would approve the B.B.C. not employing married women at all; but, "seeing as 'ow" they are employed, it looks like stretching the limits of relations between master and servant to make "domestic policy" part of the contract.

(Continued on page 896.)

MY weekly pat on the back this week goes to the Dubilier Condenser Co. (1925), Ltd., for the excellent way in which they have produced their new catalogue.

It might be thought that there is not such a lot to talk about in connection with fixed condensers, but this new Dubilier effort is an education all on its own. Its 36 pages are full of information of interest to every home constructor, and among other things it contains a comprehensive treatise upon the increasingly important subject of spark suppression in car radio installations.

I strongly recommend all "P.W." readers to take steps to obtain a copy of this new Dubilier production, and in view of the interest that it is likely to arouse

## OUR POSTCARD SERVICE

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



BY G.T. KELSEY

Weekly jottings of interest to buyers

I propose to include it in the "P.W." postcard literature service. The full title of the booklet is "Choosing Your Condensers and Resistances," but it will only be necessary for you to quote the number at the end of this paragraph when making application through us. (No. 47)

## By Air to Olympia.

To speed up the conveyance to and from Olympia of their many provincial dealers, Marconiphone hit upon the bright idea of establishing an air service during the recent Exhibition.

The fleet of sixteen planes covered a distance of well over 12,000 miles during the course of the Exhibition, and on one of the runs a record was established for the journey from Manchester to Heston. The actual flying time was 1 hour 28 minutes.

That is certainly one way of annihilating distance. May we hope that some enterprising aeronautical concern will establish a similar service next year for ordinary visitors? I am confident that it would prove exceedingly popular if it were carried out on the lines of the Marconiphone service. To be able to fly to London, tour the Exhibition and to return the same day is certainly a great attraction.

## Wet H.T. Battery Spares.

For the benefit of "P.W." readers who are at present using "Standard Wet H.T. Batteries" for high-tension supply, I have been asked to call attention to the fact that spares can no longer be obtained from the original manufacturers.

Applications for replacements for batteries of this type should henceforth be addressed to the Wet H.T. Battery Co., of 26 Lisle St., Leicester Square, London, W.C.2.

(Continued on page 896.)

# WHAT WATTAGE?

Do you know the meaning of wattage rating? It is a term frequently used, but often not clearly understood. In this article our contributor, Mr. R. H. Bradley, discusses this somewhat neglected subject and gives simple practical examples of how the various values may be worked out.

WHEN we know the voltage of the H.T. and the anode current taken by a valve it is a simple matter to calculate the value of decoupling, voltage dropping and automatic bias resistances. Or if we know the value of the resistance it is equally easy to calculate the voltage drop.

## Resistances in Series.

But what does often appear somewhat confusing is the wattagerating of the various resistances, and this is especially so when we find two resistances of different wattage rating used in series. At first glance it would appear that as both are carrying the same current, both should be of the same rating. But it will be noticed that when two resistances are used in this manner it is the one of lower resistance which has the lower wattage rating.

Supposing we have a large power valve taking 62.5 milliamps when the grid bias is 32 volts. The resistance that will drop this voltage and provide automatic bias

will be  $\frac{32 \times 1,000}{62.5}$  or 510 ohms.

The wattage rating for such a resistance is found by multiplying the voltage by the current (in amps.), so that in this case it will be  $\frac{32 \times 62.5}{1,000}$  or 2 watts.

A resistance of the 3-watt type would probably be recommended. But 510 ohms is not a standard value, and as it will be better for the valve if it is over rather than under biased, the resistance used would probably be 600 ohms. This, again, is not a standard value, so that we should use a 500-ohm in series with a 100-ohm.

## For R.C. Coupling.

The voltage drop across the 500-ohm resistance would be  $\frac{500 \times 62.5}{1,000}$  or 31.25 volts, and across the 100-ohm resistance it would be  $\frac{100 \times 62.5}{1,000}$  or 6.25 volts. (The total bias will then be 37.5 volts.)

The wattage rating of the 500-ohm resistance will be  $\frac{31.25 \times 62.5}{1,000}$  or 1.95.

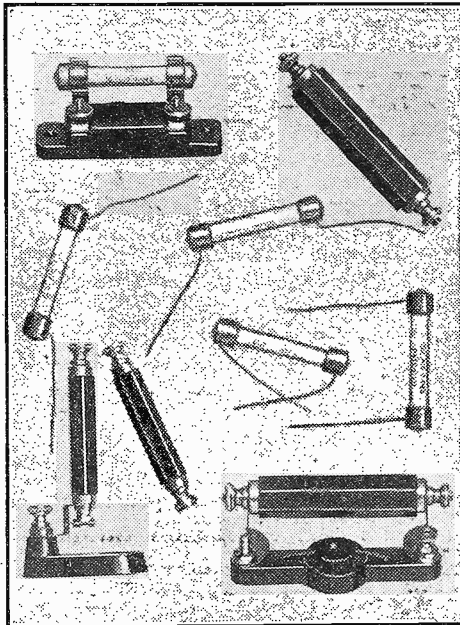
Thus a 2-watt type would be suitable. For the 100-ohm resistance the wattage will be  $\frac{6.25 \times 62.5}{1,000}$  or .39, so that a 1-watt

type will be more than sufficient.

Thus it will be seen that, to calculate the wattage rating, all that is necessary is to ascertain the voltage drop across the resistance and to multiply it by the current.

When the resistance used is not the exact value that would give the correct voltage drop the calculation is a little more involved. Supposing, for instance, that the big power valve referred to earlier is preceded by a smaller power valve used as a resistance-coupled stage, and that this valve takes 25 milliamps when the voltage is 200.

## WHAT RATING?



The wattage rating of a resistance depends upon the current passing through it and the voltage drop. A resistance capable of handling several watts is a far more substantial affair than one designed to handle a fraction of a watt.

We will suppose that, in order to supply the last valve, the total voltage available is 500; this will consequently have to be dropped by 300 to be suitable for the L.F. stage.

The necessary voltage dropping resistance would be  $\frac{300 \times 1,000}{25}$  or 12,000 ohms.

But this 12,000 is not nearly sufficient to provide for the resistance coupling, the decoupling and the automatic bias.

Thus we might have a 20,000-ohm decoupling resistance, a 10,000-ohm resistance coupling, plus the automatic bias resistance. Ignoring the latter for a moment, it will immediately be evident that we

cannot calculate the voltage drop by multiplying the resistance by the anode current, because this would be  $\frac{30,000 \times 25}{1,000}$

750 volts, which are more than we've got. The reason for this is that as the resistance is increased the current is reduced, so that the valve can no longer take 25 milliamps. It is consequently necessary to find out what current it can take.

## Finding the Working Voltage.

As the valve takes 25 milliamps when operating at 200 volts, its own resistance must be  $\frac{200 \times 1,000}{25}$  or 8,000 ohms (this, of

course, is the D.C. resistance, and must not be confused with the A.C. resistance or impedance). The total resistance in circuit will therefore be: 8,000 (valve), plus 20,000 (decoupling), plus 10,000 (coupling), plus 320 (automatic bias). This gives a total of 38,320 ohms.

With a supply at 500 volts the current will therefore be  $\frac{500 \times 1,000}{38,320}$  or 13 milliamps.

The voltage drop across the decoupling resistance will be  $\frac{20,000 \times 13}{1,000}$  or 260 volts, and across the resistance coupling it will be  $\frac{10,000 \times 13}{1,000}$  or 130 volts, making a total of 390.

In addition there will be 4 volts dropped across the automatic bias resistance, so that the valve will be operating on a voltage of 500, minus 394, or 106. (An examination of the valve maker's curve should confirm that at this voltage the anode current is approximately 13.)

## Same Current, Different Wattage.

The wattage of the decoupling resistance should be  $\frac{260 \times 13}{1,000}$  or 3.38, and for the

resistance coupling it should be  $\frac{130 \times 13}{1,000}$

or 1.69. For the decoupling resistance we must therefore use a 4- or 5-watt type, or, if this is not obtainable, two 40,000-ohm 2-watt resistances in parallel.

For the resistance coupling a 2-watt resistance will be quite suitable. This is another example of two resistances being used in series and carrying the same current, yet being of different wattage rating.



## SHORT-WAVE NOTES

BY W. S. STEEL

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

IF there is any suggestion of a kind of "close season" for short-wave radio, surely it ended on August 15th this year. The Show, coupled with the annual Convention of R.S.G.B., sets us all off with renewed impetus.

Personally, I can say that I am scuttling about like a two-year-old, simply as the result of meeting so many old and new friends at the Show and Convention. All the latent enthusiasm that we all possess for our hobby seems to come out at this time of the year.

### A.T.B. on Short Waves.

Radio is a collection of coincidences! Early this morning I was thinking hard on the subject of applying A.T.B. to a short-waver, together with the attendant advantages, and, lo! by the evening post arrives a letter from "W. H." (Tottenham) asking whether something can't be done about that very thing.

It is not too easy a matter, but I am getting down to it in three or four different

are six inches further from your nose doesn't help at all.

Hand capacity is the result of instability, and that instability has got to be stamped right out of the set before one is satisfied. There wasn't any in the "H.A.C. Three-Valver," and therefore extension handles will not be worth the space they take up.

### Programmes from Kenya.

In reply to (2), I don't think an air-dielectric reaction condenser is preferable to the solid-dielectric type except in very exceptional cases. I wouldn't dream of using a solid-dielectric type for tuning, though.

A nice log has arrived from "H. N. D. B." (Hull), the most interesting feature of which is the reception of a few South African amateurs on the 20-metre band during August. Incidentally, the "V.Q.'s" (Kenya and Tanganyika) have been coming in splendidly of late, from 6 p.m. right through until 11 p.m. on some nights.

### A Good Address.

Three or four people seem to be attracted by the "Correspondence Bureau" suggested by "J. T. S." (Leicester). I am forwarding their names to him myself; but if any others want particulars I shall be glad if they will now write direct to the sponsor of the scheme. His address is: Mr. J. T. Smith, 65, Marshall Street, Woodgate, Leicester. Stamped, addressed envelopes for replies, please.

### The N.Z. DX Club.

I am asked to bring the New Zealand DX Club to the notice of short-wave enthusiasts. Its aims are to forward the interests of all DX listeners by supplying up-to-date station lists, etc., and several branches are being formed in this country.

For full particulars apply to Mr. Stephen Cullen, whose address is 33, Dilston Grove, London, S.E.16.

## COMBINED INSTRUMENT



A combined Telefunken radiogram and television receiver on view at the German Radio Exhibition. The cathode-ray method of non-mechanical scansion is employed.

ways, two of which show quite considerable promise.

"W. H." also wants to know: (1) would extension handles improve the "H.A.C. Three-Valver"; and (2) wouldn't an air-dielectric reaction condenser improve matters?

### Remote Control of Instability.

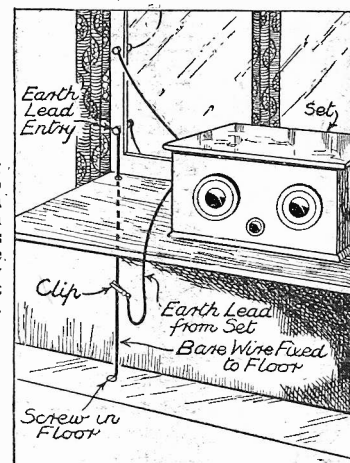
My views on the subject of extension handles are very definite. They are a delusion and a snare. As I have said before, if one "cures" hand-capacity trouble by their use, one hasn't cured it at all, but merely pushed it six inches further away.

All the other little troubles that go with it are still there, and the fact that they

## CURING HAND CAPACITY

WHEN hand-capacity troubles are present on a short-wave set they can often be cured by removing the earth lead completely. This holds good mostly in cases where a long lead has to be used. Another method of curing them, however, is this: Generally the earth lead comes into the room via a corner of the window.

Instead of connecting it directly to the set, join a length of stiff bare wire to the



By moving the clip up and down the earth wire a spot is found where hand capacity does not affect tuning.

point of entry of the lead, and take this straight down to the floor, anchoring it to a screw.

Now take a flexible lead from the earth terminal of the set and terminate it with a crocodile clip. By sliding this up and down the wire from the window to the floor it is often possible to find a point at which hand-capacity effects will disappear completely.

## THE LISTENER'S NOTEBOOK

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

I DON'T think "The Game" showed any advance in the development of purely radio drama. Has it been laid down anywhere that radio drama must deal with post-war idealism and realism? It's very dull subject-matter at its best, and becomes duller on repetition.

As soon as Sir William Gray began his speech to the boys of Marten House School one could guess the rest, so post-warish was the plot.

If anyone did excel in this play, it was the players themselves. For clearness and precision I've never heard a better cast. It was just as well, for I listened under difficulties.

Missing the performance on the National wave, I was forced to take the repeat show on the Regional, with its background noises from unwanted stations. I hope all listeners who use the Regional aren't troubled as I am. If they are, then the B.B.C. are wasting time and money to keep it going.

But to return to "The Game" and radio drama generally. Since seeing a stage performance of a Priestley play a few nights ago, I've been wondering why a broadcast play seems so colourless.

I sometimes wonder in my own case whether I am too conscious of the B.B.C.'s method of production. I can never get the multiple studios plus control panel out of my mind during a performance.

I often regret that the B.B.C. has let us into this secret, for frequently I imagine that when I butt in to a conversation that he is not hearing I can detect a lack of spontaneity in his remark.

Perhaps this is just imagination, but there you are!

Another weakness of most radio drama is its complete lack of humour. Witness "The Game." There wasn't a single laugh in it from start to finish. Priestley can write a play full of tense moments, but he knows the value of the relief afforded by a laugh, and so he introduces here and there a remark that produces an audible stir in the auditorium.

"The Game" wasn't without interest, but it just didn't give that something which a play-loving public always gets from a theatre. That's why I call it unsatisfactory. I can't say it was colourless. But it wasn't multi-coloured. It was just grey.

It will be some time before one is completely used to the woman announcer. At present it seems all wrong that she should read out racing, cricket and football results, not to mention fat-stock prices. She is rather deliberate with the preambles that usually precede these announcements, but doubtless she will rattle them off when she becomes more familiar with them.

It was amusing, as she announced some cricket results one evening, to observe her obvious bewilderment over the fact that it was possible in the same match for one player to get 127 and another 5 for 47. Strange game, cricket!

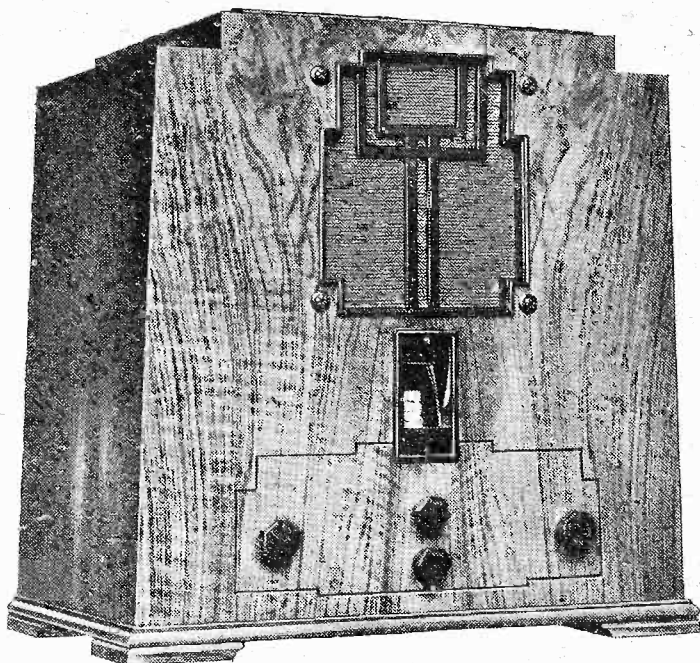
By the way, isn't it rather curious that Mrs. Borrett should have been given so much publicity, while her men colleagues got none?

The second week of variety from Olympia—or should I say from the theatre at Olympia?—was as glorious a success as the first. The Exhibition was, of course, responsible for most of the enthusiasm there. Naturally, this enthusiasm was brought into the theatre. Radio stars felt the benefit of it, with the result that broadcast variety made history.

It is a sad thought that variety will take a retrogressive step when it goes back to the unsympathetic atmosphere of the studio. This is inevitable for the time being, but it will be tragic if the B.B.C. hasn't learnt this obvious lesson that these performances had to teach. However, it is encouraging to know that the commentator of these Olympia shows saw the value of the theatre audience, judging from his remarks before the last performance there. By the way, I thought his little speech on this occasion ranked with the stars themselves for brilliance.

(Continued on page 895.)

# THE NEW HIGH POWER SUPER-HET WITH EXCLUSIVE STATIC SUPPRESSION



Hear this remarkable new model for yourself and you will realise that in its tremendous power, unprecedented selectivity and perfect tonal quality it is a definite step ahead even for Marconi. Merely to look at the figured walnut cabinet with its unusual lines and beautiful finish is to realise that here is something definitely different, definitely superior. But hear how the full Automatic Volume Control eliminates fading—how the super-selective band-pass circuits cut unerringly through interference—and how the unique Static Suppressor provides a background of silence unbelievable in so powerful a set—then will you decide that Marconi 276 is your ideal 1934 receiver.

Seven valve band-pass super-heterodyne for A.C. Mains.

Absolutely consistent adjacent-channel selectivity.

Unique Static Suppressor, adjustable for minimum background. Genuinely unlimited range.

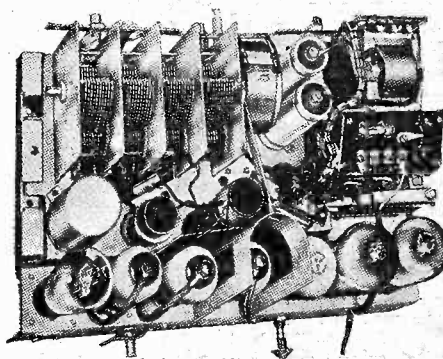
2½ watts undistorted output—enough for three extra speakers.

Full Delayed Automatic Volume Control.

Duplex tone control adjusting both bass and treble.

Illuminated scale carrying station names and wavelengths.

Superb energised moving coil speaker of wide response.



A rear view of the all-steel rubber mounted chassis, which gives some idea of its skilful design and fine engineering construction.

# MARCONI 276-

PRICE **22** GNS.

EXTENDED PAYMENTS GLADLY ARRANGED

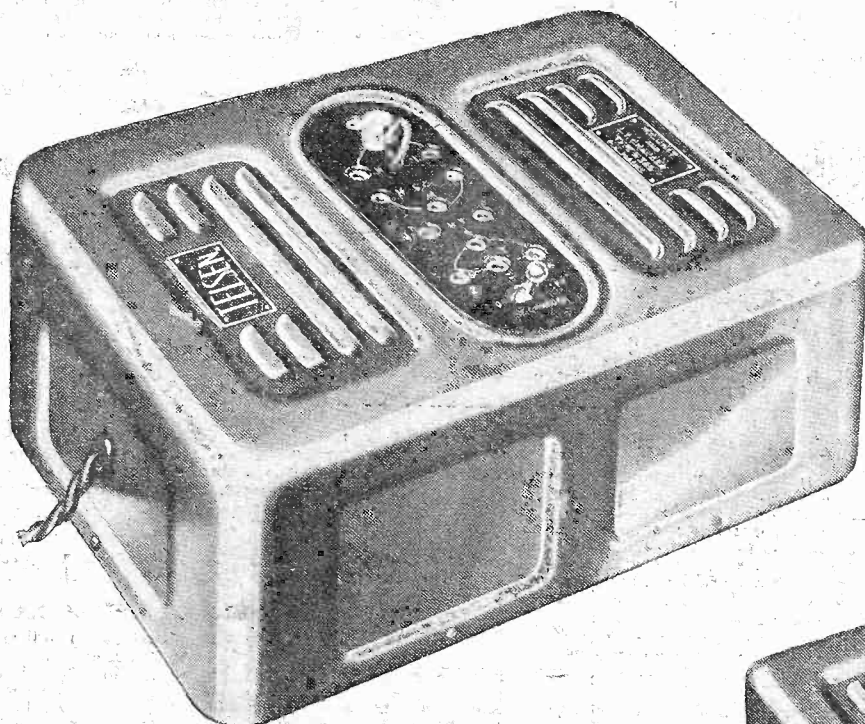
ADVERTISEMENT OF THE MARCONIPHONE CO. LTD., RADIO HOUSE, LONDON, W.1.



# Telsen

## MAINS UNITS

### cover every requirement



#### TELSEN H.T. UNIT AND L.T. CHARGER FOR A.C. MAINS.

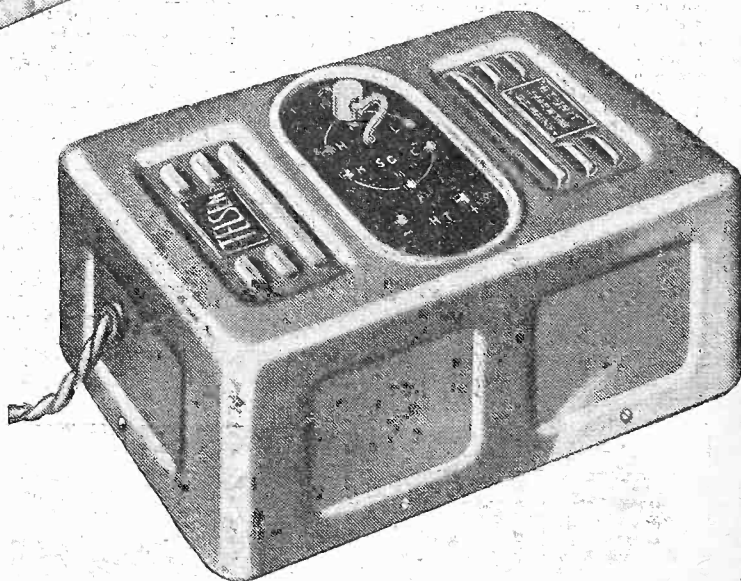
For input voltages between 200 and 250 at 40 to 100 cycles. H.T. output is 28 m.a. at 150 volts, with separate Max., Det. and S.G.appings, at each of which a choice of high, medium or low voltages is available. Very generous smoothing equipment eliminates hum. Charges 2, 4 or 6 volt accumulators at 0.5 ampere, the use of these facilities leading to such a saving of charging costs that the unit soon pays for itself. Very solidly built, and completely screened by an artistically finished metal case.

**97/6**

#### TELSEN H.T. AND L.T. UNIT FOR A.C. MAINS.

Similar to the "H.T. unit and L.T. charger" but, as it is intended to provide complete power for receivers employing A.C. valves, the L.T. charger is replaced by a centre tapped transformer winding capable of supplying 2.5 amps. at 4 volts. Very well made in every respect and completely screened by its artistically finished metal case.

**67/6**



#### TELSEN H.T. UNIT FOR D.C. MAINS.

For D.C. inputs of from 200 to 250 volts. Adequate smoothing is provided to remove ripple. Output is approximately 28 m.a. at 150 volts. Max., S.G. and Det.appings are provided, at each of which a choice of high, medium or low voltages is available. Enclosed in a well-finished metal case which provides complete screening.

**35/-**

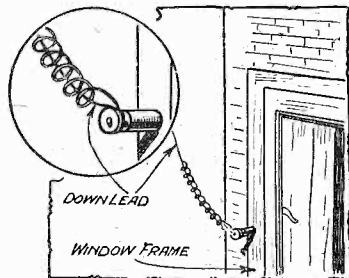
## TELSEN FOR EVERYTHING IN RADIO

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



### STRENGTHENING THE LEAD-IN.

TO prevent the aerial lead-in from breaking off at the joint to the lead-in tube, take a piece of 16- or 18-gauge copper wire and twist it round a pencil till it forms a spiral



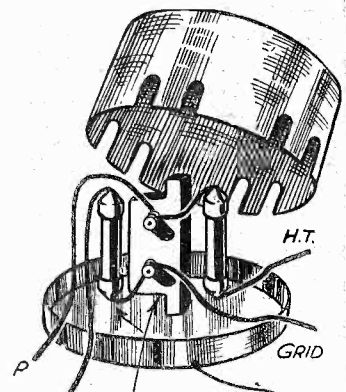
Preventing a broken down-lead.

spring 5 or 6 in. long. Pass the lead-in through this and fasten the ends of both to the lead-in tube by its screw. This will stop the swaying in the wind and consequent sharp bending of the wire which usually breaks the aerial at this point.

### SCREENING COMPONENTS.

HERE is a little scheme which I have found useful, and may be of interest to others.

When rebuilding a set, the chief aim apart from making it efficient, is a neat appearance. It is easy to buy Glazite, or similar material, for the wiring, but often the use of old-type condensers, chokes, transformers, etc., though quite O.K. in use, spoil the finished job. In my own case I had several of these, but made everything much smarter by the following idea. Firstly, for the R.C.C. unit, procure a small round tobacco tin and screw the lid to base-board. Next, the fixed condenser and the two leaks are mounted upright so as to leave clearing room for the



G.B. H.T. GRID EARTH COMPONENTS SUSPENDED ON THEIR OWN CONNECTING WIRES

tin to fit over, notches being cut in the lip for the wires passing through. The home-made tuning coil and transformer were mounted similarly in various sized tins, the covers being easily slipped off for inspection or test. All the covers are now brushed carefully with any colour Chinese lacquer (obtainable at the well-known sixpenny stores). This idea has transformed my old "junky" set to something important looking. It is advisable to earth the lids when screwed down.

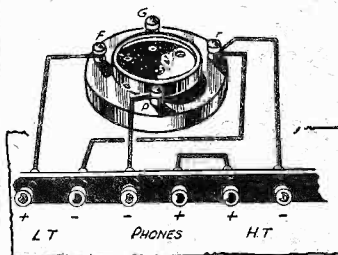
### USING ADAPTOR AS SET.

