

AN AUTOMATIC ALL-RANGE CRYSTAL SET.

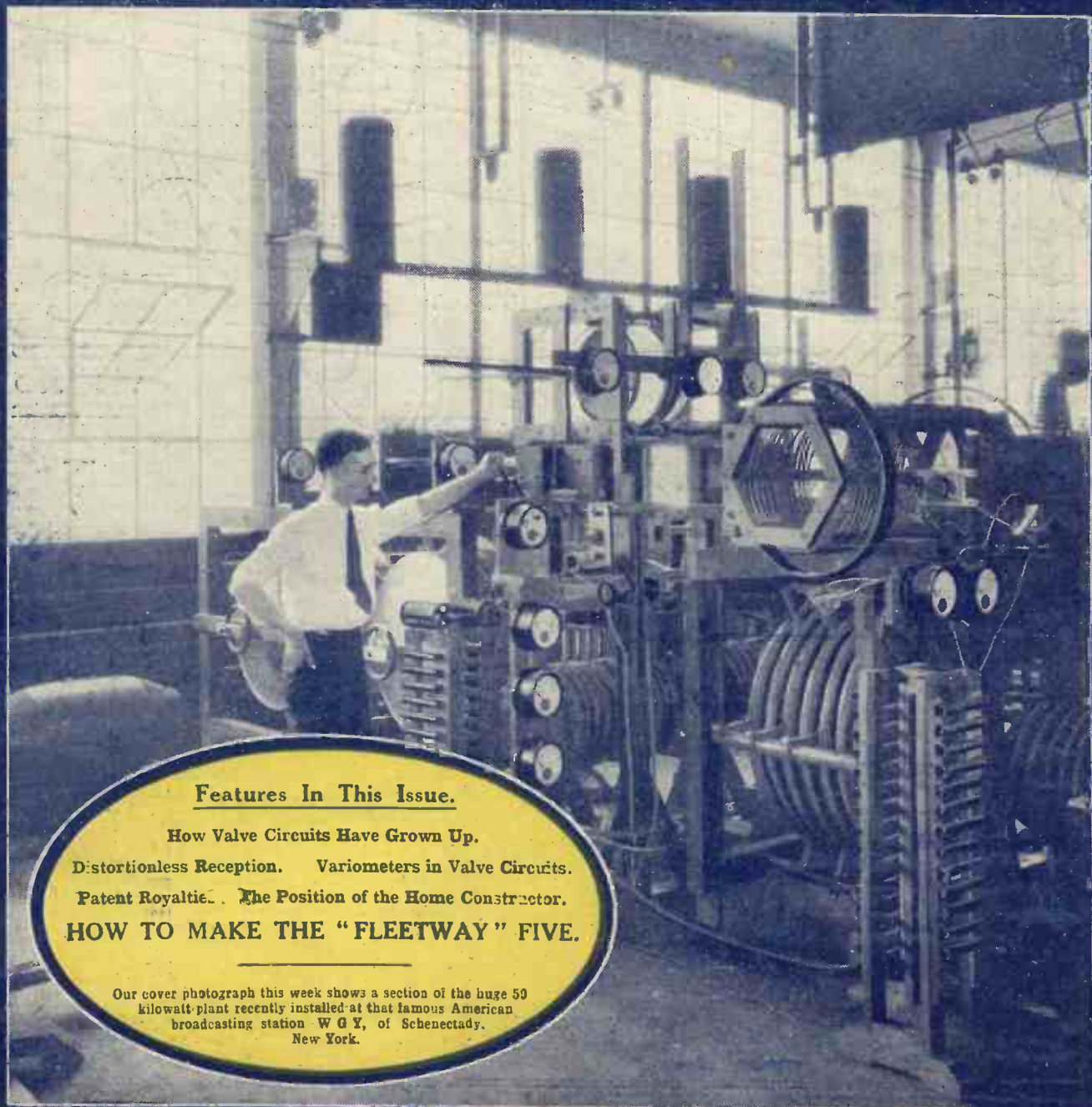
Popular Wireless

Every Thursday
PRICE
3d.