MANY short-wave "fans" who possess a short-wave adaptor and an ordinary broadcast set may wish to listen-in on short waves when the family are using the "big" set.

With the aid of a valve holder, terminal strip and half a dozen terminals, the adaptor may easily be changed into a one-valve set.

Mount the parts on the adaptor baseboard, or, if there is no room there, on a spare strip of wood, and wire up as shown in the sketch. Connect the appropriate terminals to the batteries and 'phones, insert the adaptor-plug into the valve holder, and listen in.

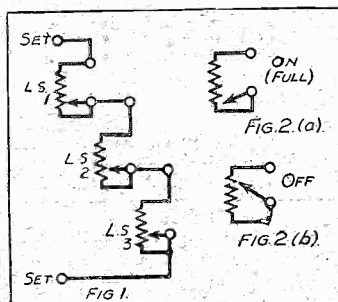
The batteries and 'phones may be left permanently connected to their terminals, so that when it is desired



How the holder is wired.

### SPEAKER VOLUME CONTROL.

HERE is a simple method of working three or more loudspeakers in different rooms so that each one can be switched on or off and have its volume controlled without affecting any of the others.



Each speaker has a volume control.

For each L.S. a variable potentiometer of, say, 500,000-50,000 ohms will be required, and an ebonite block or wooden box for mounting. (The writer used the wooden cover of an old bell set.)

The method of connecting each

### ONE GUINEA FOR THE BEST WRINKLE !

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

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

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

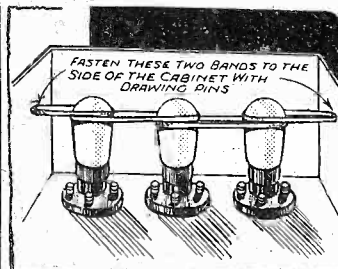
The best Wrinkle last week was sent by Mr. G. G. Wilner, 14, Beech Hill Road, Eltham, S.E.9, to whom a guinea is being awarded.

to use the adaptor with the broadcast set it takes only a second to change over, and vice versa. This is very useful when a distant station is heard on the 'phones and it is desired to get it on the loudspeaker before it fades.

It is advisable to use a separate aerial for the adaptor. When wiring make sure the H.T.—terminal is connected to the correct L.T.—terminal: in most sets it is the L.T.—terminal. All these remarks do not apply to the superhet type of adaptor.

### A CURE FOR MICROPHONICS.

IF your valves are arranged in line, and you suffer from microphonics, here is a good cure for them.



Four bands are used here.

Fasten each valve to its neighbour by means of a rubber band, and attach the bands of the end valves to suitable components or to the sides of your cabinet.

potentiometer is shown in Figure 1. It will be noted that the L.S.'s are in series. The set must have a choke output.

Figure 2a shows the potentiometer with its moving arm so that the resistance is "all in," and therefore the L.S. is "on" at full strength.

Figure 2b shows the moving arm in the position where the L.S. is "shorted," and therefore "off."

Volume control is obtained by leaving the moving arm in intermediate positions.

### SHORT-WAVE COILS.

EMERGENCY short-wave coils can be made from Glazite, or similar insulated wire, of a gauge not less than 18. The coil of Glazite is about 12 turns, of a diameter suitable for short-wave coils, and all you have to do is to cut off the requisite number of turns and bind the coil in two or three places. A little wire should be left to make connection.

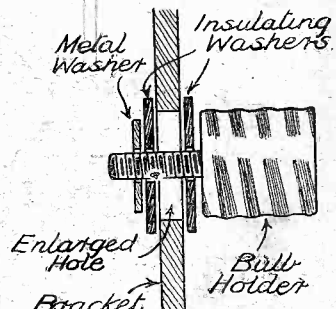
One coil of Glazite is sufficient to make three or four short-wave coils. It is interesting to note that stations are displaced a few degrees lower on the dial when using coils of this description in place of coils made of bare wire. This is due to the capacity existing between adjacent turns being increased by the insulating material.

### INSULATING A BULB HOLDER.

OCCASIONALLY it is desired to insulate a bulb holder from the bracket to which it is fixed. In the

event of no suitable insulating bushes being available, a safe method is as follows: First enlarge the hole in the bracket to about 1/4-inch diameter with a drill or by any suitable means, and then cut out two washers about 1/4-inch diameter from presspahn or similar insulating material. Card-board will do if nothing better is available, but a good insulating material is preferable.

Drill a hole in the centre of each of these washers to take the centre screw of the bulb holder, and then assemble as shown in the diagram. The metal washer illustrated is most important, and should be about 3/8-inch diameter. When assembled and tightened up

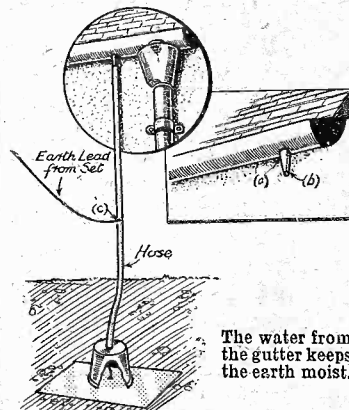


Quite simple to arrange.

the metal washer, being smaller than the hole, will draw the presspahn washer partly into the enlarged hole in the bracket, thereby centring the screw in the hole and effectively preventing it from touching the sides. There is no need to force the washer into the hole, the normal tightening being quite sufficient, if the presspahn washers are about 3/8-inch thick.

### A SELF-DAMPING EARTH.

WHERE structural conditions of the house permit, an excellent earth can be obtained as shown in the illustration. A small hole is bored in the guttering of an outhouse or low roof, and the spout of a cheap funnel soldered in as depicted at (a). A piece of old garden hose is then secured firmly to the free end of the spout (b). The earth wire from the set is then inserted through a small



hole (c), made in the hose at any convenient point, and hose and wire are then taken down to the earth plate. An inverted flower-pot will serve to keep the hose in position, and prevent undue strain on the wire. The hole in the side of the hose should, of course, be sealed with rubber solution.

Continued on next page.



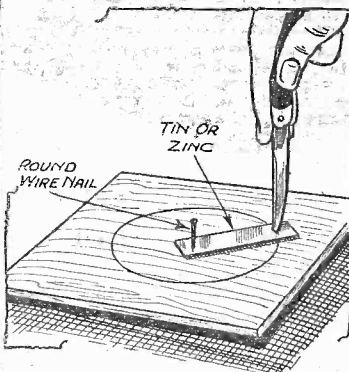
## RECOMMENDED WRINKLES

(Continued from previous page.)

### CUTTING OUT CONES.

FREQUENTLY in the construction of cone loudspeakers it is necessary to cut out circles of large diameter in such materials as paper, cardboard or felt. Even where compasses are available for marking out it is by no means easy to cut out the circle neatly with knife or scissors, especially when cutting an inner circumference.

A simple and effective method is to take a small strip of thin tin (or better



Neat cuts are obtained in this way.

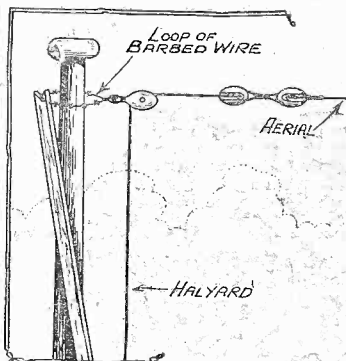
still, zinc) and to scratch on same the radius of the required circle. Through one mark drive a round wire nail, and at the other place an old pocket knife and tap through the metal until the point of the blade protrudes some  $\frac{1}{2}$  in.

If the nail is now driven through the centre of the material in which the circle is to be cut the whole may be slowly rotated and, with reasonable care, a clean-cut circle will result.

### FOR BROKEN HALYARDS.

SHOULD the misfortune of a broken aerial halyard befall any reader of "P.W.", there is no necessity for him to climb aloft to replace the fallen member. A simpler and much less hazardous method of effecting the repair is as follows:

Procure a short length of barbed wire, sufficient to form a loose loop around the base of the mast, and to the loop attach a pulley. Thread the halyard



To save lowering a mast.

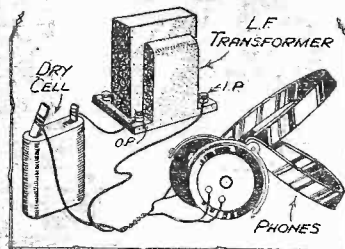
through the pulley in the usual way, and then, with the aid of two or three clothes-props lashed together, push the loop up into position at the masthead. The aerial is now pulled taut by means of the halyard, and at the same time the clothes-props are withdrawn. The "barbs" of the wire loop will bite into the wood of the mast, and a secure and not unsightly repair is the result. If a still neater appearance is desired those "barbs" which are not required to make contact with the mast may be nipped off.

### TESTING L.F. TRANSFORMERS.

THE usual method of testing for a breakdown in an L.F. transformer, etc., with 'phones and battery, and listening to the loud click when making and breaking the contact, is

not always reliable owing to the possibility of the ends of the broken wire touching. I recently tested a transformer, which I knew to be faulty using this method, and the loud clicks passed it O.K.

The following is a perfectly reliable test: Connect winding under test to 'phones and battery in the usual way (see sketch), but instead of making and



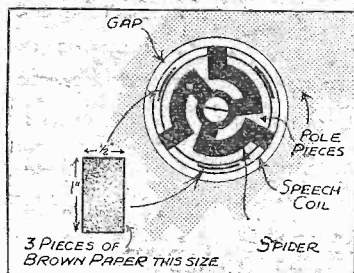
A simple but useful test.

breaking the contact, leave the leads connected. On listening through the 'phones, the result, if the winding is O.K., is perfect silence. If there is a break in the wire, a rushing and faint crackling noise will be heard, just the same as is heard in a set with a faulty transformer, only on a smaller scale. This test has never failed me.

### CENTRING THE MOVING COIL.

THE speech coil of a moving-coil speaker sometimes develops a rubbing contact with the sides of the gap, causing distortion and loss of volume. The only remedy is re-centring, which, as a rule, is such a delicate operation that most constructors refer it to the makers for re-centring.

A simple way of doing this, however,

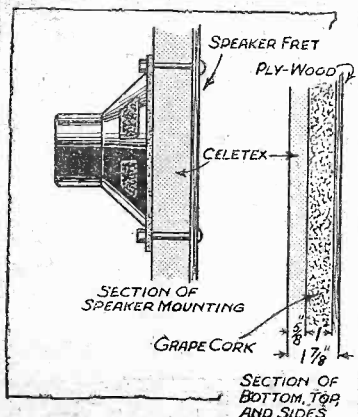


How to obtain accurate centring.

is to first loosen the screw that holds the centring spider in position. Three slips of brown paper are cut and placed at equal intervals between the inside of the speech coil and the polepiece of the magnet. This holds the coil clear whilst the centring spider is screwed up again. The slips of paper are then gently removed. An increase in volume and quality will be at once apparent.

### A SPEAKER CABINET.

TO obtain true reproduction from a moving-coil speaker it is imperative that it be housed in a suitable cabinet. Herewith I describe a cabinet-construction scheme which I evolved after months of sustained effort and many failures.



Construction of non-resonant cabinet.

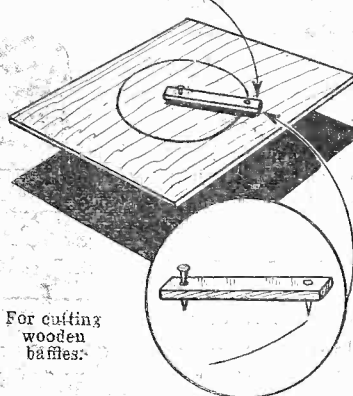
A frame of 1-in. square section wood is made to required design. Plywood is tacked to frame on outside.  $\frac{3}{8}$ -in. thick "Celotex" (or similar asbestos base sheeting) is fitted to inside of frame, after having filled space between frame members with grape cork (obtainable at any fruiterer's). The speaker is mounted on "Celotex" and to speaker fret. The rear of the cabinet is plywood to which "Celotex" is tacked, suitable ventilation being provided for cabinet.

This may appear an expensive scheme, but it is not. My cabinet cost 4s. 6d. for material—and I "scrounged" nothing!

### CUTTING BAFFLEBOARDS.

MANY readers have, no doubt, at some time or other, wished to cut a circle in a baffleboard on which to mount a speaker. As a keyhole saw is not always handy, the following is a simple method, and also very effective. Obtain a piece of wood (about 1 in. x  $\frac{3}{4}$  in. section), drill a hole about  $\frac{1}{2}$  in. from one end, and large enough for a 2-in. nail to fit easily. Now bore another hole about the same size at a distance from the first equal to the radius of the circle you wish to cut out.

SHOWING MANNER IN WHICH SCRIBER IS USED

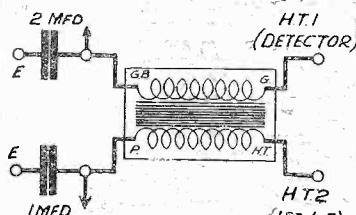


For cutting wooden baffleboards.

In the first hole insert the nail to act as a pivot, and in the second a very sharply-pointed bradawl, if this is handy (if not, sharpen up the point of another nail and use this in its place). Hold the first nail sharply embedded in the centre of board, and with the second mark round the circle, lightly at first and gradually getting heavier. When you have gone about half-way through, hammer the centre hard to give you a mark on the other side. Turn the board over, and again insert the centre nail, and continue as before. When you almost reach the other cut, the centre of the board will fall out if a light tap is given to it.

### BATTERY SET DECOUPLING.

IN sets using small current for detector and first L.F. valve, instead of using wire resistances, use the secondary winding of an old-type L.F. transformer to decouple the detector stage and the primary for the first L.F. stage, with

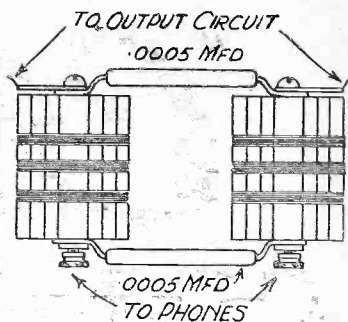


Old transformer used for decoupling.

the usual by-pass condensers. The voltage drop being small, the useful life (with reduced volume, of course) of the H.T. battery is greatly extended, and in practice the decoupling is excellent. Even coupling two run-down batteries in series has been found possible with perfect reception with this scheme, even on ultra-short waves. Do not earth the core if a terminal is provided.

### AN H.F. FILTER.

MOST short-wave experimenters have at one time or another experienced that annoying phenomena known as "body-capacity" effects. These can often be overcome by the construction of a simple device known as an H.F. output filter.



The chokes are joined by condensers.

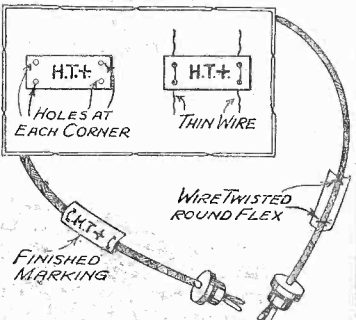
Obtain two pieces of ribbed ebonite former and two 0005-mfd. fixed condensers of the type made for suspending on wiring. With a triangular file nick three series of slots on each former, as shown on the diagram, and wind into the slots a total of some 150 turns of fine wire (old transformer wire will do excellently). The ends of the formers have screwed into them 4 B.A. screws for holding the two fixed condensers which are connected to the ends of the wires.

Connections externally to the 'phones and output stage can be made either to the screws which hold the condensers or to the soldering tags on the condensers.

This device will usually effect a cure even in the most stubborn cases of body capacity.

### LABELLING BATTERY LEADS.

A GOOD way of marking battery leads is as follows: Get a piece of thin cardboard (a plain postcard will do nicely), cut into oblong pieces about



A scheme which prevents leads being muddled.

1 in. x  $\frac{1}{2}$  in., mark the different voltages or battery markings on them and pierce two holes at each end. Thread a piece of thin wire through the two holes, then place on the battery lead and twist the wire tight behind and cut off any surplus wire; this will give neat, plain battery markings.

### BEWARE HAIRS!

IF there is one thing more than another which spoils reception, it is a constant crackling sound as the dials are turned.

A receiver with this complaint of a chronic type was encountered lately. Its owner averred he had blown all the dust from the condenser vanes, and then thoroughly cleaned them with a pipe-cleaner. Still the trouble persisted.

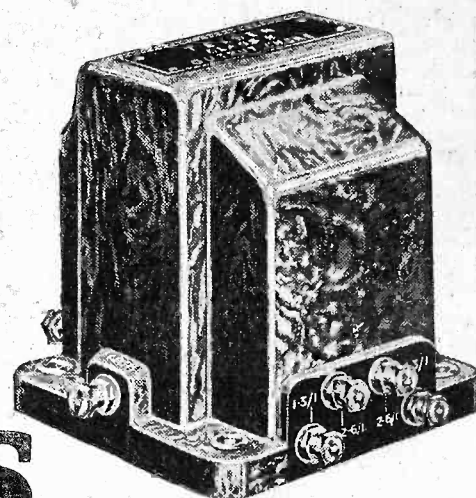
It was eventually tracked down to a minute hair which was adhering to the fixed vanes, and brushing against the moving vanes as the latter were turned. It was not until the condenser was taken from the set and held up to the light that this trouble was unearthed.

So mind your condenser doesn't sprout a hair!

With a short-wave set working close up to oscillation point a hair could be responsible for much trouble.

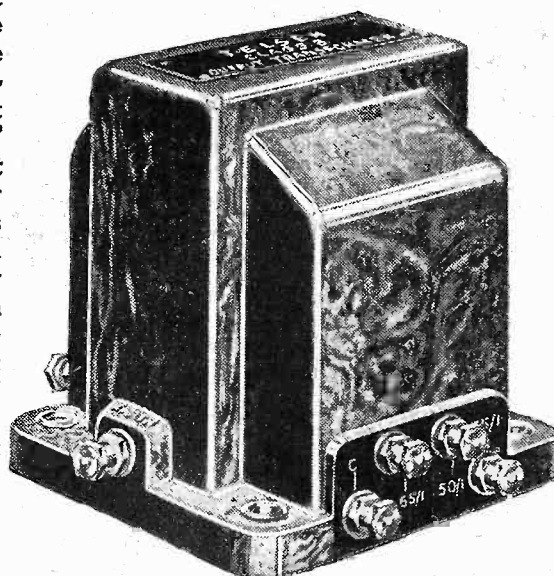
# TELSEN 'Class B' COMPONENTS

**T**HE use of the correct "Class B" valves alone is not enough to ensure perfect "Class B" amplification. You must also use the correct "Class B" components of whose perfect matching, and lasting efficiency you can be assured. That is why you should use Telsen "Class B" components. They are the outcome of long research and experiment by Telsen Technicians, representing the most enduringly perfect "Class B" components it is possible to produce. Be sure—and insist on Telsen.



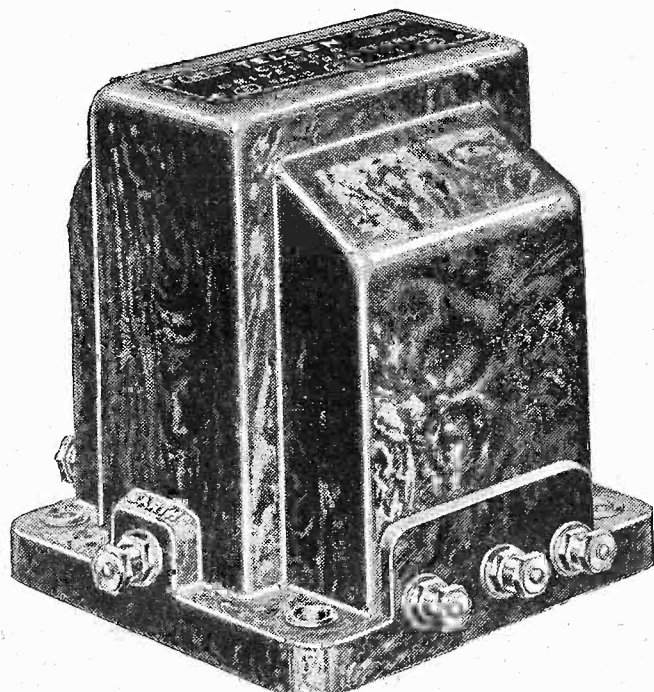
## TELSEN "CLASS B" OUTPUT CHOKE

Provides ratios of 1-1, 1'3-1, 1'2-1, 2'6-1, for matching to any Moving Coil speaker having either a high resistance speech coil or a low resistance coil and input transformer. The low D.C. resistance of 220 ohms per half winding, and generous core section prevent distortion. The total inductance is 18 **8/6** henries.



## TELSEN "CLASS B" OUTPUT TRANSFORMER

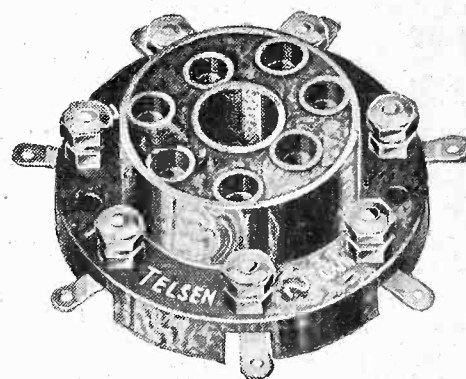
Provides ratios of 35-1, 50-1 and 65-1, ensuring correct matching to Moving Coil speakers having low resistance speech coils. Low primary resistance (200 ohms per half winding) and large core **8/6** section.



## TELSEN "CLASS B" DRIVER TRANSFORMERS

Made in two ratios covering the requirements of all the "Class B" valves available at present. Supplied with comprehensive instructions.

RATIO		Price
(Overall)	(Primary to half-secondary)	
1-1	2-1	
1.5-1	3-1	<b>8/6</b>



## TELSEN 7-PIN VALVE HOLDERS

Specially constructed to accommodate "Class B" valves. The contact sockets are extended in one piece to form the soldering tags, thus ensuring perfect connection. The terminals are numbered according to the standard R.M.A. system.

7-pin Solid Type	<b>1/6</b>
7-pin Anti-Microphonic Type	<b>1/9</b>

**TELSEN FOR EVERYTHING IN RADIO**  
ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM



# Home-built radio that gets EUROPE-AMERICA-AUSTRALIA- all on the same set!

**ULTRA  
SHORT**
**SHORT**
**MEDIUM**
**LONG  
WAVES**

At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World "Skyscraper" 4 tunes from 12 to 2100 metres. It brings two complete new wavelength ranges within reach of the ordinary listener—stations and programmes which before he was never able to receive—Ultra Short and Short-Wave transmissions from the ends of the earth. And remember you get these stations through Double-Balanced Pentode Output giving brilliant reproduction on a Moving-Coil Speaker—as much power as a Mains Set from ordinary high-tension batteries.

**FOUR WAVELENGTH RANGES  
INSTEAD OF TWO!**
**COMPLETE WITH  
FOUR VALVES  
£5.12.6**
**DOUBLED BALANCED  
PENTODE OUTPUT  
AND MOVING COIL  
LOUDSPEAKER**

The output stage of the All-Wave All-World "Skyscraper" 4 is Quiescent Push-Pull output at its best, incorporating TWO BALANCED LISSEN POWER PENTODE VALVES and giving you brilliant reproduction on a Moving-Coil Speaker. You get mains volume from this set, yet it works from ordinary high-tension batteries and is an economical set to run.

**WITH WALNUT  
CABINET and  
MOVING COIL  
LOUDSPEAKER**
**£8.26**
**LISSEN**
**ALL-WAVE ALL-WORLD  
"SKYSCRAPER" 4**
**POST COUPON for  
FREE CHART**


To LISSEN LTD.,  
Publicity Dept.,  
ISLE WORTH.  
Please send me FREE  
copy of All-Wave All-  
World "Skyscraper"  
Chart.

Name.....  
Address.....

Pop. 535



# BERLIN'S RADIO SHOW

A review of some of the main features and outstanding items of the Continent's greatest Wireless Exhibition.  
By A. A. GULLILAND.

THE first Radio Exhibition in Germany took place in 1924, and very shortly German broadcasting will be celebrating the 10th birthday of its first official broadcasting station, Berlin Witzleben. The revolution through which Germany has just passed has brought about many changes, and none greater than in the realm of radio.

Not one of the leading pioneers of German broadcasting are in office or even present at this exhibition. Some of them, in fact, are confined in the concentration camp at Oranienburg, which the new director of German broadcasting, Mr. Hadamovsky, has ironically termed, "that summer holiday resort."

## Television Progress.

The exhibition was the first under the National Socialist government, and it bore a totally different aspect from those held

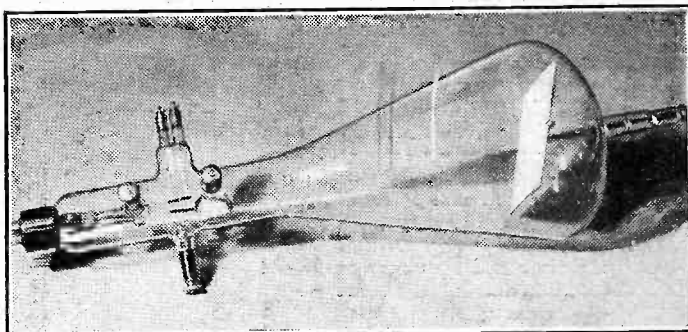
de-luxe receiver sells at nearly £25, complete with valves, moving-coil loudspeaker, etc.

Shadow tuning, or some kind of electrical means of ascertaining when the given station is tuned to maximum perfection, is contained in all sets of this price. This type of receiver also incorporates a special knob to adjust the sensitivity of the set, making it possible to eliminate unwanted distant stations and at the same time most atmospherics.

Any station creating more than 10 milli-

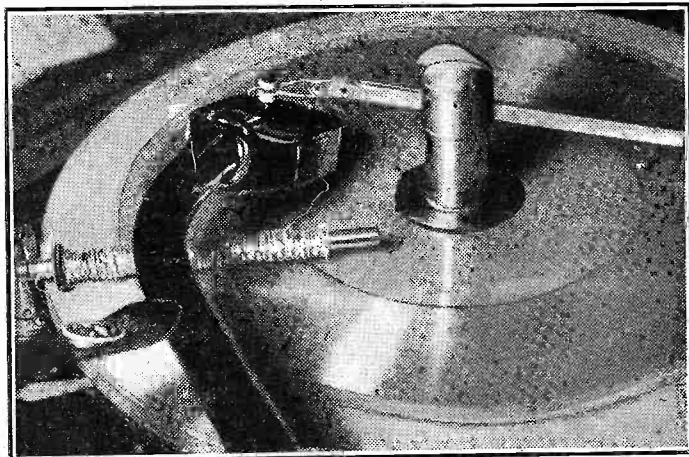
special stands arranged by the German Navy and the German Army, give the visitor a very complete idea of the uses

## CATHODE-RAY TELEVISION TUBE



This new device for television reception is due to the famous inventor Manfred von Ardenne, one of Germany's foremost radio engineers.

## SOLVING THE PROBLEM OF THE THREAD



One problem of home-recording is the disposal of the thread cut by the needle, and this ingenious device, shown by the Telefunken Co., solves it by winding the thread on to a revolving rod.

in former years. Competition among firms, as far as size and attractiveness of the stands were concerned, had been reduced to a minimum.

The main features of the exhibition on the technical side was television progress, and a very interesting historical show gave the visitor a comprehensive idea of the development of wireless.

## Prevalence of "Shadow Tuning."

German radio sets show marked improvement over those of the last year. The superhet is in two forms—the 3-valve so-called "sport's model" and the de-luxe 5- or 6-valver, complete with automatic volume control, shadow tuning, etc. This

volts per metre in the aerial can be received with these 5- or 6-valvers. Tuning is by one knob, and is usually effected with the volume control in the "off"

position, the station being brought in only with the help of the shadow or other indicator.

The new valves, the Binode and the Hexode, are to be

met with in all sets. A new power amplifier valve provides undistorted quality at full power. The three-tuned circuits 4-valve straight receiver has still many friends.

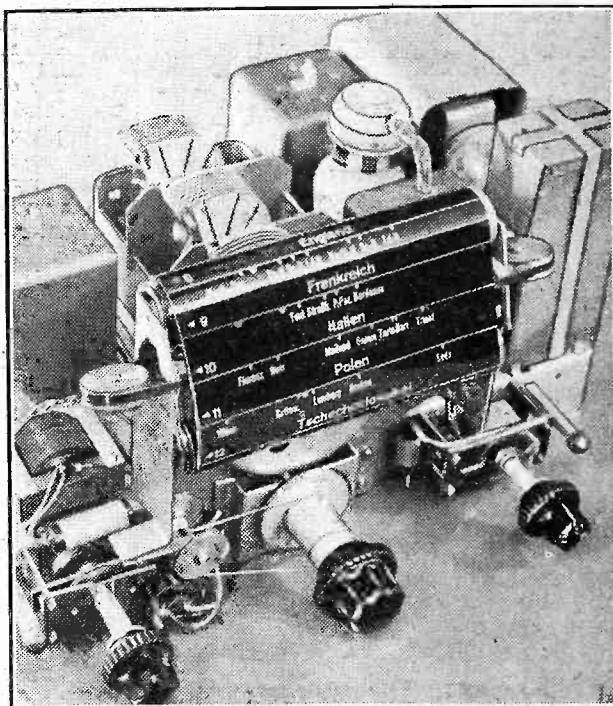
With the exception of the battery "Volksempfänger" (the "People's" set, approved by the government), there are very few battery receivers. Most German sets incorporate three wave bands this year: short, medium and long.

The historic part of the exhibition, together with the

of wireless in pre-broadcasting days. The German Air Ministry stand shows the very latest types of direction-finding apparatus for aeroplanes, together with a full-sized plane.

The German Post Office laboratories have, as in former years, concentrated their  
(Continued on page 894.)

## THE SENSATION OF THE SEASON



A novel tuning film which has taken the place of the usual illuminated dial has been styled the sensation of the Berlin Show this year.



## FROM THE TECHNICAL EDITOR'S NOTE BOOK

TESTED  
AND  
FOUND?THE FERRANTI  
SPEAKER AMPLIFIER

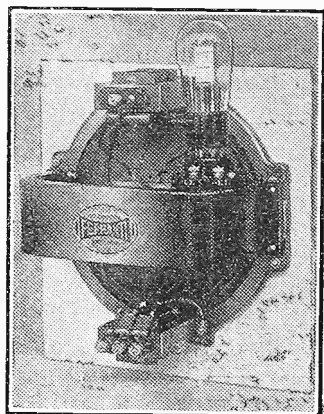
IT is one of the greatest attractions of "Class B" amplification that it can be added to practically any existing set. And now Ferranti have even further facilitated the addition.

They have done this by the production of an ingenious device known as the Ferranti Speaker Amplifier.

This comprises a first-class moving-coil loud-speaker of the permanent-magnet type, on which are neatly mounted special "Class B" driver and output transformers and a "Class B" valve holder. The whole forms a most compact unit, and when mounted in a cabinet or on a baffle is no larger than an ordinary loudspeaker.

The connections to the set are few and simple, and adequate instructions for making them are provided.

And the results are most impressive. The power output of an average type of battery-operated set can be increased about seven times with very little increase of H.T. current consumption.



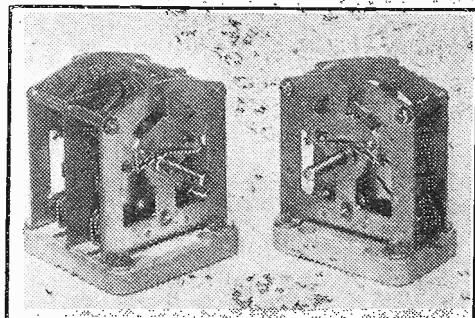
A complete "Class B" stage, including the valve, is incorporated in this Ferranti speaker-amplifier unit.

be purchased for £3 10s. without valve.

BRITISH  
RADIOPHONE CONDENSERS

British Radiophone are making great progress. Already famous for their ordinary gang and single types, they have now turned their attention seriously to the production of short-wave variables.

I have before me as I write samples of their two new types of these. One is a 00025-mfd. single type,



These variable condensers, a two-gang on the left and single on the right, are specially designed for short-wave work and are a British Radiophone product.

and the other is a two-gang of similar general construction.

This latter is for unified-control superhets and for other such purposes. Also it is obvious it could be connected, if desired, as a highly efficient "series-gap" condenser.

The design is in accordance with the very latest low-loss principles, and there is a negligible quantity of solid dielectric.

The vanes are of hard brass and the frame also is solidly and rigidly built.

A non-inductive pig-tail is run through the hollow spindle, and is kept at a tension in order to eliminate all but the necessary twisting motions.

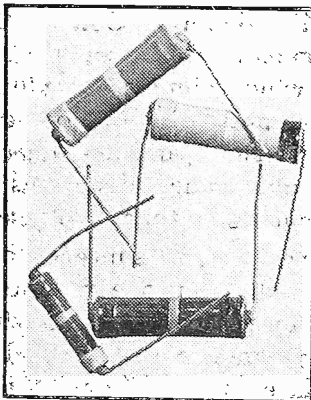
The movement is very smooth—exceptionally so, in fact—and this is no doubt due to the provision of steel bearings.

Each condenser is provided with a substantial porcelain base, and is thus in line with the best "beam" technique.

I recommend these British Radiophone short-wave condensers. I should imagine that they will satisfy the requirements of the most fastidious of "fans."

## TELSEN RESISTORS

In my opinion, the development of the small wire-end construction is extremely convenient, especially to the experimenting constructor.



The Telsen wire-end resistors seen here are available in 1- to 6-watt types, and with a very wide variety of resistance ratings.

It makes it so easy to add odd resistances or condensers to a circuit. And, of course, resistances and condensers of this (wire end) form are particularly easy to wire into a new set.

(It does seem so unnecessary, in many cases, to anchor a component weighing but a fraction of an ounce to the baseboard with screws, doesn't it?)

Naturally, that enterprising concern, Telsen, were not likely to overlook the attractions of the wire end.

I have already reviewed the Telsen Small Tubular Condensers which follow that design, and it is now my pleasure to introduce to you the Telsen Resistors with wired ends.

These are available in an extremely wide range of values. With a power rating of 1 and 1 watt there are no less than twelve values, from 250 to 500,000 ohms each at the extraordinarily reasonable price of 1s.

And, there, are ten from 250 to 100,000 ohms in the 2-watt class, these retailing at 2s. each.

But even if this very comprehensive selection does not fulfil all requirements, there are still the 3- and 6-watt types which can be supplied on demand.

We have already used numerous of the Telsen wire-end resistors for many different purposes, and have found them to be accurately rated and thoroughly reliable in all respects.

NEW  
HEAYBERD TRANSFORMER

Messrs. Heayberd have been very quick, in their usual enterprising manner, to produce a transformer especially suitable for the new H.T.12 Westinghouse Metal Rectifier.

This, as readers probably know, is a voltage-doubling type giving 30 m.a. at 200 volts—an extremely popular size.

The Heayberd transformer, which is styled the W.41, has H.T.12 tapings of 110 and 140 volts, and an L.T. 4-volt 4-ampere supply for A.C. valves. The retail price is 22s. 6d.

It is a very well-made component, and is imbued with that comforting substantiality to which undoubtedly Heayberd largely owe their success.

It is also very efficient in operation, the voltage control—that is, its freedom from marked voltage variations at differing loads—being particularly good.

A NEW HIGH-VOLTAGE  
OUTPUT VALVE

Details of a Mullard valve with an output around seven watts and a four-volt filament.

SOME of the technical terms employed in radio, though readily understood by engineers, are very apt to be misconstrued by listeners. A case in point is the term

"maximum undistorted output" as applied to a valve. When it is stated that an actual output of about a quarter of a watt will give sufficient domestic volume listeners may be pardoned if they wonder why modern mains sets employ output valves capable of giving two or three watts undistorted power, or even more.

## Effect of Loud Passages.

The explanation is, of course, that while over a very large proportion of programme time a certain programme strength is radiated, this strength is greatly increased (perhaps to five or six times the average) when specially loud passages occur in the items being broadcast. In other words, while the radio-frequency power transmitted from a station is constant, the audio-

frequency modulation varies in accordance with the programme.

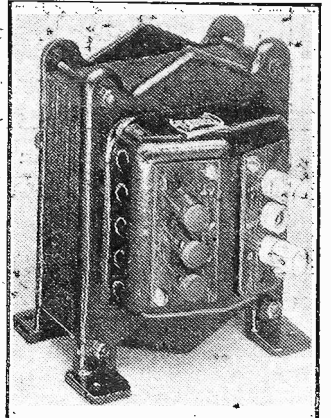
It is therefore important that the output valve in a radio set should be able to handle these extra-loud passages with-

out introducing distortion.

For all normal purposes the usual triode or pentode output valves provide ample "overload capacity" for domestic reception; but those listeners who require super-excellent quality, combined, perhaps, with rather more volume than that given by the average set, can use in the output stage of an A.C. mains receiver or radiogram one of the larger valves giving maximum undistorted outputs of 5 watts and upwards. These valves, it should be noted, require anode voltages ranging from 400 to 500 volts.

A popular valve of this type was the Mullard D.O.25, which has been a firm favourite with advanced amateurs. This valve, however, requires a low-tension supply at 6 volts, which might be inconvenient in

(Continued on page 893.)



Robust construction is a feature of this Heayberd mains transformer. It is designed for the Westinghouse H.T.12 rectifier, and has an L.T. winding.



# SUPREME

## AMONG TABLE RADIO SETS

### BECAUSE

- IT IS A SUPERHET SEVEN
- IT HAS CONCERT TONE & VOLUME
- IT HAS DELAYED AUTOMATIC VOLUME CONTROL
- IT HAS A SPECIAL STATIC SUPPRESSOR
- IT HAS ADJACENT CHANNEL SELECTIVITY

and

### BECAUSE

- IT IS BUILT BY

Q The Superhet Concert Seven combines the very latest improvements in radio science, such as delayed automatic volume control (which eliminates fading of long-distance programmes), static suppressor (which prevents the amplification of any signal in the "mush"), and real adjacent channel selectivity. It provides not only a range of stations to satisfy the inveterate station hunter, but also a tone to please the most sensitive musical ear.

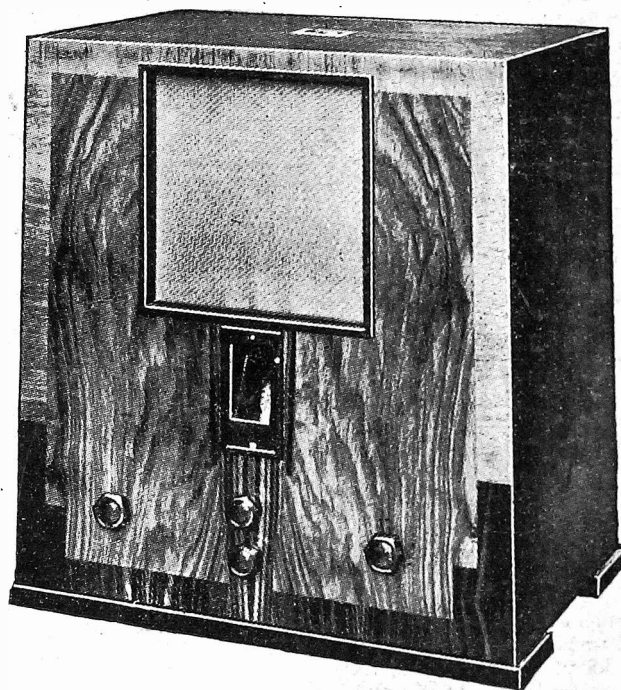
Q To prove its supremacy needs but a fractional turn of the tuning knob—to prove its supremacy as a musical instrument, *just listen!* Here is the realism of the Concert Hall itself—a tone that is true to life! The technically minded will find further details to interest them in the brief specification below.

Q But besides being good to hear, the set is also remarkably good to look at. Altogether, an instrument you will be pleased to listen to, pleased to look at, and, since it is made by "His Masters' Voice," proud to own. Price 22 Gns. (or by Hire Purchase).

#### BRIEF SPECIFICATION: Superhet Concert Seven

##### Model 467

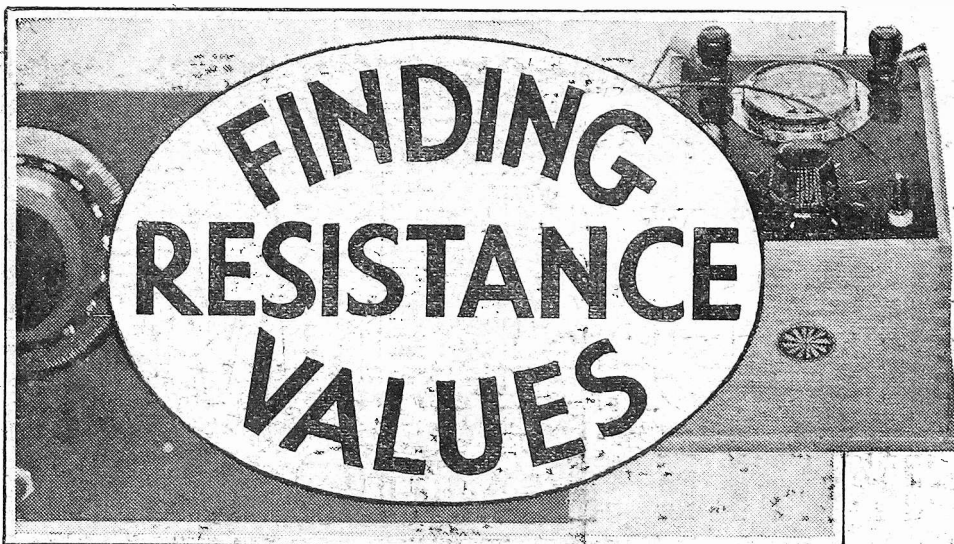
Seven - valve (inc. rectifier) superheterodyne circuit  
Marconi valves.  
Automatic Volume Control. Illuminated Scale with wavelengths and station names. Duplex tone control. Moving coil, mains-excited loud-speaker. Sockets for gramophone pick-up. Power to operate three additional loud-speakers.  
Height - 1 ft. 7 $\frac{1}{4}$  ins.  
Width - 1 ft. 5 $\frac{1}{2}$  ins.  
Depth - 11 $\frac{1}{8}$  ins.



# "HIS MASTER'S VOICE"

## TRUE - TO - LIFE RADIO & RADIO - GRAMOPHONES





There is no longer any need to feel discouraged when you are faced with the problem of working out the effective values of resistances in parallel. The simple graphical method described by our contributor, S. R. Raffan, B.Sc., does away with troublesome calculations and enables the correct answer to be obtained in a moment.

MOST constructors at some time or the other have found themselves stumped for an odd value of a resistance, and have resorted to the use of two or more in series or parallel. With resistances in series it is quite straightforward to work out their effective value, for in this case it is only necessary to add the separate resistances together and the answer is the value we require. Supposing, for example, that a resistance of 1,000 ohms is in series with one of 200 ohms, then the value of the total resistance will be 1,200 ohms.

#### Working Backwards.

It does not always happen, however, that the exact sizes needed are ready to hand, and in such cases expense can often be saved by using the parallel arrangement. In this case, it is not so easy to work out the effective value, for if two resistances having values  $r_1$  and  $r_2$  ohms are in parallel, then if they are equivalent to a resistance of  $R$  ohms, we have to solve the equation

$$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2}$$

To see how this works out in practice, take the 1,000 ohms and the 200 ohms resistances again, but this time consider them in parallel. If their value is  $R$  ohms, then

$$\frac{1}{R} = \frac{1}{1,000} + \frac{1}{200} = \frac{6}{1,000}; R = \frac{1,000}{6} = 167 \text{ ohms.}$$

This is quite easy; but if we try working backwards to find out two resistances which in parallel will give some particular value we need, then the problem is more complicated, and it will usually be necessary to make several attempts before the right value is arrived at.

#### Dispensing with Calculations.

A much simpler way to solve a problem of this sort is to use as weapons a piece of squared graph paper and a ruler, without the need of calculation of any sort. Moreover, there is no necessity for any particular chart to be drawn out on the paper.

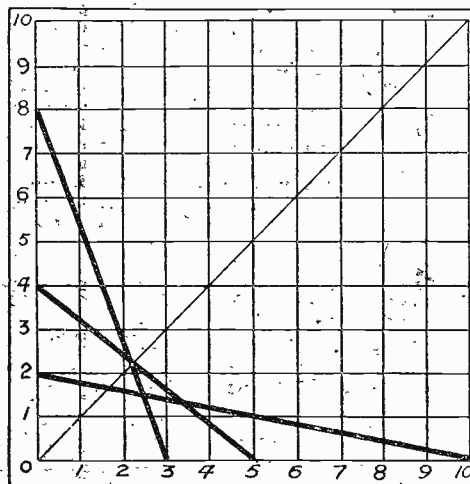
Special ready-reckoners have a habit of being missing when they are most wanted, but you can usually manage to find a piece of squared paper or, at the worst, you can draw out a few squares yourself in a minute or two. On the squared paper three lines should be drawn, two at right

angles, and one half-way between them—that is, the 45° line.

These three lines should now be marked off in units. In the figure they are shown marked off from 1 to 10. These units can be taken to represent 1 ohm each or 10 ohms each, or say 10,000 ohms, according to the particular problem in hand. Let us first of all take each square to represent 100 ohms, and see how to find the answer to the problem we have just worked out by calculation.

The problem is to find the value of a 1,000 ohms resistance and a 200 ohms resistance in parallel. On the scale we are

#### PERFECTLY SIMPLE



A piece of squared graph paper and a ruler are all that are required to find the desired resistance value.

taking these will be represented by 10 squares and 2 squares. Lay the ruler across the point 10 on one of the right-angle lines and the point 2 on the other right-angle line.

A line is drawn in on the figure to show this position of the ruler. Now notice the point at which this line cuts the 45° line—the point 1.7. Now we know that 1.7 units represent 170 ohms, which is near enough to the answer we got by calculation, and so this point on the 45° line actually shows the value of the resistances in parallel. What could be simpler?

And now let us tackle a problem that is not so easy to solve by calculation. Assume that a resistance of 2,200 ohms is needed (for an anode-feed resistance, for example) and that resistances of 1,000 ohms, 2,000 ohms and so on, up to 8,000 ohms, are available, and that the resistance of 2,000 ohms is not sufficiently close for our purpose.

What two resistances, when in parallel will give the nearest value to 2,200 ohms? Take each square to represent 1,000 ohms and mark off the point 2.2 on the 45° line. We know that the ruler must pass through this point, so swing it round and notice the different pairs of resistances which will give about this value.

It will not take very long to see that 3 and 8 units or 4 and 5 units are two pairs which give a value very close to the one we require. The values that these represent are, of course, 3,000 with 8,000 or 4,000 with 5,000 ohms. To reassure ourselves that these values are the right ones, let us check the results by calculation. For 3,000 and 8,000,

$$\frac{1}{R} = \frac{1}{3,000} + \frac{1}{8,000} = \frac{11}{24,000};$$

$$R = \frac{24,000}{11} = 2,182 \text{ ohms};$$

while for 4,000 and 5,000,

$$\frac{1}{R} = \frac{1}{4,000} + \frac{1}{5,000} = \frac{9}{20,000};$$

$$R = \frac{20,000}{9} = 2,222 \text{ ohms};$$

both of which are quite close. These two positions are again drawn in on the figure. The accuracy with which the values can be read off will, of course, depend on how finely divided is the squared paper used, and the more divisions there are to each square the better it is. With 10 divisions to the square, for example, the readings would be more accurate than could be obtained with the 2 divisions shown in the figure.

#### "WIRELESS" 500 YEARS AGO.

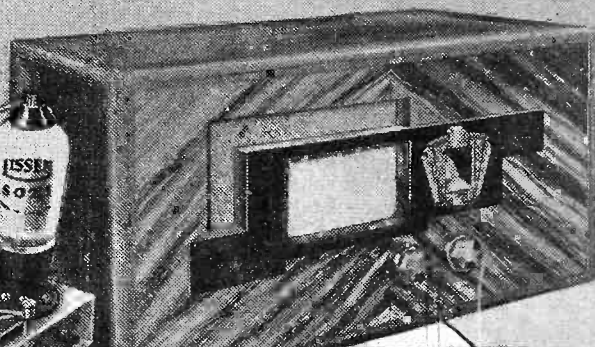
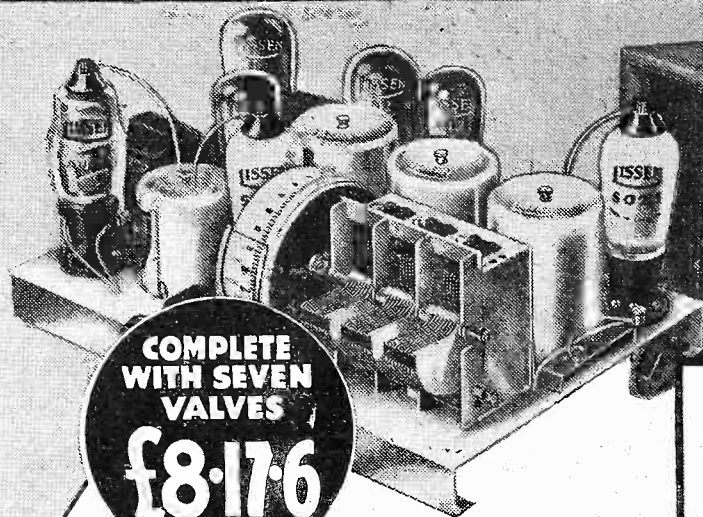
WIRELESS as an idea was suggested over five hundred years ago. Two men were discussing the merits of a piece of mineral substance. One suggested that, with this and the aid of a needle, persons might communicate with each other, although separated by prison walls. Little did these gentlemen know to what vast extent their idea would eventually be developed.

About the year 1880 the Skerries Light house communicated with the mainland by a "wireless" system. Both stations had some sort of aerial erected on telegraph poles. This really consisted of miles of telephone lines which ran parallel to each other. The signals were received by induction.

Then there were some ships which had huge plates fitted to each side of their hulls. Through these, and using the water as a conductor, they transmitted messages to shore stations.

Flag-wagging, semaphore, beacons, drums and even whistling, shouting and yodelling are all "wireless" means of communication, of course. The heliograph can also come under this category by which messages can be read over fifty miles.

**If you want to build the most ambitious kit set ever offered to Home Constructors-HERE IT IS!**



**TWENTY GUINEAS WORTH OF RADIO FOR LESS THAN HALF THAT PRICE!**

**A Seven Valve Superhet-8 Stages in all and a 6 stage Band Pass filter-exact 9Kc tuning channels with Amplified Automatic Control-Class 'B' output driving full power Moving Coil Speaker**

Never before has there been any receiver for Home Constructors on such an ambitious scale as this new Lissen "Skyscraper" Seven-valve Superhet. It embodies every up-to-the-minute advance and refinement of the most luxurious factory-built superhets—it gives the constructor the opportunity to build a £20 receiver for less than half that price. The circuit of the Lissen "Skyscraper" Seven-valve Superhet incorporates a 6-stage bandpass filter, giving exact 9-kilocycle channels and therefore providing a standard of selectivity never before achieved by a home-constructor's kit set and very rarely found except in laboratory apparatus. Amplified Automatic Volume Control is provided, a special valve for this purpose having

been produced by Lissen for use in this receiver. The use of this Amplified Automatic Volume Control constitutes an entirely new experience in listening; no "fading," no "blasting"—you will find yourself enjoying every word of every programme, however near or however distant, without the slightest temptation to interfere with the receiver once you have tuned it. This is radio listening as it should be enjoyed!