No. 201. Vol. IX.

and *Wireless Review*
Scientific Adviser: SIR OLIVER LODGE, F.R.S., D.Sc.

April 3rd, 1926.



Features In This Issue.

How Valve Circuits Have Grown Up.

Distortionless Reception. Variometers in Valve Circuits.

Patent Royalties. The Position of the Home Constructor.

HOW TO MAKE THE "FLEETWAY" FIVE.

Our cover photograph this week shows a section of the huge 50 kilowatt plant recently installed at that famous American broadcasting station WGY, of Schenectady, New York.



For Economy

EMPLOY MARCONI D.E.3 VALVES

For 4-volt
Accumulator
or 3 dry cells

General Purpose Valve

Current Consumption only 0.06
amps.

Type D.E.3

Fil. Volts - - - 2.8
Fil. Amps. - - - 0.06
Anode Volts - - - 20-80
Impedance (ohms) - - 22,000
Amplification Factor - - 7

Type D.E. 3B

Fil. Volts - - - 2.8
Fil. Amps. - - - 0.06
Anode Volts - - - 120
Impedance (ohms) 50,000
Amplification Factor. 17

PRICE 16/6 each

TABLE SHOWING SOME RECOMMENDED COMBINATIONS FOR ECONOMICAL WORKING.

	Type.	Position.	Grid Bias Volts.	High Tension Volts.
2-Valve Set	D.E.3.B.	H.F.	0	60
	D.E.3.B.	DET.	+2.8	60
	D.E.3.	L.F.	-3	80
3-Valve Set	D.E.3.B.	H.F.	0	80
	D.E.3.B.	DET.	+2.8	80
	D.E.3.	L.F.	-3	80
	D.E.4.	2 L.F.	-7.5	120
4-Valve Set	D.E.3.B.	H.F.	0	80
	D.E.3.B.	DET.	+2.8	80
	D.E.3.	1 L.F.	-3	80
	D.E.4.	2 L.F.	-7.5	120

Write for Valve Publication No 443A.

Marconi Valves

IN THE PURPLE BOX.

The name that guarantees  all that is best in Radio

Next to the valve, the component that matters most on your set is the *Transformer*

The "IDEAL" Transformer is guaranteed to amplify with minimum distortion at all frequencies. It is subjected to rigorous tests at every stage of manufacture, and every transformer sold is guaranteed to conform to the individual curve supplied with the instrument. The windings are impregnated with MARCONITE — a specially prepared insulating material which protects it from all risk of deterioration and corrosion.

The performance of the "Ideal Junior" is consistent with that of the "Ideal," and is designed chiefly to follow a detector valve which is usually of high impedance.

All types of "Ideal" Transformers are unconditionally guaranteed for one year from date of purchase.

Write for Publication No. 364 F.

Marconiphone "IDEAL" Transformers

THE MARCONIPHONE COMPANY, LTD.,

Regd. Office: Marconi House, Strand, London, W.C.2.

Head Office: 210-212, Tottenham Court Road, London, W.1.

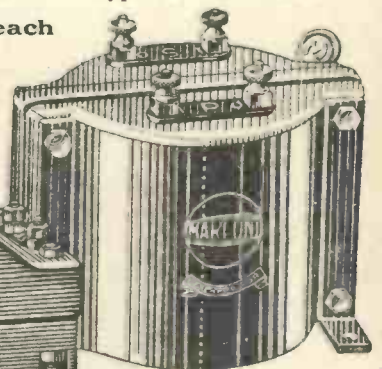
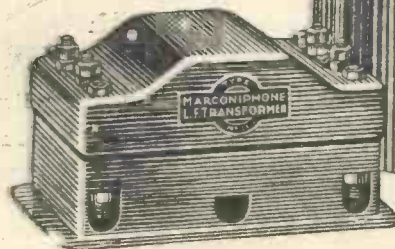
"IDEAL" TRANSFORMER

Type 'A' Ratio 2.7 to 1 Type 'C' Ratio 6 to 1
" 'B' " 4 to 1 Type 'E' " 8 to 1

PRICE 30/- each

"IDEAL" Transformer
(Junior Model.) Ratio 3 to 1.