Lissen Class-B Output through a new full-power Lissen Moving-coil Loud-speaker—glorious rich tone and majestic volume, actually more faultless in its reproduction than anything you ever heard from even the most powerful mains receiver, yet working economically in this Lissen "Skyscraper" from H.T. batteries.

# LISSEN "SKYSCRAPER" 7

SEVEN · VALVE · SUPERHET

Lissen have published for this great new "Skyscraper" Seven-valve Superhet a most luxurious chart which gives more detailed instructions and more lavish illustrations than have ever before been put into a constructional chart. It makes success certain for everybody who decides to build this set; it shows everybody, even without previous constructional experience, how they can have a luxury receiver and save pounds by building it themselves. A copy of this Chart will be sent FREE in return for coupon on the left, or your radio dealer can supply you. Get your FREE CHART now!

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# The MOTHER of the MICROPHONE

By J. F. STIRLING.

An interesting explanation of how the carbon microphone is arranged. The article also tells you how an experimental model may be made with easily obtainable materials to demonstrate the working of the principle.

AS, no doubt, you will have guessed from the title, these columns have nothing at all to do with the technics of the up-to-date super-sensitive and non-distorting microphones which are employed by the B.B.C. and other broadcasting organisations the world over.

I want to deal solely with the old *carbon microphone*, the microphone which was in use when broadcasting began: the microphone which you and I make use of from time to time during the course of our various experimental endeavours in radio and electrical work.

## It is Really a Relay.

The carbon microphone, like any other type of microphone, is really a relay which is operated by the voice. That is to say, it is a device which passes varying amounts of current through an electrical circuit, the flow of current being very minutely controlled by the voice, or by whatever type of sound waves are allowed to fall on to the instrument.

However, what I want to draw your attention to is the fact that the true nature of the microphone's action is still more or less a mystery.

Any—or almost any—loose contact can be made to acquire microphonic properties. But by far the best microphonic material is carbon, and it was with this material that Professor Hughes, the originator of the microphone, conducted his new classical pioneer experiments in the seventies of the last century.

## Making One at Home.

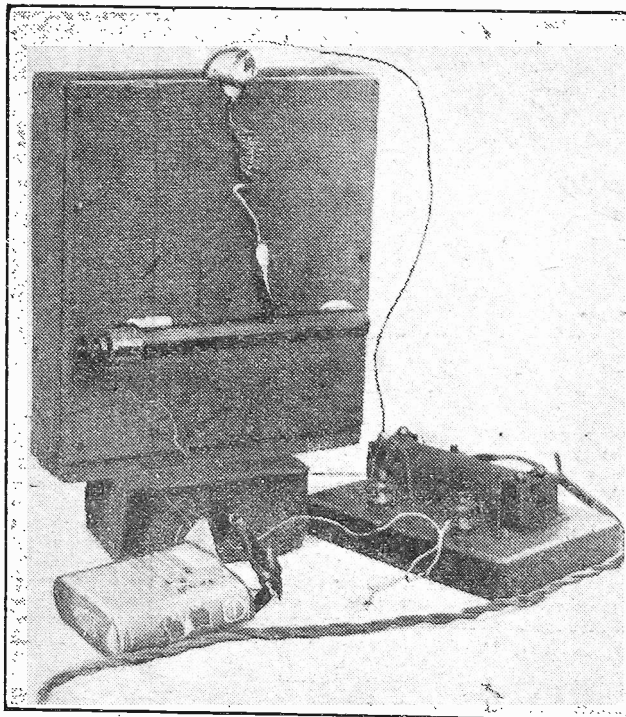
You can readily make one of Hughes' simple microphones for yourself. The photo depicts the arrangement. A battery carbon is fixed by means of wax, or some other adhesive material, to a hollow box which rests upon a piece of spongy rubber. A small carbon rod makes very light contact with the fixed rod, the degree of contact being adjusted, so far as possible, by means of the little coil of wire above it.

The two carbon rods are connected in series with a flashlamp battery and with the primary winding of a telephone transformer. (The transformer is not *absolutely* necessary, but much better results are obtained with it.) A pair of headphones are connected to the secondary of the transformer, thus completing the transmitting-receiving circuit.

It will take some patience to get the right adjustment of the smaller carbon rod, but once you have obtained this the improvised instrument will function as

well as any post-office telephone transmitter. Speak to it, sing to it, play a musical instrument in front of it. The sounds will all be transmitted to the distant receiver.

## RECREATING AN HISTORICAL INVENTION



A working version of the original Hughes' carbon microphone, constructed from materials possessed by every radio amateur, is shown in the centre picture.

Below is a portrait of the great American inventor, Thomas A. Edison, who utilised the carbon microphone principle in his strikingly successful early telephones.

Naturally, this type of microphone is of no practical value, for the slightest disturbance will send it out of adjustment. Hence it is that the various carbon microphones which are so well known to experimenters at the present day have been evolved from this original type of microphone. In all cases the working principle is the same—that of the variation of contact resistance between carbon rods, grains or granules.

## A Remarkable Effect.

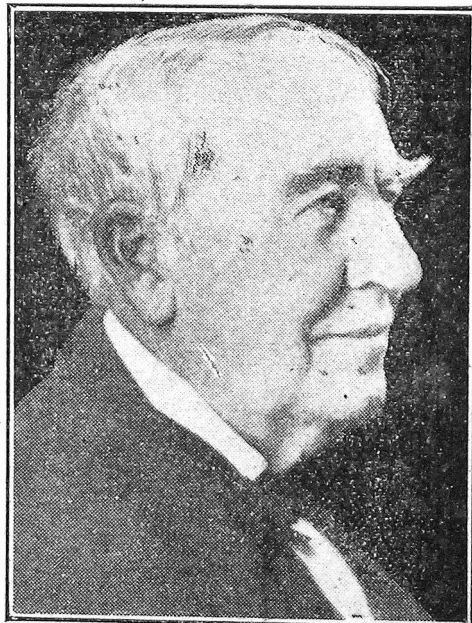
Now, why does carbon alter its electrical resistance so extraordinarily under the influence of very small variations of pressure? It is really a question which has never been satisfactorily answered. Indeed, if this remarkable effect were thoroughly understood it might be possible to develop a material many times more sensitive than carbon, a microphonic material which, by detecting sound impulses totally inaudible to our unaided ears, would enable a real "ultra-microphone" to be constructed.

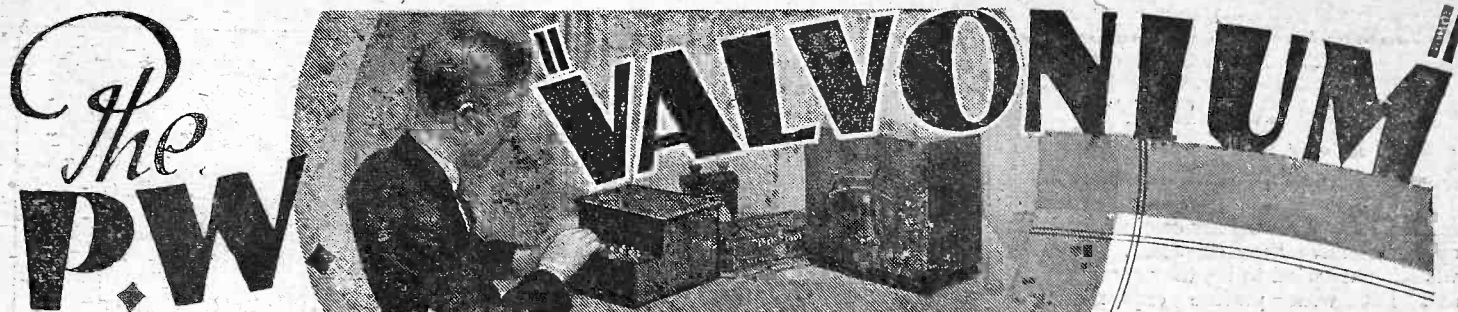
It is very strange that a solid mass of material should alter its electrical resistance under the influence of sound-wave pressure. Probably, indeed, the microphonic effect is not due to any peculiarity existing in the carbon atoms or molecules. Rather we may look for the explanation of the microphonic effect in the minute films of air which intervene between the contacting surfaces of the carbon-microphone.

## Formation of Small Arcs.

It has been supposed, in explanation of the carbon microphone's action, that small electrical arcs (not luminous ones, even in the dark) are formed between the majority of the carbon grains in a microphone, and that the effect of the impinging sound vibrations is to alter the length of these minute arcs and, consequently, to vary their resistance. Hence, in these circumstances, the resistance of the system of minute, non-luminous carbon arcs will vary as a whole in fairly accurate sympathy with the frequencies of the sound waves.

This being the case, it will follow that all conducting materials are microphonic; and this is correct, although of all known materials carbon is the only one which possesses microphonic properties capable of practical use. Of all the elements carbon is, in many aspects, one of the most mysterious, and the microphone magic which it has carried out since the time of Hughes, the discoverer of its microphonic properties, in no way lessens its reputation in this respect.





## ABSOLUTELY NOVEL

**N**EARLY everyone has the urge to "make a tune." In some cases it may be only a tiny urge, and it might even be stifled under a load of bitter annoyance and resentment because so many others "make tunes" of a disagreeable kind.

But the urge is there, and is nearly always given its expression in the bathroom. Why is it that bathrooms have this effect? I suppose it is because, being comparatively small and nicely resonant, they bring out one's voice or whistle to the best effect (at least, as judged by one's own ears!).

There would be millions more pianos and violins and saxophones played in the house if (1) they were not so expensive to buy and (2) they didn't take such a darn long time and so much practice to play.

### The Ambitions of a Beethoven.

No, it's not the radio that's killing home-made music. It may have killed the domestic Sunday-evening concert, and good riddance to that, I say. But not many of us have enough money or time these days to equip ourselves with "baby grands" and the skill with which to play them.

If there is a piano in the house already there will be plenty of people to tap it with one finger in the hope of being able to wring a tune out of it (when they think there is nobody else about to hear!).

But if one-finger execution were recognised as a proper and dignified method of playing, that wretched piano would be hammered at night and day by all who could get near it. Unhappily it isn't. And in any case it is not a fully satisfying technique.

Now, I myself have got the ambitions of a Beethoven, although my skill at the keyboard and powers of composition are less than the dust on his most carelessly disposed manuscripts. Further, I've had the pleasure of studying the reactions of a relation who has developed as something of a one-finger expert.

So I can sympathise with all whose music-making desires are frustrated by lack of opportunity and skill, and it was inevitable that I should turn to wireless to see if something could be done about it.

### Anyone Can Play It.

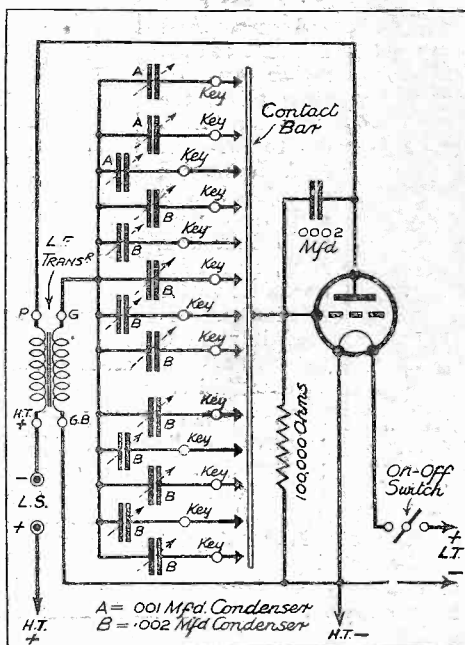
And after considerable thought and experiment I discovered a complete solution to the problem. You now have it before you in the form of the P.W. "Valvonium," an instrument that costs very little, which anyone can play at once after hardly any practice and which, moreover, has no overshadowing, highly-developed technique

By G. V. DOWDING, Associate,  
I.E.E.

Here is something for the constructor which is entirely unique. Employing one valve and a few ordinary wireless components, it is a complete musical instrument of immense potentialities. Read our Technical Editor's description of this remarkable and fascinating device.

to humiliate those who haven't devoted a lifetime to its mastery.

Nevertheless, it is not an electronic version of a one-string fiddle or a "musical saw." I'd never inflict that on the "P.B.P."



## CONDENSERS THAT STRIKE A NEW NOTE!

The principle on which the "Valvonium" works is that of the oscillating valve, and the note emitted depends upon the capacity in circuit. The amount of this capacity is controlled by the operating keys, and when the condensers have been adjusted by anyone, a range of notes are available at the keyboard. The instrument is thus a kind of electrical organ, from which extremely pleasing tunes can be obtained.

## "P.W." AGAIN FIRST

Of all the torturing sounds manufactured by man I give the palm, biscuit and medal to those mournful devices.

There is no other way to play them easily except to go wailing from note to note like a tuned ghost.

No, the "Valvonium" has got keys which you tap just like you tap the keys of a piano. In fact, you "strike a note" with a clean, healthy snap, although you can rest on any one note as long as you like.

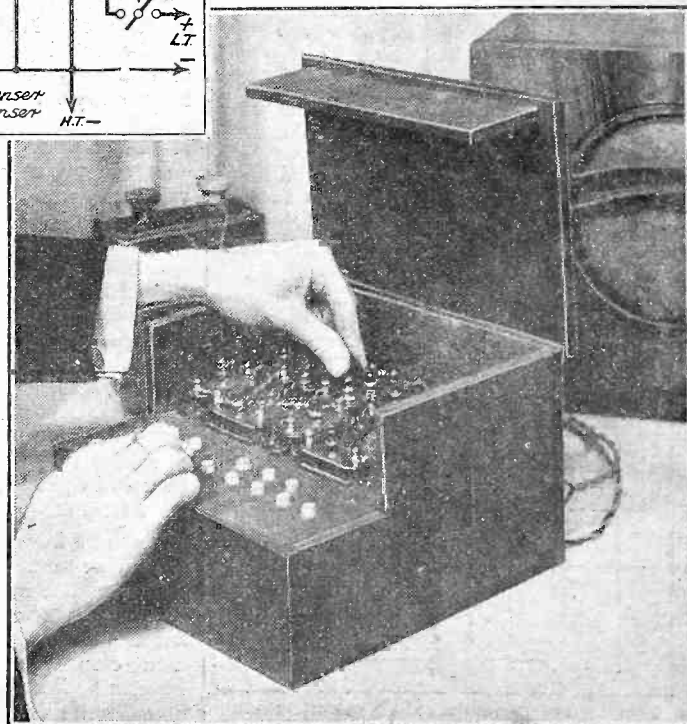
The tone is not a thin, clear, piping tone without "body." There is plenty of colourative individuality, rather like the flute stop of a cinema organ.

### An Instrument to be Proud Of.

And I assure you that you get much more "change from it" than you do from single-note piano-playing. Also, of course, you can vary the volume within extremely wide limits, so that you "swell" from a whispering murmur to a stentorian roar, and there's great satisfaction in that.

Indeed, when, next week, I describe the manipulation of this apparently so-simple instrument you will appreciate that, although only one finger is required to play it, you need not be apologetic to your friends on that account. The "Valvonium" compensates entirely for that deficiency.

(Continued on next page.)





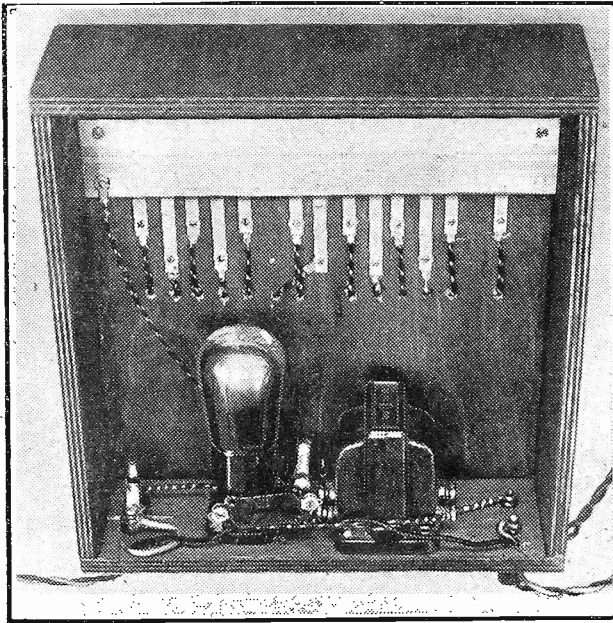
## THE "P.W." "VALVONIUM."

(Continued from previous page.)

All who have heard my original model in operation have been surprised. Knowing what it purported to be, they came to scoff and left with profuse expressions of admiration.

As you will see from the theoretical diagram, the circuit is remarkably simple. Just one valve which is made to oscillate at low frequencies. (The colouration is supplied by harmonics due both to circuitual circumstances and to the reproducer—of which more next week.)

### UNDERNEATH THE KEYBOARD

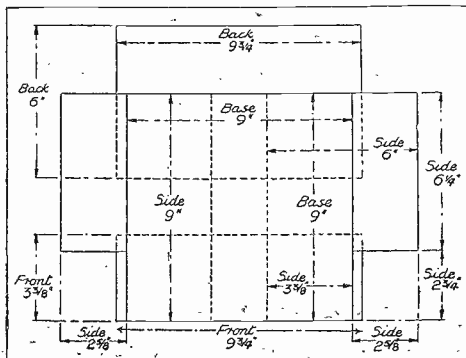


The few components that are needed, in addition to the preset condensers, are arranged in the bottom of the cabinet, as shown.

The pitch of the L.F. oscillation is varied by switching in different capacities. These capacities are supplied by preset condensers, and it should be mentioned that tuning is extremely easy.

There isn't a sustained note that laboriously switches up and down the scale. All is silence until you tap a key, and then the particular note is emitted for just as long as the key is kept down, for it is only then that the circuit is completed, as you can see.

### EASY TO MAKE



Here are the dimensions for the cabinet, which, as can be seen, presents no constructional difficulties whatever.

The note can be as sharp as a piano note with good damping or as sustained as an organ note.

### About the Components.

But be careful with those preset condensers. Don't think any old make will serve. The "Valvonium" cannot fail to work if you build it as directed; but if those presets aren't up to scratch you'll not find it possible to tune to the right notes. A batch of one make I had were nearly all 50 per cent out in regard to their capacities!

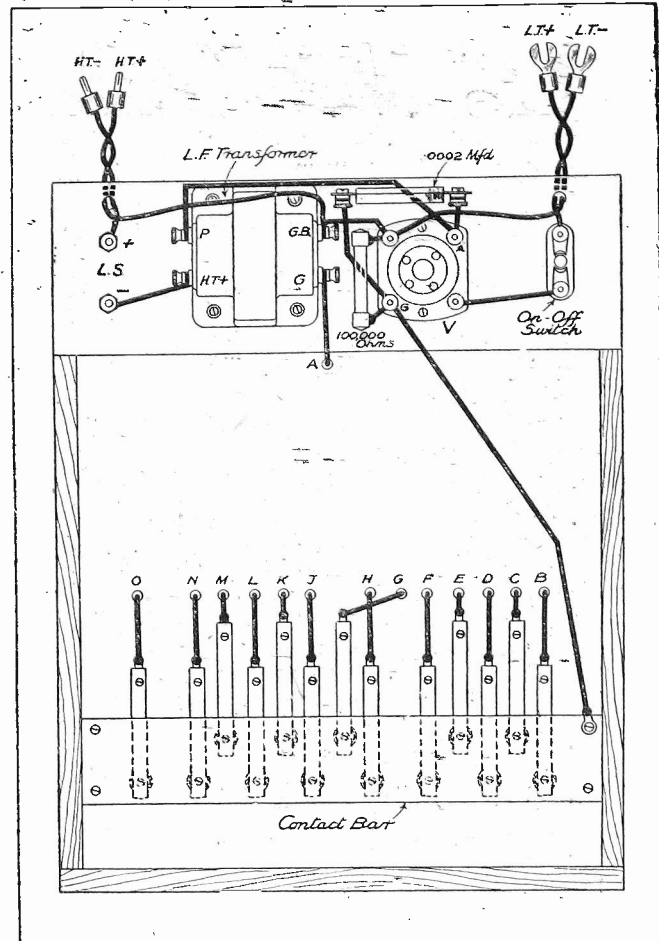
As for the L.F. transformer, you can try any make. It is not by any means a critical component.

Valve holder, grid leak and condenser and a switch complete the shopping list, except for odds and ends. And I will insert, rather out of their place, the facts that from 60- to 100-volts H.T. is needed and a 2-volt L.T., and that your radio L.T. and H.T., and even one of its valves and its loudspeaker, can all be used if you don't feel inclined to invest in an all-in "Valvonium" kit.

The whole of the body of the "Valvonium" is made of  $\frac{3}{4}$  in. plywood. And it is easy to make, too. Elementary carpentry, in fact. All the measurements are clearly shown in the diagrams.

The making of this body or frame and its lid and the placing of the components are all so well illustrated that I need not waste space in describing them in words. You can supply the lid with small hinges if you like, though, as it is not likely you'll ever have to retune, it can be held in place with screws.

The little keys should be made from  $\frac{3}{4}$ -in. dowel rod in either beech or birch. You can buy exactly this size all ready for use for a few pence



The wiring is particularly simple, those connections which pass through the holes in the keyboard going to the various preset condensers. These leads can be easily identified by the lettering, which corresponds with that on the diagram on page 879.

Each key is  $\frac{5}{8}$  in. long. The holes for them are  $\frac{7}{16}$  in. These are spaced by exactly 1 in., and the line of the back row is  $\frac{3}{4}$  in. behind the line of the front row.

You will note that a blank is left between the second and third ones. You need not make a hole there if you don't want to alter the scale from "C" to "F." I'll discuss that point next week.

(Continued on page 879.)

### EVERYTHING THAT YOU WILL NEED

Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.
1 L.F. transformer	Telsen "Ace"	Varley, Lissen, R.I.
1 4-pin valve holder	Benjamin "Vibro-der"	W.B., Telsen, Ferranti, Lissen, Benjamin
1 .0002-mfd. fixed condenser	Dubilier 673	Graham Farish.
1 100,000-ohm resistance with terminals or wire ends	Dubilier	—
10 .002-mfd. max. preset condensers	Polar	—
3 .001-mfd. max. preset condensers	Polar	—
1 two-point on/off switch	Lissen	Telsen, Bulgin, W.B., Goltone
10 ft. connecting wire	Radiophone "pull-back"	—
9" hardwood dowel rod, $\frac{3}{4}$ -in. diameter	(See text)	—
3 ft. phosphor bronze $\frac{1}{16}$ -in. strip, .012-in. thick	(See text)	—
1 9-in. length strip brass, $\frac{1}{16}$ in. by $\frac{1}{8}$ in. thick	(See text)	—
Cabinet	(See text)	—
Screws, flex, etc.	Peto-Scott	—
OSCILLATING VALVE.—Cossor 220P.A., Mullard P.M.2A, Mazda P.223, Marconi L.P.2, Osram L.P.2, Eta B.X.604, Hivac P.220.		
BATTERIES.—H.T. 99 or 108 volts: Pertrix, Ever Ready, Lissen, Drydex, Ediswan, Marconiphone, Siemens, etc. L.T. 2 volts: Ediswan, Exide, Oldham, Block, Lissen, Pertrix, etc.		
LOUDSPEAKER.—Atlas, Amphon, W.B., Magnavox, Blue Spot, Celestion, R. & A., Ferranti, Marconiphone, Rola, H.M.V., Epoch, etc.		

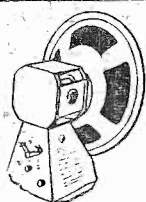
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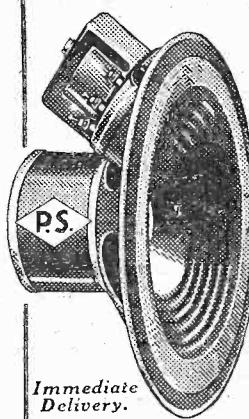
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1 TELSEN "Class B" Output Choke	8	6	
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1 DUBILIER "or-mtd." Fixed Condenser No. 670	2	0	
1 GRAHAM FARISH Ohmite Resistance, 10,000 ohms	1	6	
1 BULGIN Q.M.B. Snap Switch	1	6	
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### PERMANENT MAGNET MOVING-COIL SPEAKER AND AMPLIFIER

Complete with Valve and Input Transformer. Two Models: A for PM2B, PD220, and 220B; B for 240B and HP2 (state which when ordering). Cash or C.O.D. Carriage Paid, **£3/11/6**. Balance in 11 monthly payments of 6/6 only. Send **6/6**

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# TELSEN

## cover every **coil** requirement

At the new reduced prices, the wonderful Telsen range of components represents more than ever radio's finest value. Whatever your coil requirements, be sure and insist on Telsen for lasting efficiency at the lowest cost consistent with quality.

### TELSEN IRON-CORED SCREENED COILS

The result of extensive research, these Coils employ an iron-dust core, achieving greatly reduced size, with considerably higher efficiency than that of the majority of air-cored coils. Magnification and selectivity are correspondingly improved, the metal screening also preventing inter-action. For use either as aerial tuning coils or H.F. transformers, a reaction winding being included. They do not incorporate switching (since incorporated switching has proved to be much less efficient than a well-designed external switch, in addition to increasing the size, and restricting the symmetrical arrangement of controls, and consequently take the fullest advantage of all the benefits that the "Iron-Cored" principle provides.

		Price
No. W.349	Single Coil .. .. .	8/6
No. W.422	Twin Matched Coils .. .. .	17/-
No. W.423	Triple Matched Coils .. .. .	25/6

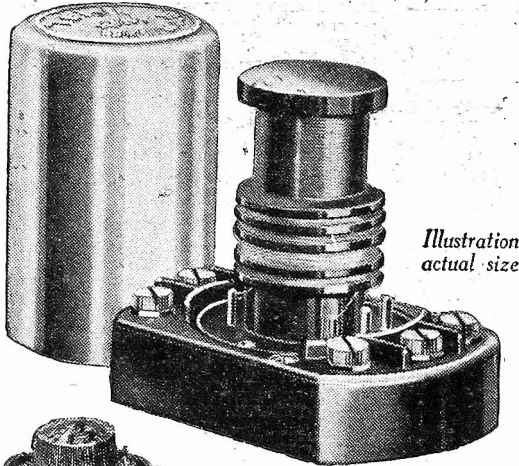
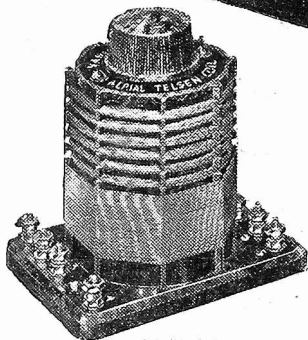


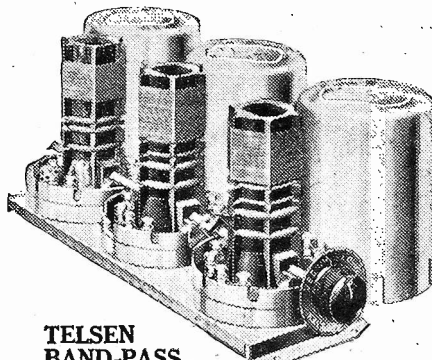
Illustration  
actual size



#### TELSEN DUAL-RANGE AERIAL COIL.

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

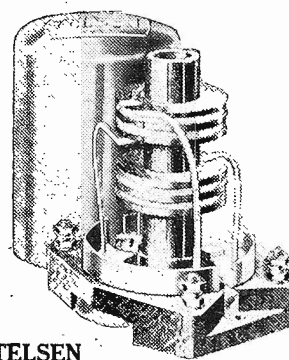
Price .. .. . 5/6



#### TELSEN BAND-PASS AND OSCILLATOR COIL UNIT

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

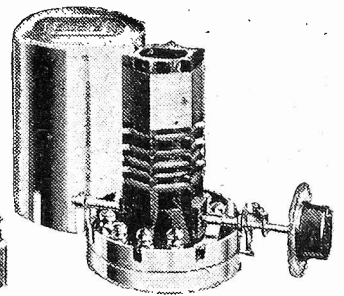
Price .. .. . 21/6



#### TELSEN INTERMEDIATE FREQUENCY TRANSFORMER COIL

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

Price 7/6



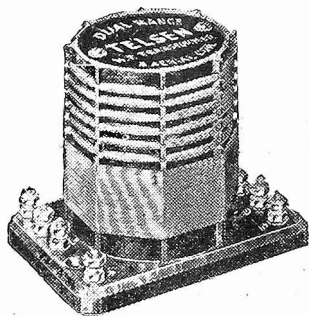
#### TELSEN SCREENED TUNING COILS

With separate coupling coils for medium and long waves. Highly suitable for use as aerial coils or as anode coils following a screened grid valve, giving selectivity equal to that of a well-designed band-pass filter.

Price .. .. . 7/-

Twin Matched .. .. . 14/6

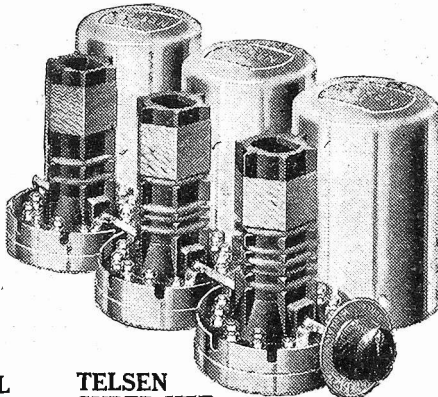
Triple Matched .. .. . 21/6



#### TELSEN H.F. TRANSFORMER COIL

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

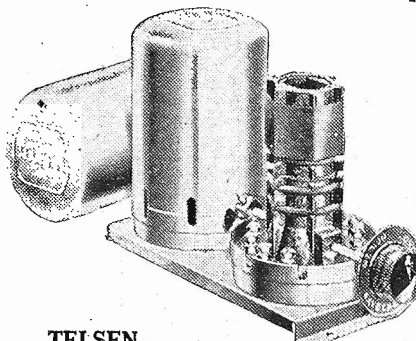
Price 4/6



#### TELSEN SUPER-HET. COILS (TYPE No. S 330)

For Superhets which do not employ band-pass tuning in their pre-detector H.F. stages. Mechanical construction and wave-change switch assembly almost identical with standard Telsen Screened Coils

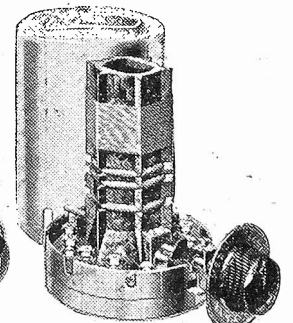
Price 21/6



#### TELSEN BAND-PASS COIL UNIT

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

Price 14/6



#### TELSEN OSCILLATOR COIL

Particularly suited to Superheterodyne circuits in conjunction with the Telsen Band-Pass Coils. Operates at a frequency separation of 110 kilocycles from the Band-Pass tuning range.

Price 7/6

**TELSEN FOR EVERYTHING IN RADIO**  
ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

## THE "P.W." "VALVONIUM"

(Continued from page 876.)

The contact bar comprises a piece of  $\frac{1}{16}$ -in. brass measuring  $1\frac{1}{2}$  in. by 9-in. It is raised 1-in. by means of blocks of wood at each end.

The key-springs can be of spring brass. I used .012-in. thick phosphor bronze. It is harder to work, but it is infinitely better, and I strongly advise you to use it.

### Arrangement of the Key-Springs.

Each spring measures  $2\frac{1}{2}$  by  $\frac{1}{4}$  in., and it is screwed to its key-peg at one end and secured to the baseboard at the other by  $\frac{1}{4}$ -in. No. 2 round-headed brass screws.

The circuit connection is best made with

each key-spring by means of a soldering tag. The key-spring must lie flat against the wood so that the head of the screw which holds the peg well clears the contact bar. The note is played by these two being made to touch.

A little care is needed in fixing these key-springs and pegs, because the latter must ride in their holes easily and without restraint. You should be able to depress them with a light touch, and the moment pressure is removed they should spring back to their normal positions.

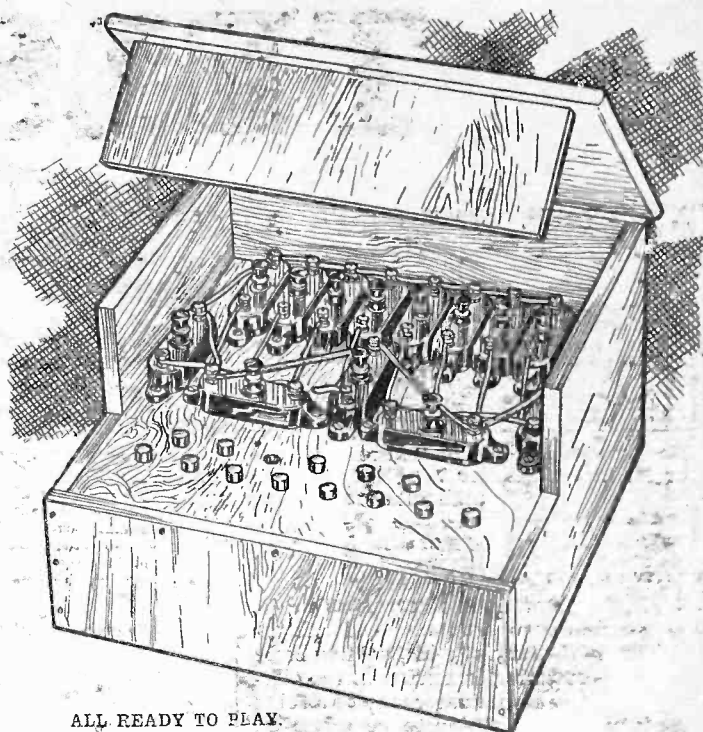
As the front keys correspond with the white notes on the piano and back ones with the black, you can, if you like, enamel them in appropriate tints.

### Simple Wiring.

Well, I don't think there is anything more to say about the construction of the "Valvonium," for the wiring is simplicity itself and is clearly shown in the illustrations.

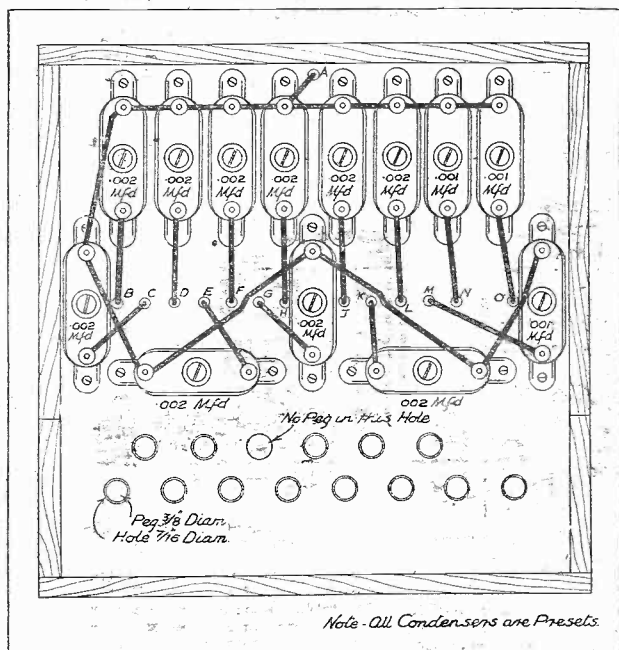
But there is a great deal to be said about the playing of the instrument, and that is what I am eager to get to, for it is full of fascinating possibilities.

However, I fear I shall have to leave that until next week.



ALL READY TO PLAY.

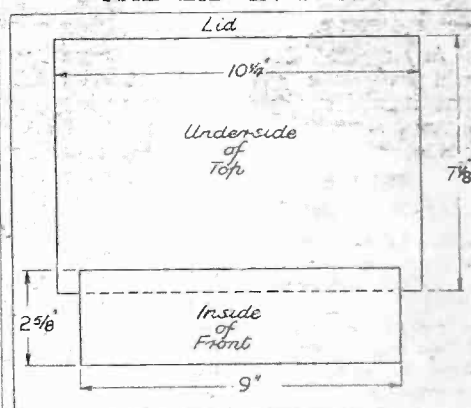
## PRESET CONDENSER CONNECTIONS



How the presets are wired. It will be observed that the lead A is joined to one terminal of each condenser, and also to G on the L.F. transformer (see diagram on page 876).

when I shall explain, among other things, how the note range may be extended.

## THE LID IN PLAN



This diagram gives the dimensions for the lid, which consists simply of two pieces of wood hinged at the back.

## CATHODE-RAY TELEVISION

Notes on an interesting and authoritative book which every experimenter should read.

THE cathode-ray tube is still a comparative newcomer, and its use in radio research and in television is still in its infancy. That being the case, all interested in this marvellous valve are naturally anxious to collate all the information they can on the subject, whether or not they wish to apply the knowledge to cathode-ray oscillographs or to the use of the tube for the reception of television.

So far not very much has been written on the subject, and text books are few, so that the arrival of an official handbook

on the subject, issued by H.M. Stationery Office, will be welcomed by all radio investigators.

The book retails at ten shillings, and contains nearly 300 pages of the most interesting data on research work carried out on, and with the cathode-ray tube.

### Data of Great Value.

Entitled "Applications of the Cathode-Ray Oscillograph in Radio Research," the book is written by R. A. Watson Watt, Superintendent of the Radio Research Station at Slough, and two of the scientific officers there, Messrs. J. F. Herd and L. H. Bainbridge-Bell.

The actual use of the tube for television is not discussed, but a very full selection of chapters on all sorts of applications of the cathode ray for measurement purposes is given, and the data provided is of the greatest value to all radio investigators who are likely to use cathode-ray tubes, whether for measurements or for television.

The question of oscillograph photography is dealt with, together with such advanced applications of the cathode ray as frequency conversion and direction finding. For the television investigator the chapters on the "Study of Variation with Time," "Linear Time-bases," "Locking Time-base Frequency," "Single-Stroke Time-sweeps" and so forth will be of the utmost interest, for they enable a very full practical knowledge of the cathode-ray tube to be obtained.

### Money Well Spent.

I cannot but advise all who are seriously interested in the subject of television, as well as the less picturesque aspects of cathode-ray oscillography, to get hold of this book. It represents money well spent, for the information it gives is excellent and copious. All suspicion of "padding" or frills has been omitted, and the book is chock full of "meat."

K. D. R.





Do you know how to ensure a long and trouble-free life for your L.T. battery or H.T. accumulator? If not, you should make a special point of reading this authoritative and highly interesting article.

By S. H. PARSONAGE.

NOWADAYS even the small boy of the house generally knows that, as a rule, accumulators contain lead plates, which are in the form of grids, holding paste (the active material) immersed in the electrolyte. A new accumulator may be a thing of beauty and something to be proud of, but, in time, its uninitiated owner does, on occasion, come along with remarks such as "Look, the paste is dropping out!" or "I say, these plates are swelling and bending! Why is it?"

#### Consequences of Over-Charging.

Any reputable text-book on the subject will give detailed technical information; but it will suffice to say here that, on charge, electrical energy is converted into potential chemical energy, whilst during discharge the reverse action takes place. It should be noted, therefore, that the action within the cell is purely a chemical one, the cell neither "accumulating" nor "storing" energy in the real sense of the words.

The process of charging by passing a specified current is accompanied by minute bubbles, which are often confused with the convulsions known as "gassing," occurring on full charge of a healthy cell. While the passage of an excessive current shortens the duration of charge, the consequent gassing may be so violent that it not only loosens the paste but the heat developed becomes very appreciable and unevenly distributed, resulting in irregular plate expansion, which, in turn, inevitably causes bending and buckling, with a further tendency to loosen or shed paste.

#### Generating Heat.

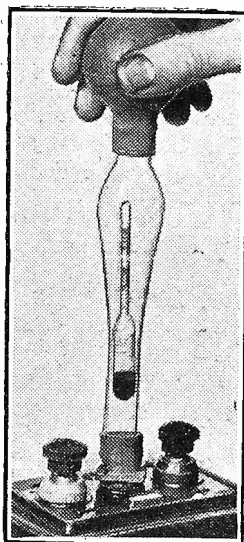
At first it may be wondered why heat is developed, but one does not have to look far for the answer. The action during charge

is such that acid is produced at the plate surfaces.

As is well known, the mixing of acid and water develops heat; and, moreover, this heat will obviously be greater at the centre of the plates than around the edges, owing, of course, to its being more easily dissipated there. Therefore we have the uneven heating resulting in irregular expansion and plate distortion.

Incidentally, it is opportune to note at this juncture that as acid is produced on charge and water on discharge, it illustrates that the density or specific gravity (S.G.) falls as the cell is discharged.

Fig. 1 gives an impression of how the S.G. changes with cell voltage. The hydro-



#### AN ACID TEST

The hydrometer test provides one of the methods of checking up the condition of an accumulator. The specific gravity of the acid shows the state of charge, but unless the cell is new a voltage reading should also be made as an additional check on the condition of the cell.

meter now commonly in use for indicating the S.G. of the electrolyte does, therefore, show fairly accurately, on a new cell at least, when the charge is completed.

In the event of there being particles of paste, etc., in the bottom of the cell, after having been shed from the plates, however, the S.G. is no true criterion, for the "give-and-take" acid action is of necessity incomplete.

With the advent of the multitude of "tinpot" charging stations, the utmost caution should be exercised to ensure that a reliable and capable person of understanding supervises the welfare of one's cells.

It is by no means an exaggeration or even a rarity to come across large cells

connected in series with very small ones, the latter having to withstand the charging current suitable only for the former. Such circumstances obviously spell ruin for the small cell, which is seen to foam and bubble violently as if on the verge of boiling over.

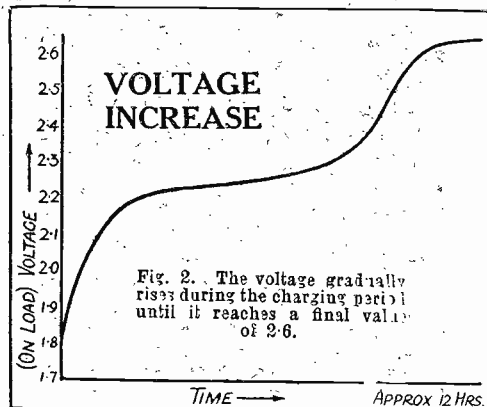
Now for a few thoughts on discharge conditions.

When a cell is normally discharged, lead sulphate (the well-known white substance) is formed on the plates. If, however, a rapid discharge (for example, a dead short circuit) occurs, this sulphation is enormously increased and, if prolonged, takes the form of granite-hard crystals effectually armouring the plates from the electrolyte.

#### Bad Effects of Sulphation.

Now, it will be easily seen that the more of this sulphate there is present the smaller is the active area of the plates. Consequently, a normal charging current does, in effect, constitute an overload for the cell, because, to all intents and purposes, it is decreased in capacity; and, furthermore, for reasons already explained, heat is developed with its disastrous results.

This effect is unfortunately much more pronounced, as, in the normal course of



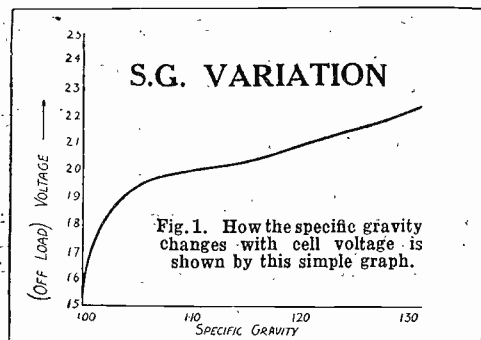
events, the plates always expand slightly when discharged, and, owing to their being supported at the edges, expansion causes the bowl-shaped formation very frequently met with.

Quite often the question is raised as to when the charge is completed. Briefly speaking, it may be said that much depends on the condition of the cell, but the safest guide is to be led by the indications of both voltage and S.G. Fig. 2 depicts the curve of voltage variation during charge, and from which it will be learnt that it would be quite in order to remove the cell after the voltage had remained constant at 2.6 volts for, say, 30 minutes. A good average value of S.G. is 1.25 at full strength; but, as can be seen from Fig. 1, this value is not nearly so critical as is the voltage.

#### Beware of Evaporation.

Finally, the question of evaporation. After a long spell of hot weather the level of the electrolyte must be examined in order to ensure that evaporation has not made the tops of plates stand out of the liquid. Evaporation can be made good with distilled water.

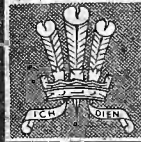
That the accumulator is at times regarded as a bugbear of the radio installation is an established fact; but care and attention do much to alleviate the troubles which otherwise are almost certain to occur.



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ELECTRIC LAMPS  
BY APPOINTMENT



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& SURVEYORS OF  
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# some take chances

...

# others buy



Research goes on all the while in every radio valve laboratory, and every once in a while (but not nearly as often as you might suppose!), there is a real step forward in valve design or construction. But the real all-day and every-day problem of the valve maker is to achieve reliability! It is reliability that has brought Mazda right up to the top in the last three or four years. And it is because of reliability that Mazda will remain there.

# MAZDA

THE  
SAFETY  
VALVE

(T.)



*Mazda Radio Valves are manufactured in Gr. Britain for The British Thomson-Houston Co. Ltd., London & Rugby*

THE EDISON SWAN ELECTRIC CO. LTD., 155, CHARING CROSS ROAD, W.C.2.



# BEHIND THE SCENES AT DAVENTRY

Short-wave listeners should read this authoritative article on the experiences gained with the Empire broadcasters.  
BY OUR SPECIAL CORRESPONDENT.

THE Daventry short-wavers have been broadcasting long enough now to give some vital facts about short-wave work.

First let me tell you how the two transmitters are made up.

With the exception of the master oscillators and their associated equipment, each of the two transmitters is contained in four separate cubicles.

The framework of the cubicles is constructed of duralumin. The backs and sides consist of removable metal panels or doors, and as a safety precaution these are so interlocked with the power-supply switch gear that the cubicles cannot be opened without switching off all

This apparatus is housed in a small unit which stands alongside the first cubicle.

With the crystal method of control the crystal itself has to be ground to such a size that it will oscillate at the required frequency or a submultiple of it.

With a disc-shaped crystal (which is the form used at Daventry) the higher the frequency required the thinner will be the crystal. It is impracticable to grind crystals to such a size that they will oscillate at the very high frequencies (short wavelengths) employed by the transmitters, and for this reason crystals with much lower natural frequencies are employed, and the required frequency is obtained by means of a series of frequency-doubling stages.

Actually on wavelengths below 17 metres the crystal frequency is doubled three times, thus giving an overall multiplication of eight times, so that the crystal used for any particular wavelength oscillates at one eighth of the transmission frequency. On wavelengths above 17 metres one or two doubling stages are used.

## Constant Temperature.

As the frequency produced by a crystal is governed by its physical dimensions, it is essential to avoid expansion or contraction due to changes in temperature, and for this

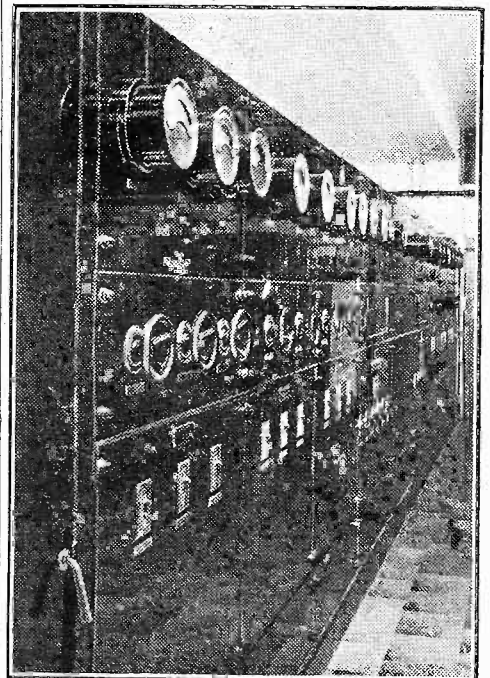
reason each crystal is housed in an asbestos insulated box, the interior of which is kept at a set temperature by means of an electric heater controlled by a thermostat. By this means the temperature inside the crystal box is kept constant within a fraction of a degree.

All of the crystals are mounted in their boxes next to their associated circuits, and any particular crystal can be connected to the transmitter by means of switches. The master oscillator unit provides a very flexible form of

drive unit, which can easily be made to provide high-frequency energy on a number of prearranged wavelengths.

The output of the oscillator unit is connected to the input of the first transmitter unit which contains the frequency-doubling stages already mentioned, the

## CONTROLLING DAVENTRY'S POWER

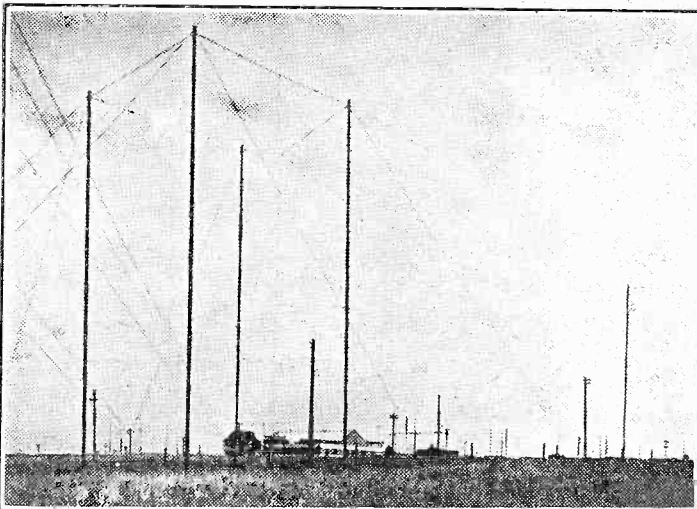


Control of the power to the transmitters at Daventry is effected at this giant switchboard.

modulating stage and the first modulated amplifier. It should be explained that what is known as the low-power system of

(Continued on page 884.)

## DIRECTED ON WEST AFRICA



A distant view of the Empire station building through the masts of the West African aerial array.

dangerous voltages. The front panels of the cubicles are of polished black slate, and on them are mounted the various adjustment controls and meters.

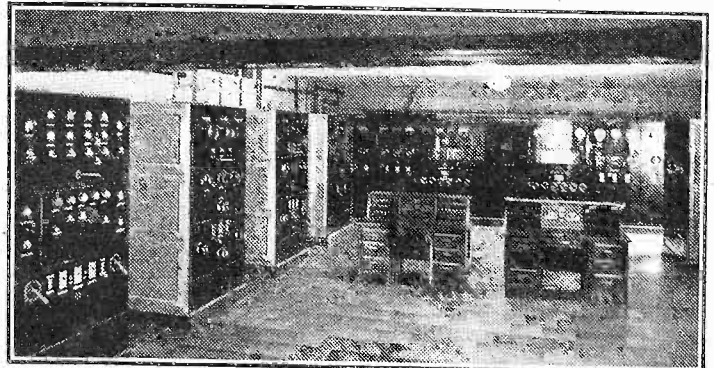
The panels are screened from the transmitter components in the cubicles by duralumin screens fixed to the back of each panel.

This is in order to prevent dielectric losses in the slate panels and to localise the strong electric fields produced by the transmitter components.

## Quartz Crystal Control.

In Empire broadcasting you must stick right on the wavelength. To obtain the necessary high degree of accuracy the frequency of each master oscillator valve is controlled by a quartz crystal, a separate crystal being employed for each wavelength.