NEW REDUCED
PRICE 21/-



America Acknowledges Amplion Supremacy

THE BEST features and latest developments of radio and phonograph are effectively combined in the beautiful Adler-Royal creation shown above. The price of Model 10 (a 5 tube Neutrodyne Radio-Phonograph with Amplion loud speaker unit) is, without accessories, \$275.00.

“... with AMPLION Loud Speaker unit”

The manufacturers of the famous Adler-Royal are intent on providing the very best that money can buy. Thus it happens that Britain's Best Loud Speaker is incorporated in this famous American Radio Receiver.

The World's Standard

AMPLION

Wireless Loud Speaker

The Radiolux AMPLION, the most recent addition to the AMPLION range, by reason of its volume, clarity, sensitivity, and realistic tone, is a revelation in loud speaker quality.

The illustration shows a typical Radiolux Amplion, Model R.S.2.O. price £5/10/0.



Obtainable in two sizes, and in various distinctive finishes from AMPLION STOCKISTS, Radio Dealers, or Stores.

Demonstrations gladly given during business hours at the AMPLION Showrooms: 25, Savile Row, London, W.1; 79-82, High Street, Clapham, S.W.4; 10, Whitworth Street West, Deansgate End, Manchester; and 101, -St. Vincent Street, Glasgow.

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ALFRED GRAHAM & CO. (E. A. GRAHAM), St. Andrew's Works, Crofton Park, S.E.4.

"BEST WAY"

GUIDES FOR WIRELESS CONSTRUCTORS



*The Two Latest Numbers
Now on Sale Everywhere*

This Year's CRYSTAL SETS

This new addition to the popular "Best Way" series of Guides for the Wireless Constructor contains the latest and most authentic information on the best Crystal Sets of the Year. A special feature of the book is the clear constructional photographs illustrating the assembling of each set. All of the circuits described have been carefully tested, so that amateur constructors can be certain of good results. The sets described are as follows: A One-Control All-Range Set; Building a "D" Coil Receiver; The Universal Crystal Set; A Quick-Change 2 L O-5XX Receiver; A Main Stations Ultra and The Half-Crown Crystal Set

Three Famous VALVE SETS

This book describes and illustrates in photographic detail three absolutely reliable circuits. All have been most carefully tested under normal broadcasting conditions and will give the utmost satisfaction. The sets concerned are "A Triodyne Two-Valver," "The 'Chitos' One-Valve Set," and "The One-Valve Unidyne Receiver," and the directions given in this book make the assembling of each set exceedingly straightforward and easy to follow.

Price **6^{D.}** each

At all Newsagents and Bookstalls.

CONSTRUCTORS USING THESE BOOKS CANNOT GO WRONG

Invaluable to EVERY Amateur and Constructor.

The "POPULAR WIRELESS"

BLUE PRINTS of TESTED Circuits.

Every wireless amateur and every wireless constructor will find these "POPULAR WIRELESS" Blue Prints absolutely reliable. They have been most accurately drawn, and every circuit has been tested under normal broadcasting conditions by the technical staff of "Popular Wireless." It will be seen from the complete list given below that the series covers a very wide field. The veriest tyro will find each print most straightforward to follow and the receivers most easy to construct.