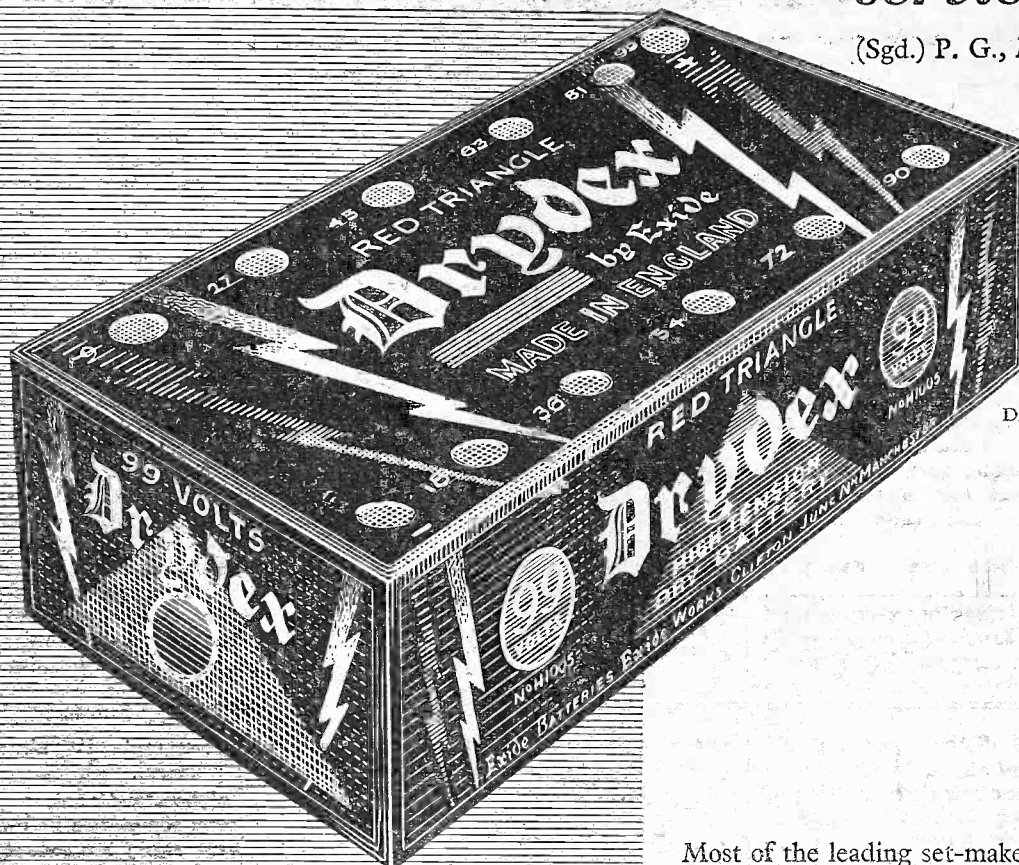
## TRANSMITTERS ON PARADE



The imposing array of amplifiers and oscillators in the Transmitter Hall at the Empire Station.

*"This battery has given me wonderful service"*

(Sgd.) P. G., Monkseaton



Dx 104

Most of the leading set-makers fit Exide Batteries for L.T. or Drydex Batteries for H.T. • Obtainable from Exide Service Stations and all reputable dealers.

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## BEHIND THE SCENES AT DAVENTRY

(Continued from page 882.)

modulation is employed. The output of this first transmitter unit is, therefore, a completely modulated carrier wave suitable for transmission, but of insufficient power. Amplification is carried out in the second and third transmitter cubicles, of which each contains a stage of push-pull high-frequency amplification, the first amplifier employing two 2-kilowatt water-cooled valves and the second two 10-kilowatt water-cooled valves.

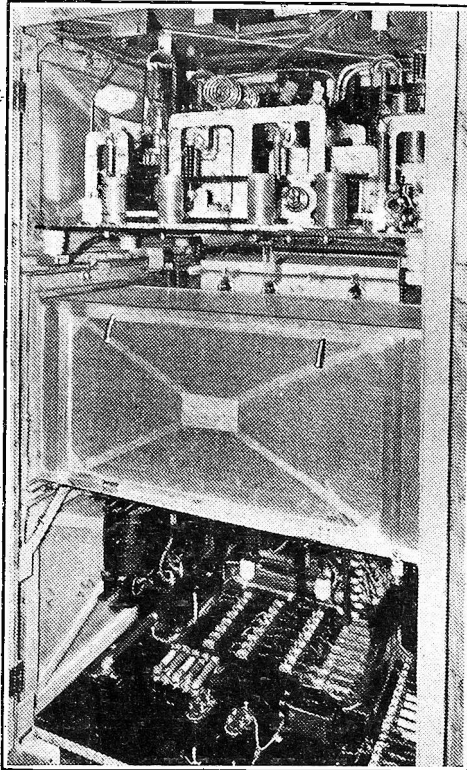
### Stabilising Precautions.

The fourth cubicle of the transmitter contains the final amplifier or output stage, which consists of four 15-kilowatt water-cooled valves connected in push-pull, the output circuits of which are coupled to the aerial feeder. The circuits of the last three "stages" (the intermediate amplifier, first-power amplifier and main-power amplifier) are of the balanced-bridge type, which is now almost standard in high-power transmitters. Needless to say, the circuits are more complicated in detail than those used in transmitters working on relatively long wavelengths, because special precautions have to be taken to stabilise the circuits and to lay out the components in such a manner that spurious inductances and capacities are either made use of or eliminated entirely. *The necessity for avoiding stray capacities and inductances and for keeping the circuits quite symmetrical cuts out the possibility of using*

*spare valves in situ, as in the B.B.C.'s regional transmitters.*

Wave-changing requirements mentioned earlier also necessitated very careful design in order that the balance of the various circuits may be maintained. The design of

### BACK-OF-PANEL VIEW



An unusual view of a modulator-amplifier unit, showing the intricate assembly of apparatus behind the panel.

the tuning circuits is such that the values of inductances can be changed very quickly, in some cases by altering tappings, and where large changes are required by changing the coils. In every case identical changes must, of course, be made on both sides of each balanced circuit.

The outgoing feeders from the power stage in each transmitter are connected to an aerial-changing panel mounted above each transmitter. On each panel is mounted a form of selector switch gear of special design, by means of which either of the transmitters can be connected to any one of the number of aerial systems which will be described later.

### Fully Modulated Carriers.

Low-power modulation has several advantages as compared with the old system of high-power modulation. What is more important from the listeners' point of view, however, is the maximum depth of modulation of which the transmitter is capable, as what may be termed the "receptability" of the transmission depends not only upon the power of the carrier wave which is radiated, but also upon the percentage to which the carrier wave is modulated. If a weakly modulated carrier wave is radiated from a station it may be quite impracticable to obtain a useful volume of reproduction with given apparatus, even though the carrier wave is easily receivable.

*It is essential, therefore, if the maximum service is to be obtained from a broadcasting transmitter that it should radiate a carrier wave modulated as nearly as is practicable to the full extent.*

During the course of a programme the sound intensity in the studio, and therefore the output of the microphone, varies within

(Continued on page 895.)

ATMOSPHERIC disturbances are still fairly prevalent about this time of the year, since the electrified condition of the cloud particles producing these disturbances is brought about by evaporation and condensation. Hence, a long spell of hot weather when the process has been rapid usually heralds exceptionally bad reception conditions.

Quite a number of readers still have some difficulty in understanding just why atmospherics should be so troublesome: why, with all the special ultra-selective tuning devices which we now have, it is still impossible to eliminate the irritating frying-pan noises that impinge on the top of broadcast programmes.

### No Particular Frequency.

Unfortunately, electro-magnetic waves which arise from electrical upheavals of the atmosphere have no particular frequency like the carefully adjusted radiations of an ordinary transmitter. They start off with a bang, as it were, dispersing immense energy into the ether in a fraction of a second, like a much-magnified edition of the old, untuned spark transmitter of pre-historic wireless days.

In the same manner, all the aerials in the neighbourhood are set into oscillation by shock excitation at the particular frequency to which they happen to be tuned. Of course, the area over which an atmospheric disturbance can make itself felt is much greater than that of the comparatively feeble spark transmitter.

## WHAT CAUSES ATMOSPHERICS?

*The summer's good weather brought the usual crop of atmospherics to worry the wireless listener, and this interesting article explains their origin and causes.*

Various ingenious schemes have been conceived, ever since the inception of wireless, to overcome the bugbear of atmospherics. But usually the success has been of little practical value. One or two simple methods may be employed to reduce interference.

For example, the use of a small aerial or a buried aerial is sometimes advocated. But in practice these merely reduce the overall sensitivity and cut down the strength of the desired transmitting station as well as the undesired interference. Something of the same effect may be attained by connecting a fairly high resistance between aerial and earth terminals of the set.

### Not Designed for Frames.

In certain cases it actually has been possible to reduce atmospherics, if they were local, in a greater ratio than signal strength, by a suitable buried aerial, but in a very wet or a very dry soil the

experiment is almost invariably unsuccessful.

The directional property of a frame aerial may sometimes be used to advantage, but here again the extent to which it may be used is limited, since the majority of receivers are not suitably designed for frame working.

It is simply no good expecting to get the same results in summer as in winter months from distant stations, or grouching because a new set doesn't come up to expectation, for, apart from the higher level of interference, the average of signal strength of any particular station reaching one's aerial during the hours of listening is bound to be less, since these are principally in daylight at this period.

### Inconsequence of Nature.

The absorption of the wave is notoriously greater in daylight than at night, and since the absorption arises indirectly from the sun's ray, it is particularly noticeable during summer. Moreover, the higher level of static interference discounts the practicality of extra amplification in the receiver, for if the station level is increased the interference level is increased with it.

It seems that at present, at any rate, we must resign ourselves to this particular inconsequence of nature. But it is, perhaps, some consolation to remember that if you yourself can't get Timbuctoo on the speaker because of atmospherics, the fellow next door can't, either!

H. C.

# of GREAT strength

## BUT LITTLE SIZE

OSRAM "CATKIN" VALVES are essential for modern receiver practice. Immensely strong yet compact in design they are constructed to microscopically precise limits and therefore allow for greatly improved set performance. A set equipped with OSRAM "CATKIN" VALVES gives the highest quality reception.

The all-metal construction of OSRAM "CATKIN" VALVES is a radical departure and results prove beyond dispute that they definitely give more uniform results, complete freedom from microphonicity and more effective screening. A change to OSRAM "CATKIN" VALVES is a change to faultless radio reception.

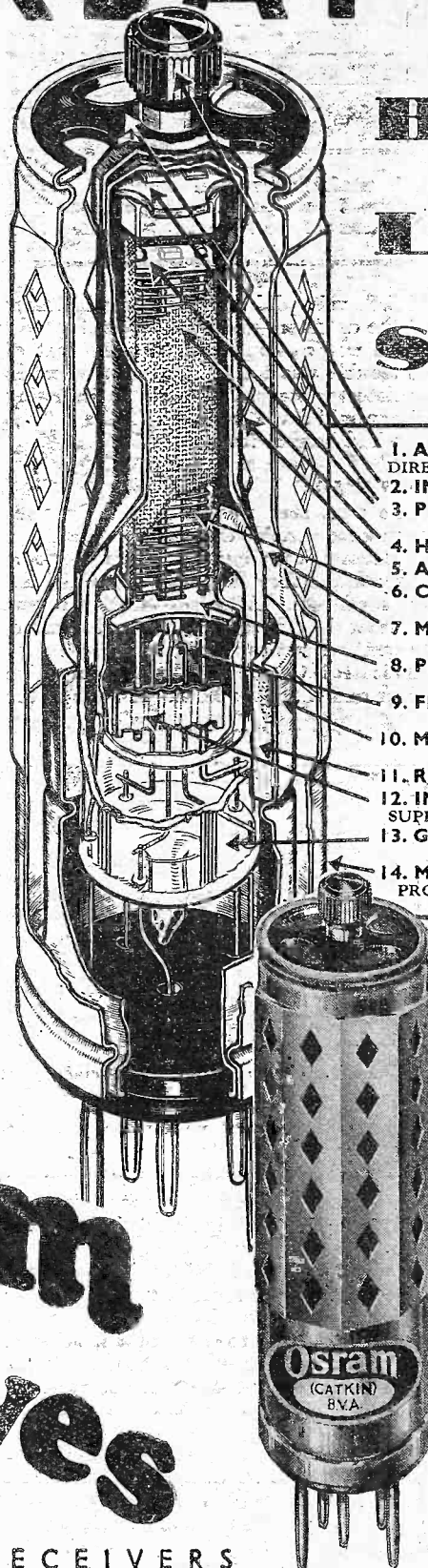
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 MH4 High Magnification Detector A.C. Mains Valve 13/6  
 MPT4 Power Pentode A.C. Mains Valve 18/6  
 (Other types to follow)

Sold by all Wireless Dealers

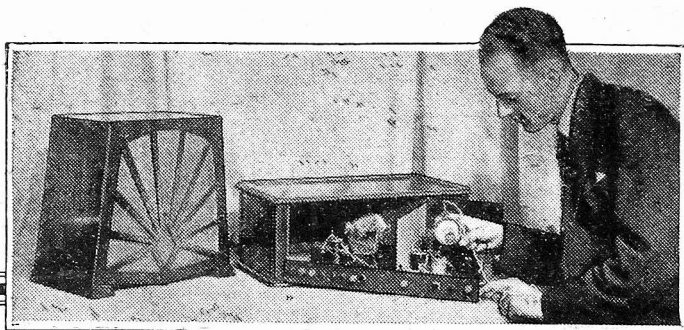
WRITE for the OSRAM VALVE GUIDE (1933. Edition) sent post free.

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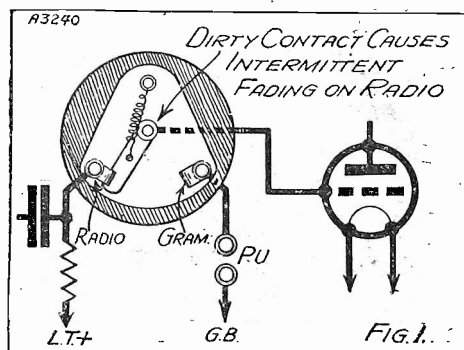
# SOME UNUSUAL FAULTS

BY  
*Krypton*



IN nine cases out of ten, when the receiver goes wrong, it is not something that causes a complete breakdown which is most puzzling and hard to trace, but some defect which mars reception, such as a noisy background, uneven volume, or perhaps insidious and intermittent distortion. More often than not the least expected fault turns out to be the real cause of such troubles, as happened quite recently in the case of a receiver on which I was asked to pass judgment.

## A POINT TO WATCH



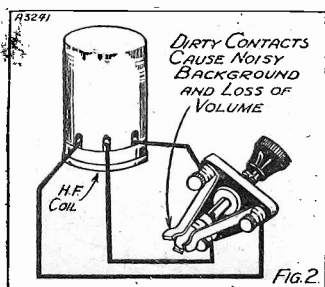
Even a good snap-action switch can cause no end of trouble if its contacts are not clean.

This set, a popular H.F.-det.-L.F. arrangement, put up a really good performance, excellent volume and quality on local reception, and more than average selectivity and sensitivity for distance reception. The only blemish on an otherwise perfectly good set was a faint irregular spluttering, audible during silent intervals and periods of low volume.

## Narrowing the Field.

It was easy enough to eliminate the possibility of outside interference, for on disconnecting the aerial and earth leads the trouble persisted. On test, filament and grid-bias batteries and their leads were found above suspicion, while substituting an H.T. battery for the mains unit used with the set had not the least effect.

This narrowed the field of inquiry to the receiver itself, where the quickest way of "getting warm" was to pull out each valve in turn with the set switched on, commencing with the H.F. valve. Removing



## THE SWITCH

Many of the troubles put down to "fading" are really caused by inefficient switches.

A useful survey of some of the causes of poor reception, and details of how to remove them.

the S.G. valve did not stop the spluttering but the detector—complete silence!

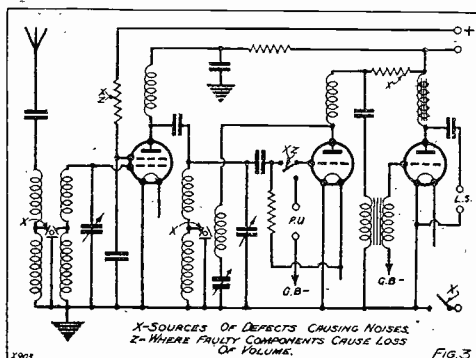
This was certain proof that the seat of the trouble was to be found somewhere in the detector stage, because that irritating noise would have persisted if the output stage had been at fault.

## Discovering the Culprit.

The next step was to test likely components for possible defects. The shunt-fed transformer coupling after the detector proved quite free from faults, as did the grid condenser. After substituting a new grid leak, the same old spitting and spluttering went on just as merrily as before!

This left little else but the detector valve holder and the valve itself. In spite of the

## LOSS OF VOLUME



The points marked Z are those which should be checked most carefully when the fault takes the form of loss of volume.

fact that the latter was a relatively new one with a blameless record, another valve was inserted, when that irritating background disappeared entirely!

Here the cause of the trouble had been all along a defective valve, possibly erratic filament emission (rather an unusual valve fault), but it goes to show that it is never safe to take your valves absolutely for granted, especially those that have already seen good service.

## Causes of Fading.

Although it is no uncommon experience to find the volume level of reception changing perceptibly when you are situated some considerable distance from a main transmitter, it is quite a different matter in the case of a receiver in the "swamp area," where such trouble cannot be blamed to natural fading of the transmitted wave.

I came across a very interesting and intriguing case of this latter type recently,

where the receiver had previously shown no sign of fading on the "local." Gradually there had developed a slow intermittent fade, occasionally to inaudibility, without any distortion, and recovering as mysteriously to full volume.

The first clue was got when I noticed that there was no fading at all on the gramophone side. This eliminated from the area of search all that part of the receiver after the detector-grid circuit.

A milliammeter inserted in the anode circuit of the detector showed that fading corresponded with a gradual increase in anode current, a dead fade-out bringing the latter up to the normal reading when no signal was tuned in. (Remember that, with the grid detector, the steady anode current is reduced appreciably when a strong station is tuned in.)

## Traced to a Switch.

It was then noticed that snapping the radiogram switch to and fro a few times effected a cure—but, unfortunately, only a temporary one.

Being now so hot on the scent, you can guess that it was not many minutes before that switch was out of the set and completely dismantled! Although it was an excellent snap-action design, I was rather surprised to find the pivot of the moving blade, to which contact with the detector grid is made, smeared with an evil-looking grease.

This was cleaned off entirely, the contacts brightened, the switch reassembled and then remounted. On switching on the receiver functioned perfectly without a trace of fading, and has done so ever since.

In general, it is a paying idea to examine periodically all switches for dirty and defective contacts.

## "CLASS B" TONE CORRECTION

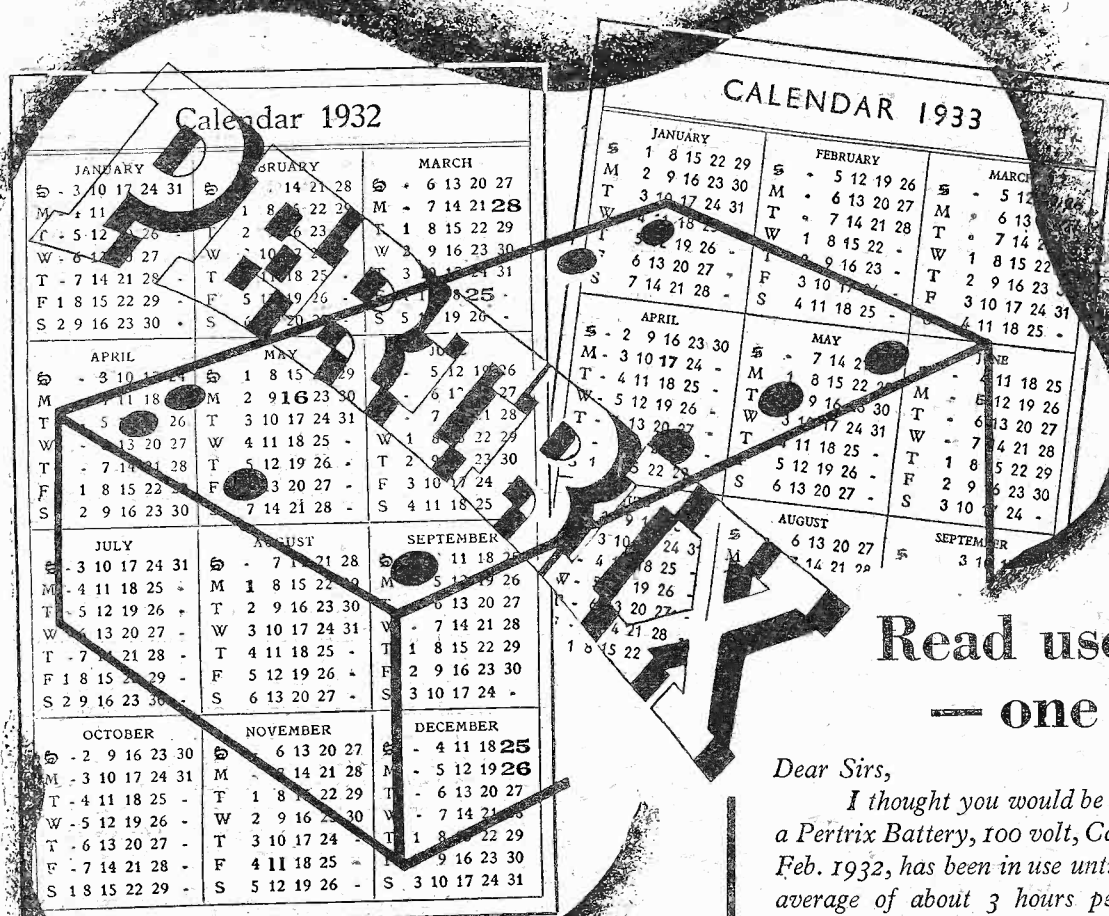
The best way to avoid high-pitched reproduction with positive-drive output.

IT is usually found that the reproduction given by a "Class B" set is inclined to be slightly high pitched.

Connecting a .001-mfd. fixed condenser between each anode of the "Class B" valve and H.T. + or L.T. — corrects this tendency; but it should be noted that this causes a slight waste of H.T. current. It is preferable to incorporate a tone control with the L.F. transformer which couples the detector to the driver valve. This may be effected by using one of the special tone-control transformers or by connecting a .01-mfd. fixed condenser in series with a 50,000-ohms variable resistance across the transformer primary.

C. R.

# His PERTRIX lasted EIGHTEEN MONTHS!



## Read user's letter — one of scores

Dear Sirs,

July 29th, 1933

I thought you would be interested to know that a Pertrix Battery, 100 volt, Cat. No. 272, I purchased Feb. 1932, has been in use until now, being used on an average of about 3 hours per day, which I think excellent. I have to-day purchased another one, G.B. & H.T. combined.

Yours faithfully, F. M. U., Bellingham.

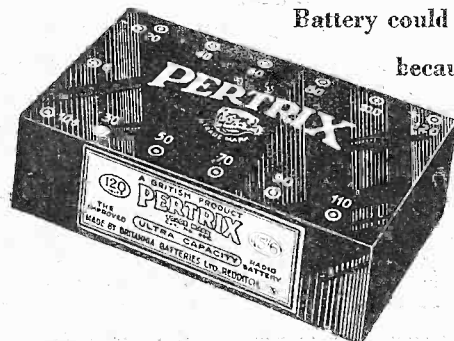
The above letter can be inspected at the offices of Britannia Batteries Ltd., 233 Shaftesbury Avenue, London, W.C.1

Three hours a day for eighteen months. In cold figures, over 1,500 hours of active service! Yet this is no unusual feat for a Pertrix — almost every post brings a letter from some member of the public whose Pertrix has lasted a year or more! Only a Pertrix High Tension

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# RADIOTORIAL

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



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

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

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

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

## QUESTIONS AND ANSWERS

### WHAT IS A DRIVER VALVE?

P. R. (Uckfield, Sussex).—"As I now understand it, a complete two-valver, with its small power valve, can be used in front of a 'Class B' stage to get really large volume on batteries. But if I get only the new 'Class B' valve and its input and output transformers, etc., as recommended for the new arrangement, the old power valve will have to do the 'driver's' work. "Is this in order, or do I really need a special driver valve?"

No, the old valve is quite suitable for use in the driver stage, as the characteristics required for this are those possessed by the ordinary small power valve.

### A SIMPLE CURE FOR THRESHOLD HOWL.

P. K. (Wanstead).—"I was never really lucky with short waves before, but this time I have struck a winner. The curious thing is that it was quite by accident I got it to go, the first attempts being completely spoilt by a low threshold howl."

"To cure it I was going to put a spaghetti across the transformer secondary, as recommended in 'P.W.' some time ago, but it was obviously of too low a value, and cut the volume right down (I think it is a 20,000 ohms.)"

"So I wondered if it would be any good trying across the primary, and found that was no good either. But whilst it was still connected on primary at one end I happened to join it up in a way which works finely."

"No trace of threshold howl, and certainly no drop in volume. It is fixed as follows:

"Formerly one side of H.F. choke went to A on the transformer, and the latter's H.T. + terminal went to the H.T.B."

"As I have got it fixed now, the H.F. choke goes to A, but the transformer's H.T. + terminal goes to the spaghetti. Then the other side of this goes to H.T.B."

"It is a perfect cure, and if you will pass on the tip it may do others a bit of good who find threshold howl impossible to cure. But I should like to know why it helps to make the set stable if there is an explanation?"

Threshold howl is notoriously "tricky" but one of the often-advised cures is a resistance in series in the detector's anode lead, which is what your modification amounts to.

The idea behind this is that if we can maintain a more constant voltage it will assist a detector to keep smoothly oscillating or nearly oscillating in

(Continued on page 890.)

## IS YOUR SET BEHAVING ITSELF?

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

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

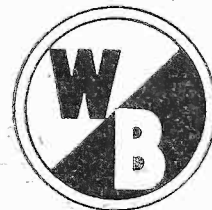
Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

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

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



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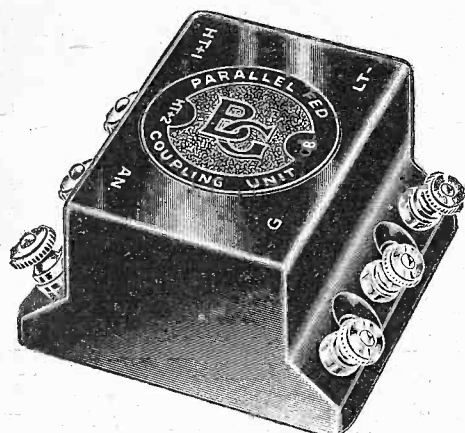
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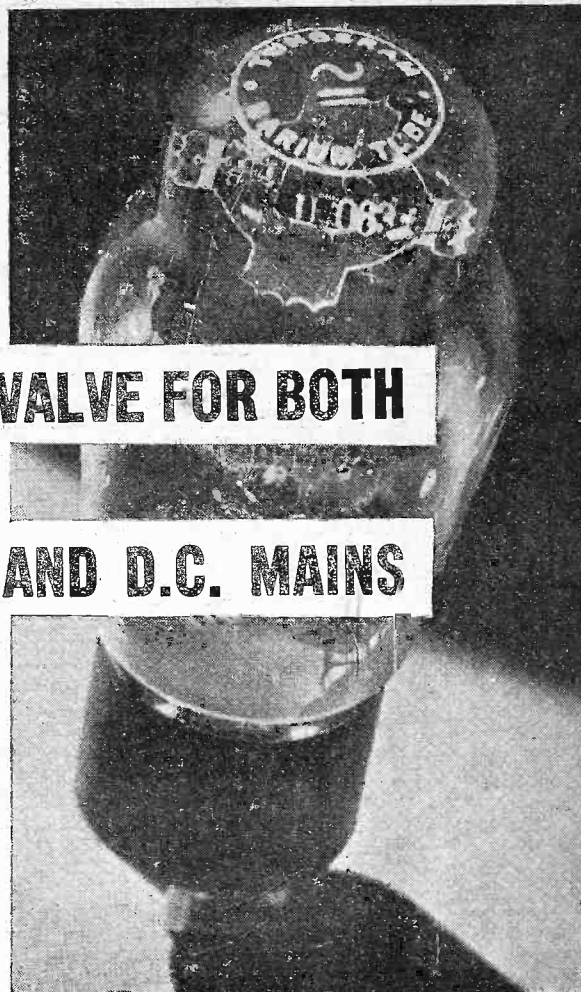
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please  
Everyone*



NCC 176

## ONE VALVE FOR BOTH

## A.C. AND D.C. MAINS



Tungram have achieved it—a Universal Valve which works on both A.C. and D.C. mains, With these Tungram Universal Valves any circuit can be built. All valves, including rectifier, are indirectly heated—there is practically no hum—and they are really economical, for the mains consumption is only 35 watts.

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## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 888.)

contrast to the threshold howl condition, in which the valve oscillates, stops itself by virtue of some circuit condition, and immediately re-starts oscillating, only to stop again immediately, and so on. (The frequency with which this happens is an audible one, and so we get the howl.)

Normally, the anode current drops sharply in the oscillating condition, but if there is a resistance in the anode circuit the voltage drop across it will then decrease accordingly, and thus the actual anode voltage at that instant will rise.

Therefore, the tendency of the valve to continually stop oscillating is reduced by the higher voltage on its anode.

In practice, of course, it is not so much oscillation that is needed as stability when near the oscillation point, and the above arrangement tends towards such stability.

### USING A ROOF AERIAL.

F. C. B. (Harlesden, N.W.).—"I find a roof aerial gives me ample strength on the London stations, but it has one fault when it comes to foreign reception, and that is that the weather affects it.

"Whilst it is raining the reception is never so good as when the roof is dry. Is there anything I can do to overcome this?"

You could try the effect of spacing the aerial wires farther away from the slates or tiles, but very often this alteration has no beneficial effect.

The trouble is that the wet makes the large roof surface conductive to some extent, and thus it acts

like a screen, shutting off the aerial wire beneath from the waves which would otherwise reach it.

An outdoor wire does not suffer from this drawback; indoor aerials, on the other hand, though they differ a good deal, are generally liable to variations from this cause.

### A GOOD TWO-VALVER FOR A SHORT-WAVE NOVICE.

H. L. (Bideford, Devon).—"I am expecting to go abroad towards the end of next year, when I have passed the exam., but I haven't the faintest idea where I shall be sent. The only thing I know is that it will be for three years or thereabouts.

"Aware that the Empire programmes now sent out from Daventry are being picked up all over the world by those who have taken short-wave receivers abroad with them, I think I might as well be prepared for when it comes to my turn.

"I have never tried my hand at short waves, so I should like to make one set, preferably a two-valve, and possibly launch out into three or four valves later on. Can you put me on to a good up-to-date description of a special short-wave set, suitable for the novice at that branch of radio?"

You could not do better than try your hand at the one described in the July 22nd issue of "P.W.", (No. 581). It is easily built and operated, full details for the whole process being given under the title "How to Make a Short-Wave Two," by W. L. S.

The circuit is an interesting and very effective one, employing a screened-grid valve as detector, and

following this either a small-power valve or a pentode.

Having been designed especially for the novice, this set is exceptionally easy to construct and operate.

### TESTING FOR H.F. OSCILLATION IN L.F. AMPLIFYING STAGE.

"VALVO" (Coventry).—"The trouble was found to be H.F. oscillations in the L.F. stage, and it was cured by the simple expedient of placing a 100-ohms wire-wound resistance

## DO YOU KNOW—

the Answers to the following Questions?

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

1. Does a coating of insulating enamel on the aerial wire affect reception?
2. What is the fundamental difference between the "Class A" and "Class B" methods of amplification.
3. How can you test if a valve is microphonic?

between the anode terminal of the valve holder and the wiring which previously went direct to this.

"I did not see the tests by the expert who called, but they tell me he used a flashlamp bulb held near the valve, and the oscillation was shown by the glowing of the bulb. Is this the usual test, and does it need any special apparatus in addition to the flashlamp bulb?"

The glowing flashlamp bulb method is frequently used to discover H.F. oscillations in an L.F. amplifier, and all that is needed for the test is the bulb itself, joined in series with a loop of wire, the ends of which go to the respective terminals of a variable

(Continued on page 892.)

### "P.W." PANELS, No. 135. MORAVSKA-OSTRAVA.

This famous Czecho-Slovakian station is well received in Britain at times, although it is about 820 miles from London. The wavelength is 263.8 metres, immediately above that of the London National.

Moravsko-Ostrava employs a power of 11 kilowatts, and announcements are made in Czech, Slovak, Hungarian, French and German.

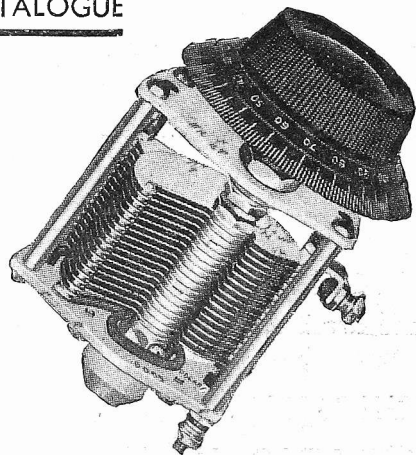
The call is "Radiojournal Moravsko-Ostrava," and good-night is given as "Dobrou-Noc."



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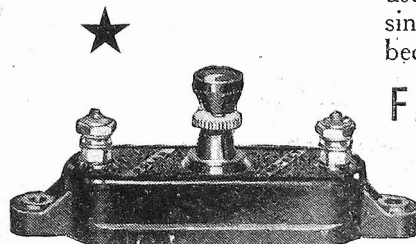
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The POLAR No. 2 S.M.

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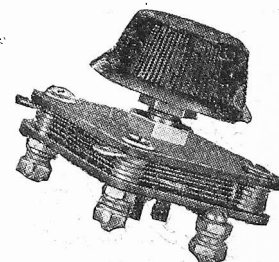
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•0001 each side  
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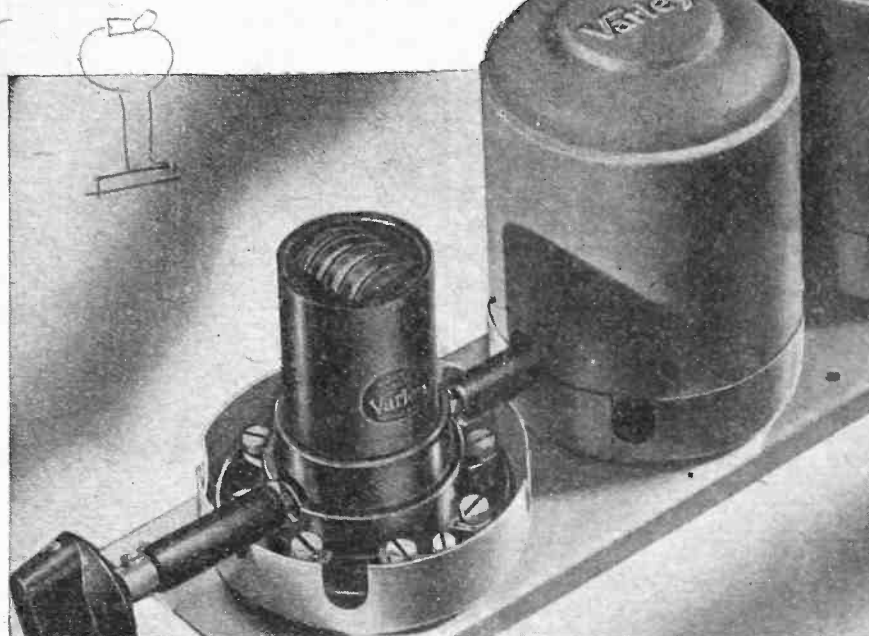
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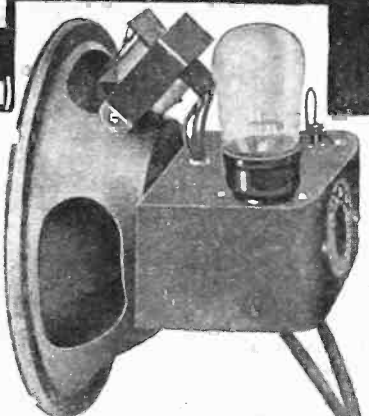
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Advertisement of Oliver Pell Control Ltd., 103 Kingsway House, Kingsway, London, W.C.2. Telephone: Hol. 5303

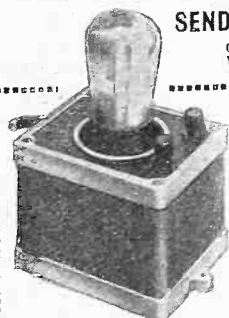
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If you already have a moving-coil speaker and wish to incorporate "Class B" amplification, the EPOCH "Class B" Adaptor is ideal for this purpose. It converts your set to "Class B" without any alteration whatever (Supplied complete with "Class B" valve).



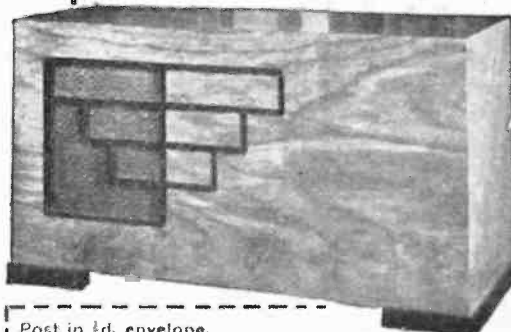
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## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 890.)

condenser having a small maximum capacity of the order of 0.0005 mfd.

In effect this amounts to wiring the bulb across the variable condenser, the short leads forming a loop, which is then lowered over each suspected valve in turn.

By adjusting the variable condenser a wide range of different high frequencies is covered, and when the circuit is brought near to the valve it will, when "in tune," indicate the oscillating condition by the glow of the flashlamp bulb.

### CONNECTIONS TO A DIFFERENTIAL CONDENSER.

W. B. (Saxmundham, Suffolk).—"The wiring of the differential condenser is the only thing that is puzzling me, the terminals of this being different from the one given in the diagrams.

"It is the correct kind, 0.0003 mfd., and it has two sets of fixed plates and one set of moving. But there are four terminals altogether, instead of three.

"One connects to one set of the fixed plates, another to the other set of fixed plates, and two terminals are joined to the spindle of the condenser—that is, to the moving plates. Does it matter which of these I use?"

"(The diagram shows one fixed plate terminal to L.T., the other fixed plate terminal to R on coil unit, and moving plates to H.F. choke and A on valve holder.)"

The two terminals fixed to the moving plates of the condenser are, in effect, only one terminal, because they are permanently joined together. Anything that is connected to the one is thus automatically connected to the other at the same time.

## THE ANSWERS

TO THE QUESTIONS GIVEN ON PAGE 891  
ARE GIVEN BELOW.

1. No, there is no measurable effect. So in seaside districts or near factory chimneys enamelled wire is often employed because it protects the copper from the atmosphere. \* \* \*
2. In "Class A" amplification a steady H.T. current flows irrespective of programme strength but in "Class B" the average H.T. current varies in direct proportion to the volume. \* \* \*
3. Tap it lightly when it is working. A microphonic valve gives rise to a very loud resonant note in such cases.

So you can use either of them, and it will not make the slightest difference in operation which one you choose. (The maker's reason for providing two terminals instead of only one is merely to give the set-builder a choice of connecting points to this set of plates. He can use whichever is more convenient.)

### STEPPING ON FLOORBOARD CAUSES CRACKLING NOISES.

G. L. (Richmond).—"During the past month or so we have been annoyed by harsh crackling sounds in the loudspeaker, and we have lately noticed the curious fact that these will nearly always occur when anyone is walking on a certain floorboard.

"I have examined the leads to loudspeaker, wall-plug, etc., but these appear to be in good condition. And, in any case, they are at the other end of the room from the floorboard which is causing the trouble.

"Would it be something to do with the electric-light wiring from which the set is run? It is a new house, and the wiring is all laid in metal pipes, so it should not be going wrong; but that is the only reason I can think of why one part of the floor should be associated with the crackles, which it undoubtedly is."

You are probably right in your supposition. We expect there is a wire with faulty insulation in the pipe near the spot in question, and if the board is just a little loose it may, when walked on, bend the adjacent metal pipe just enough to cause sparking at the badly-insulated point.

If you explain the symptoms to an electrician he will probably be able to put the trouble right straight away.

## ECKERSLEY EXPLAINS

(Continued from page 859.)

experimenter who held this theory used, for his tests, a necessarily bad loudspeaker. This, then, did not give the required uniform response—and so one evil added to a grosser does not detect the added sin!

No! I cannot say I am terribly convinced; but hearing is believing, and I did hear, just once in my life, quality, real quality, and that was achieved largely owing to a uniform response of amplifiers and good response of loudspeakers over a very wide band of frequencies.

What a pity I cannot say to you: "Go on, design (resistance-capacity is easier) amplifiers which do not forget to amplify until 20,000 vibrations a second are passed, and then listen for quality"! But where is the input? For no fault of the B.B.C.'s, wireless broadcasting has forgotten how to be a quality standard. Too many, too powerful, and too many, and too-too powerful stations simply forbid the reproduction of anything above about 8,000 cycles/second in the general case. You'll never get people to bother about top while top is jammed. In America, now, they can: because they are a united states, and a measure of dictatorship looks after public interest. And not because we are behind, necessarily, but because they are ahead (in transmission facility), the American set *does* give better quality than the European.

Of course, there's the gramophone record to fall back upon, and the Americans have shown how to produce the almost perfect record (80 db. level, range 30—12,000 cycles/second gamut, and plays for twenty minutes). But there's many a fight 'twixt vested interest and new invention, and we may have to wait a long, long time for that perfection.

There, again, in wire broadcasting we are not faced by so many technical problems because we can control all the quantities, and we need no *international* agreements about wires as we have to have with wireless.

Sic transient gloria amplificatus—which means, "We can do it, but THEY won't let us!"

## A NEW HIGH VOLTAGE OUTPUT VALVE

(Continued from page 870.)

view of the fact that most standard mains transformers give only a 4-volt L.T. supply.

It is therefore interesting to learn that the Mullard Company have brought out a new large output valve, D.O.26, which may be considered as a 4-volt version of the D.O.25. Its published data are as under:

Filament voltage	.. ..	4.0 v.
Filament current	.. ..	2.0 a.
Max. anode voltage	.. ..	400 v.
Optimum load	.. ..	4,000 ohms
Anode impedance*	.. ..	600 ohms
Amplification factor*	.. ..	3.8
Mutual conductance*	.. ..	6.3 m.a./v.

\* At anode volts 100 and grid volts zero.

With 400-volt high tension the D.O.26 requires a negative grid bias of 92 volts and takes an anode current of 63 m.a. It will handle maximum input signals of 65 volts R.M.S.

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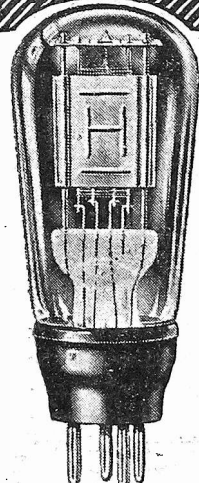
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## BERLIN'S RADIO SHOW

(Continued from page 869.)

attention on television. The step from last year's standard (90 lines) to this year's standard (180 lines) is very remarkable.

Telefunken and Loewe were showing cathode-ray tube reception of the standard picture. The Hungarian inventor, Denes von Mihaly, had on view a demonstration model of his new mechanical television receiver, a great advantage of which will be its inexpensiveness.

### The Sensation of the Show.

The young Baron von Ardenne was showing his projection cathode-ray tube. Tekade had their 90-line and a new 180-line mirror-screw receiver on view, together with a superhet for 7 metres. The Fernseh A.G. had two exhibits: one, the direct scanning transmitter and mirror-screw receiver operating with 90 lines, and secondly an intermediate film television projection receiver for large halls.

This latter was certainly the sensation of the show. The method employed is briefly as follows: A continuous band of celluloid is emulsioned, exposed to a ray of light modulated by the incoming television impulses over a Kerr cell and built up by a scanning disc, developed and fixed, dried and passed through a special cinema projector and then washed off again ready for re-use.

The whole process is nearly instantaneous. It only occupies 20 seconds.

### Television and the Cinema.

Telefunken were showing an application of this transmitter film system for television transmission. (It will be remembered that the Fernseh A.G. first demonstrated this last year.) By means of the intermediate film system it is now possible to televise any given scene which a modern cinema camera can handle and to receive it and project it on to a screen 3 or 4 metres in size.

The time lag between televising the scene and its reproduction on a cinema screen miles away is under 30 seconds. The accompanying sound can, of course, be recorded and reproduced in the same manner.

The German Radio Exhibition of 1933 was a very important exhibition for Germany, marking the threshold of ultra-short-wave television broadcasting. The National Socialist government has termed the exhibition the end of the democratic period in German broadcasting.

## A SURVEY OF THE GLASGOW EXHIBITION

(Continued from page 856.)

the "Microlode" principle; Blue Spot (Stand 4) are maintaining their high reputation with several new additions to their already comprehensive range; Ferranti (Stand 38), Epoch (Stand 61) and Rola (Stand 19) are all showing special "Class B" speaker-amplifier units for the instantaneous conversion of existing sets to Class B output; Clarke's "Atlas" (Stand 44), Ediswan (Stand 37), G.E.C. (Stand 34), H.M.V. (Stand 33), Igranac (Stand 23), Marconiphone (Stand 35), etc., all have something new to offer, and prices seem to range from, roughly, 30s. to anything up to £5 or more.

What with all the new speakers, new output valves, and the new circuit schemes, there is now no excuse for anybody putting up with anything but absolute fidelity of reproduction. The battery user in particular is extremely well catered for, even to the extent of the batteries themselves.

New and improved types at, in several cases, substantially reduced prices compared with those of last year, feature in almost all the leading makes. Space will not permit of a detailed description of all the new types, but that is information that you can readily obtain from the exhibition or even from your local dealer. If you are able to get to the exhibition and are interested in batteries, make a point of visiting the stands of Block Batteries (67), Britannia Batteries (69), Ediswan (37), Ever Ready (30), and Hellekens (45). You will find more than enough to interest you, and, moreover, you will certainly not come away disappointed.

### A Magnificent Response.

Undoubtedly, the present Glasgow Exhibition is the finest that Scotland has yet seen. The manufacturers, on their part, have responded magnificently to the needs of the present day, not only by producing the "goods" but by bringing them to Scotland for your examination, and now the rest is up to you. Just keep your weather eye on "P.W." for all the good things we have in store for you, and then not only will you be in keeping with, but actually ahead of, the times. Just you wait!

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## BEHIND THE SCENES AT DAVENTRY

(Continued from page 884.)

very wide limits, particularly during programmes of a "peaky" nature. The result is that the maximum possible depth of modulation can only be employed on the loudest passages of a particular transmission, the mean depth of modulation being the average between this point and the percentage modulation produced by the quietest passages in the transmission. This means that the mean depth of modulation may be quite different during a "peaky" transmission from what it is on a more level programme, such as speech. The modulation of the two Empire transmitters is adjusted to peak at 90 per cent, which gives the maximum practicable efficiency consistent with a satisfactory linearity of response.

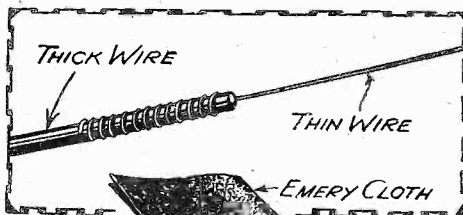
Finally, short-wave enthusiasts will appreciate what care has to be taken with power supply. The power for the master oscillators is taken from a 220-volt A.C. supply provided by a 15-K.V.A. single-phase transformer, which also supplies current for lighting purposes and other auxiliary services.

As the circuits of transmitters of the type used at Daventry are fairly sensitive to changes in voltage, automatic-induction regulators have been installed to compensate for variations in the voltage of the mains.

## USING FINE WIRE

A practical hint for constructors.

REMOVING the enamel insulation from very fine gauge wire may present a problem. A very good method is to remove it with a piece of worn emery cloth. Very little pressure should be used, otherwise the wire will break.



The illustration shows how a piece of thin gauge wire should be wrapped round a thicker piece before soldering the two together.

If it has to be soldered to a thicker wire, the best way is to bind the fine wire round the thick wire as in sketch.

The enamel can now be removed with emery cloth, with little fear of the wire breaking.

## THE LISTENER'S NOTEBOOK

(Continued from page 862.)

But for Dorothy Ward, I would have said without hesitation that Henry Hall was the most popular of all the stars, if applause is any criterion of popularity. But on this score Dorothy must be considered, for she ran Henry Hall pretty close. This is entirely satisfactory, especially to those of us who are a bit jealous of the supremacy of the crooner and his pseudo-songs.

Henry Hall deserves his holiday. But it is rather frightening to know that he has gone to America both for a holiday and also to study American dance-band methods. All I hope is that he won't find time for study. We already know so much about American methods that one often doubts whether there is a spark of originality left among some of our dance-band leaders.

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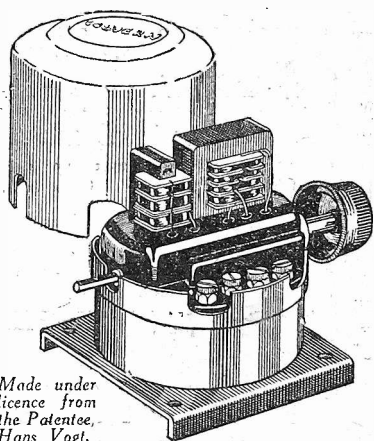


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## MIRROR OF THE B.B.C.

(Continued from page 860.)

### The Weekly Welsh Interludes.

You may or may not have noticed it, but the weekly Welsh interludes during the summer months, which have been included in the programmes from all stations, except Scottish, which have had their own interludes, have consisted entirely of music. No talks whatsoever, but recitals of folk songs, part songs and instrumental music.

On Saturday, September 23rd, the feature goes back to talks, and then, no doubt, Wales will be able to keep its interludes, because other stations will offer their own alternatives. These remarks are written in no spirit of criticism, because Welsh listeners appreciate these interludes of talks.

There is proof of this in the fact that since January of this year no fewer than nineteen broadcast talks have afterwards been reproduced (by permission of the B.B.C., of course) in Welsh weekly and monthly publications.

### Brass Band Contest—Winners from the North Regional.

On Sunday, September 10th, six days after the great championship brass-band contest at Belle Vue, Manchester, North Regional listeners will hear a concert by the winning band from the Manchester studio. Meirion Morris, who has won umpteen prizes at musical festivals, will be the solo artist, but neither he, nor you, nor us knows which band will be with him when he sings.

## THE LINK BETWEEN

(Continued from page 860.)

### A.V.C. for Existing Sets.

I am interested to learn that Messrs. Wearite have recently introduced an automatic volume control unit which can be fitted to any set employing high-frequency screened-grid amplification, whether of the "straight" or superhet type.

There are only three connections to the unit, and in order to fit it to an existing set, only one alteration has to be made to the wiring. It certainly seems an excellent scheme, and if it is up to the usual Wearite standard, I am confident that it will enjoy considerable popularity among the home constructing public.

"P.W." readers who would care for further details can obtain them by making application in the usual way through our postcard literature service. (No.48)

### Universal Mains Valves.

A.C.-D.C. valves, which are suitable for operation on either A.C. or D.C. mains circuits, are becoming increasingly popular.

In this connection, the range of universal valves (as they are called) which is being produced by the Tungram Electric Lamps Works is one of the most comprehensive yet available. In fact, I believe I am correct in saying that they were the first firm to produce a complete range.

The present Tungram range includes the following types: variable-mu screened-grid H.F., detector, low-frequency; power, multi-grid output, double-grid frequency changer, H.F. pentode, etc.

A leaflet describing these new valves is available through the postcard literature service. It is a leaflet that is likely to be of interest to all readers who are interested in mains set construction. (No.49)

## WHY WASTE MONEY ON COSTLY H.T. REPLACEMENTS



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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.

### Aerial Constants.

ALTHOUGH we are always told to examine the aerial every now and again, to make sure that there is no corrosion or bad contact anywhere about, many of us, I am afraid, pay little heed. But it is really worth while to make a periodical inspection of the aerial, because not only are you liable to get a loss in its efficiency as a pick-up of signals, but also, what is not so commonly known, if the electrical constants of the aerial are changed even slightly, this interferes with the loading conditions in the aerial tuning circuit.

### Adjusting Trimmers.

In the old days of independent condensers this was not perhaps so important; but in these days of ganged condensers it may mean that the ganged condenser will need the trimmers re-set. This is a nuisance, and therefore it pays you to keep the aerial as far as possible in the same electrical condition.

Of course, it is a good plan to make sure occasionally that the trimmers are correctly adjusted, because no matter how careful you may be with the aerial it is liable to go out of electrical condition—that is to say, its electrical constants may change slightly through no fault on your part. But a general caretaking of the aerial will reduce the amount of attention you have to give to adjustment of the ganged condenser, and will help to keep the set up to concert pitch.

### Screen-Grid H.F. and Band-Pass.

When using a screen-grid high-frequency stage with a bandpass circuit you can easily get negative bias on the screen-grid valve by juggling about with the resistance which shunts the fixed condenser used in connection with the bandpass. This condenser, which generally has a value of about 0.05 microfarads, is connected to the earth end of the circuit and has the fixed resistance shunted across it, one end of this resistance going to low-tension negative.

If, however, this end of the resistance is connected instead to the negative terminal of the bias battery you will get an extra negative bias on the screen-grid valve, the positive end of the battery being connected to the L.T. negative instead.

### Short-Wave Reaction.

The voltage on the detector valve, as you know, greatly affects the control of reaction. This influence becomes more pronounced the shorter the wavelength, and if you are operating a short-wave receiver, or if you have a triple-wave set, you will find it very convenient to provide yourself with some means for adjusting the detector voltage fairly accurately.

(Continued on next page.)

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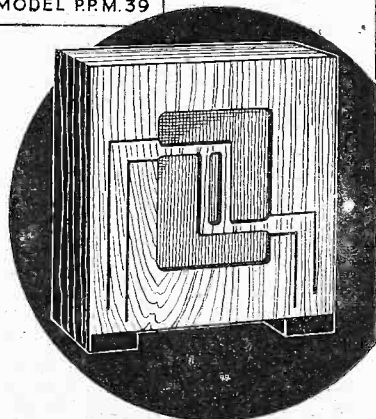
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MODEL PPM.39



# CELESTION

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THE FOREMOST NAME  
IN SOUND REPRODUCTION

## TECHNICAL NOTES

(Continued from previous page.)

One very obvious means is to use a potentiometer for the detector tapping on an H.T. battery; with a mains unit it is quite likely that you will have a control already provided for you for adjusting the voltage of the detector tapping.

In this way you can get quite a fine adjustment of the reaction effect simply by controlling the detector voltage, and this method has the great advantage that it is free from hand capacity.

### Howling Troubles.

In a short-wave set you often get trouble with what is called threshold howl, but the above dodge should enable you to use reaction to the full without trouble. It is very difficult, when you are relying upon any method of control which involves hand capacity, to get any very accurate adjustment, because you have more or less to guess what the result will be after you have taken your hand away and keep on trying until you get things right.

### Making Screens.

A reader wants to know if there is any simple way of taking the sharp edges off home-made aluminium or copper screens. He says he has tried using a file, but this causes a jagged edge and distorts the screen.

The simplest way is to cut the screen to the desired size with scissors or snips, and then to flatten out the screen very carefully on a flat plate or surface plate (taking care not to hit it hard in any spot, but just gently all over), and then to rub the edges on a piece of sandpaper, the sandpaper being laid flat on a wooden bench and the metal sheet held in the hand.

If the screen is made from a very light-gauge metal you can hold it between two flat pieces of wood, just leaving the edge protruding and rubbing it quite gently on the sandpaper. If the sandpaper is of fairly fine grade you will get a beautifully smooth rounded edge even on quite thin aluminium or copper.

### Transformer Tone.

The tone of a low-frequency transformer can be controlled to some extent—hence the name tone-control transformer—by the simple process of connecting a suitable resistance across two of its terminals. Apart from this resistance the component is an ordinary L.F. transformer.

Sometimes this tone-control effect with the L.F. transformer is very useful for counteracting loss in some part of the audio range. For instance, high-note loss often occurs in sets which are very selective, and in such a case this loss can be largely made up by a suitable value of resistance across the L.F. transformer. In many types of tone-control transformer at present on the market the transformer itself includes a special choke, the two being combined together in the transformer case.

### Flat Tuning.

In the old days, when there was not the pressing need for selectivity which exists to-day, it was a simple matter to connect the aerial to the grid end of the tuning

(Continued on next page.)

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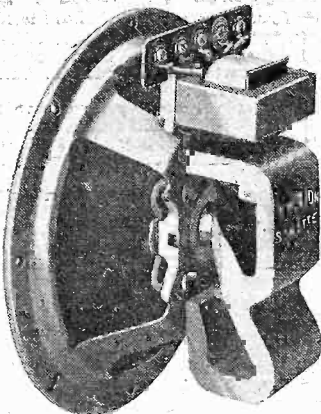
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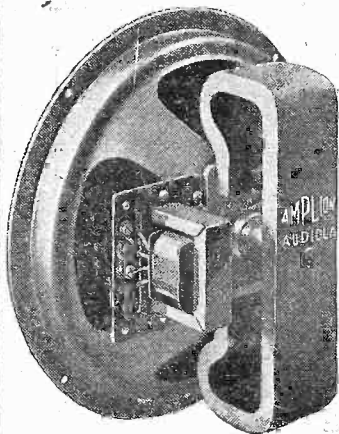
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# AMPLION

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## TECHNICAL NOTES

(Continued from previous page.)

coil. Nowadays, however, the flatness of tuning which results from this arrangement puts it out of court for most purposes, not to mention the fact that it also gives only a restricted wavelength range.

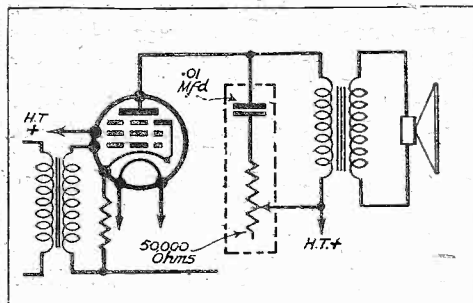
With a single-circuit tuner you can get over this trouble of flat tuning by connecting the aerial to a tapping on the coil, whilst another dodge is to insert a small condenser in series with the aerial. In this latter method the condenser should be variable, but, as it does not need to be adjusted very often, it need not be an ordinary variable air condenser, but should preferably be one of the pre-set variety.

You will thus be able to sharpen the tuning and increase the selectivity of the set, and at the same time increase the wavelength range that you can get with the same tuning condenser, coil and aerial.

### Pentode Tone Control.

With a pentode output it is very useful to employ a tone control, owing to the fact that this valve tends to emphasise the higher notes and so produce a tone which

### SIMPLE TO CONNECT



A suitable tone control for use on the output of pentode valves. The values shown are usually satisfactory.

some people regard as "squeaky" or high pitched. If a variable resistance and a condenser of suitable values are connected in series with one another, and the combination is then connected across the primary of the output transformer, the tone can be adjusted by varying the resistance.

If the resistance is reduced the higher notes will be weakened so that the lower notes will be relatively strengthened. This tone-control arrangement is shown in the accompanying figure connected across the output transformer primary, and it can, if desired, be connected across an output choke or across the terminals of a loudspeaker which is directly fed.

### Detuning Effects

Everyone knows that with many sets you get very bad distortion if you detune ever so slightly, especially when the reaction is pushed pretty well up to the limit. For this reason it is important to have a good slow-motion adjustment with the tuning condenser if you want to get tone and quality.

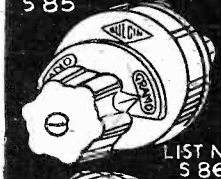
At the same time, there are cases in which detuning is actually an advantage. A case in point is when you have a powerful long-range set with, say, two or more H.F. stages, when you will sometimes find that

(Continued on next page.)

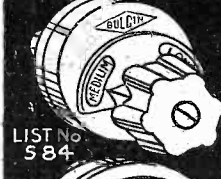
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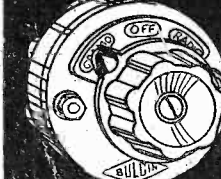
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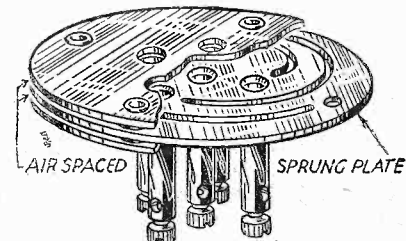
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## TECHNICAL NOTES

(Continued from previous page.)

on detuning slightly from the exact position you will get an improvement in quality.

This is really a spurious effect, because it generally means that overloading is taking place on one or more of the valves when the desired station is accurately tuned in. In other words, it means that the set is already working under a disability, and the second disability—that is, detuning—tends to counteract the first one.

## Overloaded Valves.

If this is the case the proper thing to do is to introduce a suitable form of volume control at some early part of the circuit, and in any case before the detector stage is reached, so as to get rid of the overloading. I should mention that it is not a good plan to use the reaction for the purpose of a volume control in a case like this, nor, for the matter of that, in a good many other cases.

Some people think that reaction only affects the volume, but it can also affect the selectivity. So that if you rely upon the reaction to get rid of the overloading in the sort of case mentioned above you may reduce the selectivity and flatten the tuning at the same time.

It is far better, therefore, to use an independent volume control so that you are free to adjust the reaction on its own.

## Using Components Correctly.

I have often referred to the importance of employing a valve—or any other component for that matter, but particularly a valve—under its proper operating conditions. People often use valves for different purposes with little or no regard to their suitability for the purpose in question and without paying any special attention to whether the valve is working under its right conditions. It is really worth while—in fact, it is almost essential—to study the conditions under which the valve is working, because otherwise you cannot expect to get anything like the best performance out of it.

## Matching Impedances.

For one thing, the question of the relationship between the impedance external to the valve—that is, in the anode circuit—and the impedance of the valve itself is a very important one, and you will not get the best output from the valve unless these two impedances bear something like the right ratio to one another.

The internal impedance of the valve—that is, the impedance between the anode and the filament—should not be greater than the impedance of the anode circuit, and in actual practice it is found best if the impedance in the anode circuit is at least twice the internal impedance of the valve. When I speak of the impedance in the anode circuit I should say at a medium frequency, because if this is a transformer or other inductive component the impedance, as you know, will vary according to the frequency of the currents applied to it.

## Low-Note Loss.

You will easily see the importance of this if you consider a transformer in the circuit. If the transformer is a poor one, with too small an inductance in the primary circuit,

(Continued on next page.)

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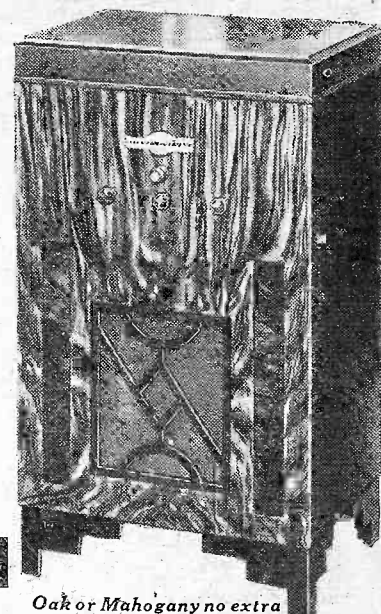
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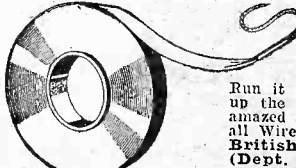
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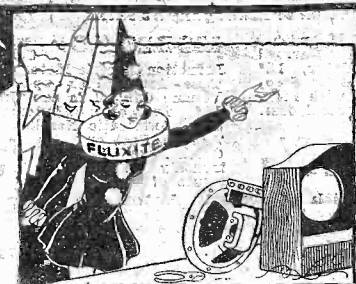
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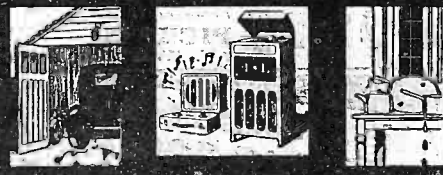
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## TECHNICAL NOTES

(Continued from previous page.)

the relationship between this impedance and the impedance of the valve will be all wrong—the impedance of the transformer being too small as compared with that of the valve—and you will get a poor output. This will be worse the lower the frequency. It is a well-known fact that a transformer with too low an impedance in the primary will fail badly on the low notes.

Cheap components, especially coils and transformers, are never worth while and should never find a place in a decent circuit layout. The strength of a chain is that of its weakest link, and in the same way the overall performance of the receiver will be limited by the weakest component in it.

### Condensers and Frequency.

Talking about impedance reminds me that I have been asked several questions following what I said the other week about the impedance of condensers. You will remember that the impedance of a coil (whether it be a tuning coil, transformer

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primary, or choke) increases as the frequency of the current increases, whereas the impedance of a condenser does precisely the opposite. If you apply direct current to a choke, no matter what the impedance of the choke may be, it will make no difference to the direct current; and two coils of the same ohmic resistance, but of totally different inductances, will act in the same way so far as direct current is concerned. In fact, direct current may be regarded as alternating current of zero frequency.

### Separating Currents.

A condenser, on the other hand, acts as an infinite resistance to direct current, but as soon as the current starts to alternate the condenser allows it to pass through. The impedance of the condenser is inversely proportional to the frequency of the current and also inversely proportional to the capacity of the condenser.

Perhaps I should explain that when one quantity A is *inversely proportional* to the other quantity B, it means that as A goes up so B goes down, and in the same ratio.

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Classes for Radio-Gramophone Dealers, Salesmen and Service Engineers. Commencing September 26th, 1933.

Each class consists of a lecture or demonstration of 30 minutes, followed by practical work for one hour.

The classes will be held on Tuesdays, 10-30 a.m.—12 Noon; or 6-30—8 p.m.; or 8-0—9-30 p.m.

Enrolments may be made from September 18th to 22nd, 6—9 p.m.

Fee for the Course of about 20 attendances, 20s.

Syllabus from the Director of Education.

NEW MODEL EXACT TUNER, 14/- CROFT TUNER (Something new), 9/- Both tuners will tune all wavelengths from 200 to 2,000 metres. Send 2d. stamp for particulars and circuits. EXACT MANUFACTURING CO., Croft Works, Priory Street, COVENTRY.

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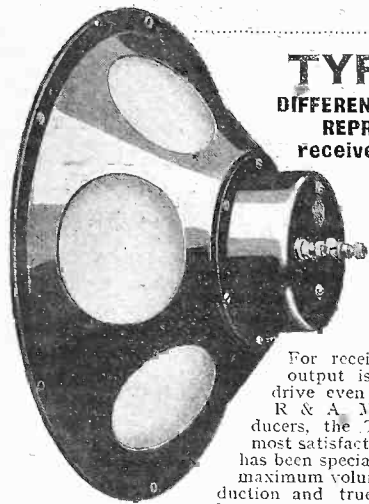
September 9th, 1933

POPULAR WIRELESS

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# There is an R & A Reproducer for your receiver

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**TYPE 60**  
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**REPRODUCER for**  
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**21/-**

For receivers in which the output is not sufficient to drive even the super-sensitive R & A Moving Coil Reproducers, the Type 60 offers the most satisfactory alternative. It has been specially designed to give maximum volume, purity of reproduction and true balance between bass, middle and upper register when used in conjunction with even the smallest output valve.

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Separate Models for the most popular output stages have been produced, each of which is fitted with the Transformer specially designed to operate with maximum efficiency. As a result the finest possible quality in reproduction combined with maximum volume is assured.

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This reproducer has a world-wide reputation as the finest instrument of its type obtainable at so low a price.

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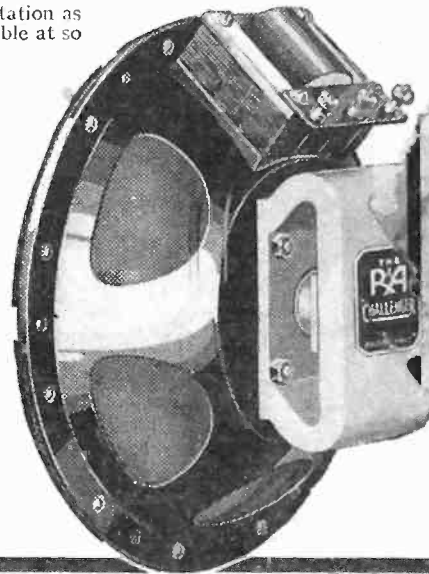
### OTHER "CHALLENGER" MODELS—

TYPE "B" for Class B Amplification, Model B8 for Low Impedance, Model B15 for High Impedance.

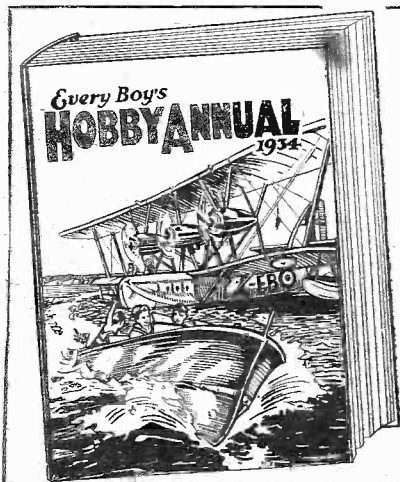
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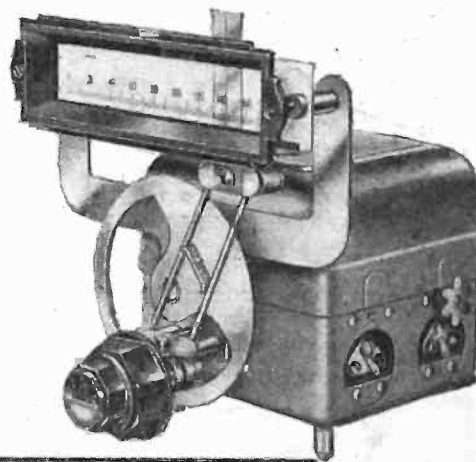
**PRECISION**  
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## THE NEW J.B. LINATUNE GANG

Whatever the circuit, the experienced constructor will always choose "J.B." For tuning iron-cored coils, in particular, the accurate matching found in J.B. Gangs becomes imperative; and the mechanical rigidity of "J.B." ensures the permanence of this matching.

Illustrated is the new J.B. LINATUNE with one trimmer panel—operated by a knob concentric with the main tuning control. It is fitted with the new J.B. Straight-Line Dial, the whole scale being always on view and illuminated by a lampholder which travels with the cursor.

Prices (with cover) 2-Gang ... 22/6, 3-Gang ... 27/6



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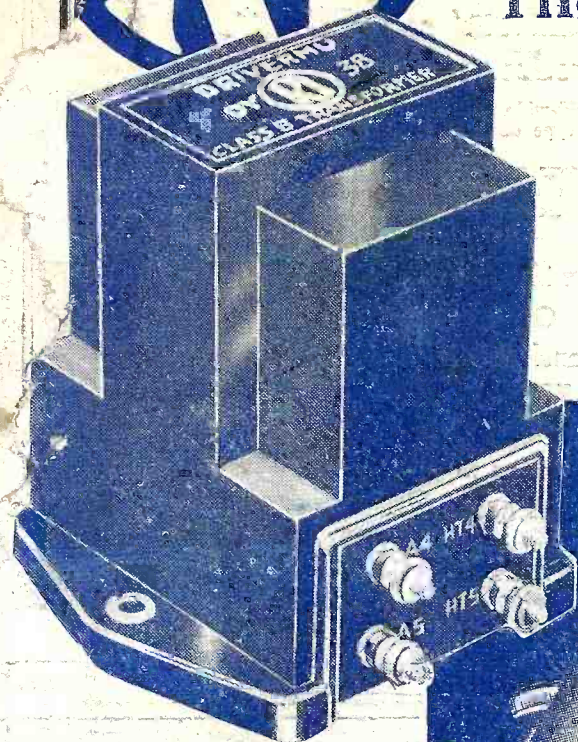


# BIG THREE for 1933-1934

The Something New—

The Something Better in Radio

In the L.F. and H.F. stages, R.I. have developed components that are literally miles ahead in design and general efficiency. They cover the important fields in radio in which real progress could be made. The introduction of Quiescent and "Class B" components, the Auto-Parafeed transformer and the Micrion coil comes at the crucial moment when tuning and amplification efficiency together with increased selectivity are most needed.

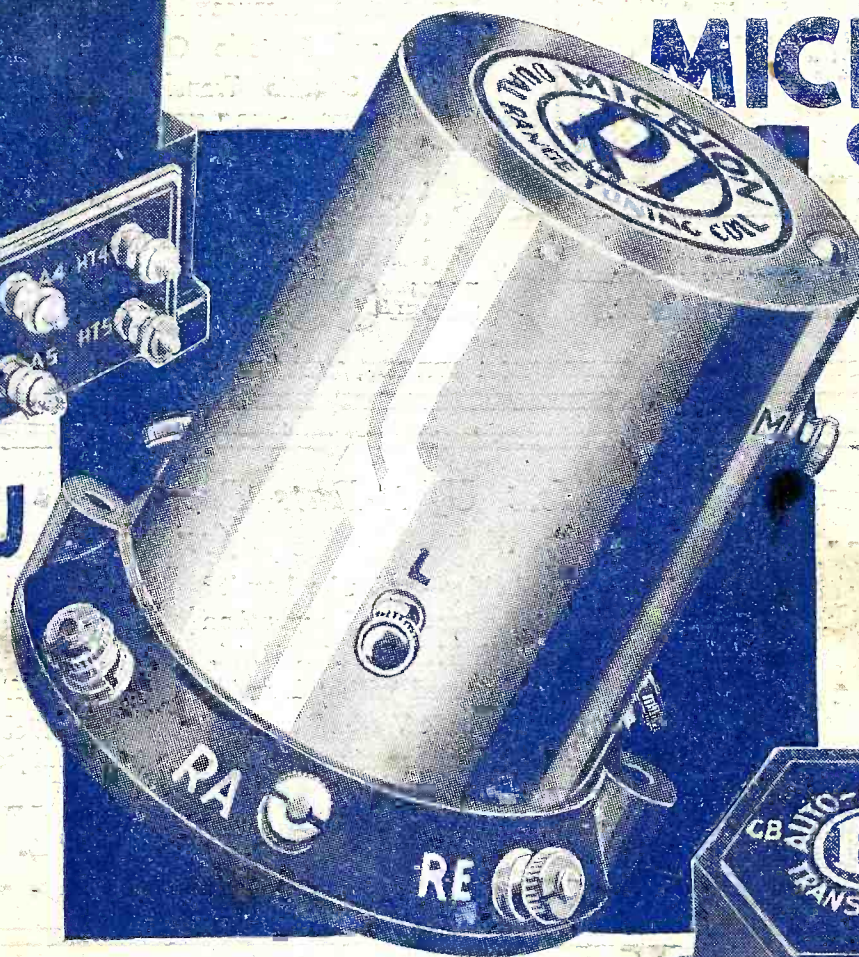


## DRIVERMU CLASS 'B' COMPONENTS

The "Class B" system of amplification has been more fully developed by R.I. as far as suitable components for the particular valves are concerned. This fact, and the lucidity with which R.I. have described the system and made it exceptionally easy to understand in their brochure, have made R.I. "Class B" components the inevitable choice of the experienced constructor and the best for the beginner.

With the correct R.I. "Drivermu" Transformer and the R.I. "Class B" Output Choke, perfect reproduction with all-mains quality from your existing or new battery set is both inexpensive and easy. With R.I. components, you know you will get the best results for the least expenditure.

R.I. "Drivermu" Transformers are priced at 15/- and 11/- (plus 1/6 royalty) and the choke at 12/6.



## MICRION COIL

Employing the new POWDERED IRON CORE, the "Micrion" has revolutionised tuning, and so much does it improve range and selectivity that every existing dual-range coil is superseded.

The "Micrion" is the only dust iron-cored coil with Micrometer adjustment on both medium and long waves and it enables replacement of the existing coil without interfering with calibration.

List No. B.Y.36. Actual size 2 1/2 x 2 1/2 x 3 ins. high. **12'6**

## AUTO-PARAFEED

This latest development of the famous R.I. Parafeed System is an amazing transformer giving increased connection facility and efficiency in Parallel Feed Amplification.

The maximum variation of L.F. gain produced by this transformer as measured by the new Decibel method is about 2 Decibels only—a variation inaudible to the human ear. This means that every note and every sound may now be reproduced more perfectly than ever before with a complete absence of distortion.

Primary inductance 84 henries. Ratio 1 to 4 (auto-connection). List No. D.Y.45. **6'9**



The literature for all these components are masterpieces of simple explanation and clear instruction: Ask your dealer for them or write direct to R.I.

The Advt. of Radio Instruments Ltd., Croydon, Surrey. 'Phone: Thornton Heath 3211.

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