**P.W. BLUE PRINT
Number**

1. DETECTOR VALVE WITH REACTION.
2. UNIDYNE DETECTOR VALVE WITH REACTION.
3. 1-VALVE L.F. AMPLIFIER.
4. CRYSTAL DETECTOR WITH L.F. AMPLIFIER.
5. H.F. (Tuned Anode) AND CRYSTAL, WITH REACTION.
6. H.F. AND CRYSTAL. (Transformer Coupled, Without Reaction).
7. 1-VALVE REFLEX WITH CRYSTAL DETECTOR (Tuned Anode).
8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction).
9. H.F. AND DETECTOR (Tuned Anode Coupling, with Reaction on Anode).
10. H.F. AND DETECTOR. (Transformer Coupled, with Reaction).
11. DETECTOR AND L.F. (With Switch to Cut Out L.F. Valve).
12. DETECTOR AND L.F. UNIDYNE (With Switch to Cut Out L.F. Valve).
13. 2-VALVE REFLEX (Employing Valve Detector).
14. 2-VALVE L.F. AMPLIFIER (Transformer coupled with Switch to Cut Out Last Valve).
15. 2-VALVE L.F. AMPLIFIER (Transformer-Resistance Coupled with Switch for Cutting Out Last Valve).
16. H.F. (Tuned Anode), CRYSTAL DETECTOR AND L.F. (with Switch for Last Valve).
17. CRYSTAL DETECTOR WITH TWO L.F. AMPLIFIERS (with Switching).
18. 1-VALVE REFLEX AND CRYSTAL DETECTOR, with 1-VALVE L.F. AMPLIFIER, Controlled by Switch.
19. H.F. DETECTOR AND L.F. (with Switch to Cut Out the Last Valve).
20. DETECTOR AND 2 L.F. AMPLIFIERS (with Switches for 1, 2 or 3 Valves).

**ALL "POPULAR WIRELESS"
BLUE PRINTS — 6d. EACH**

All orders for these Blue Prints should be sent direct to the "Popular Wireless" Queries Department, Fleetway House, Farringdon Street, E.C.4. enclosing a stamped addressed envelope and a postal order for 6d. for each Blue Print Ordered.

Louden Valves



TWO NEW LOUDEN VALVES

The fact that Louden Valves have to-day become one of the most popular valves in the Kingdom is the most convincing proof possible of their sterling merit and value.

And the fact that they have achieved this popularity in spite of every obstacle thrown in their path proves conclusively that the Public will invariably have what it wants in the long run.

The Fellows policy has always been to give the Public what it wants and at the price it wants, and the enormous support which we have received proves finally that that policy has met with entire approval.

Following this policy we have now introduced two new types of Louden Valve having all the qualities of Silver Clear reception, low current consumption and low cost which have made the Louden so famous. These are the type L.E.R., a 2-volt Dull Emitter Valve and the type P.E.R., a Dull Emitter Power Valve. Details of these new types are given in the list below, which also shows the complete Louden range.

You can only get Louden Valves direct from us or our branches—send for yours at once.

Send for 44-page Illustrated Catalogue Free.

DULL EMITTERS.					
Type.	Filament Volts.	Filament Amps.	Anode Volts.	Purpose.	Price.
F.E.R.1 (6)	6	0.1	40 to 80	H.F. Amplification	9/-
F.E.R.2 (6)	6	0.1	40 to 80	Detection & L.F. Amplification	9/-
F.E.R.1 (4)	4	0.1	40 to 80	H.F. Amplification	8/-
F.E.R.2 (4)	4	0.1	40 to 80	Detection & L.F. Amplification	8/-
L.E.R.1	2	0.2	40 to 80	H.F. Amplification	8/-
L.E.R.2	2	0.2	40 to 80	Detection & L.F. Amplification	8/-
DULL EMITTER POWER VALVES.					
P.E.R.1 (6)	6	0.2	60 to 200	For Transformer Coupled Amplifiers	12/-
P.E.R.2 (6)	6	0.2	60 to 200	For Resistance Coupled Amplifiers	12/-
P.E.R.1 (4)	4	0.2	60 to 200	For Transformer Coupled Amplifiers	11/-
P.E.R.2 (4)	4	0.2	60 to 200	For Resistance Coupled Amplifiers	11/-
BRIGHT EMITTERS.					
F.1	5 to 5.5	0.4	40 to 80	H.F. Amplification	4/6
F.2	5 to 5.5	0.4	40 to 80	Detection & L.F. Amplification	4/6

Postage: 1 Valve 4d., 2 or 3 Valves 6d., 4, 5, or 6 Valves, 9d.

THE FELLOWS MAGNETO CO., LTD.,
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BRANCHES.

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E.P.3. 81.

How the Wuncell defies old age

OLD friends, they say, are best. The longer one uses the Wuncell Dull Emitter, the more one appreciates its many sterling qualities—its supreme sensitiveness—its outstanding ability to produce a wonderful mellowness of tone—its complete freedom from microphonic noises—and, above all, its unvarying high standard of performance.

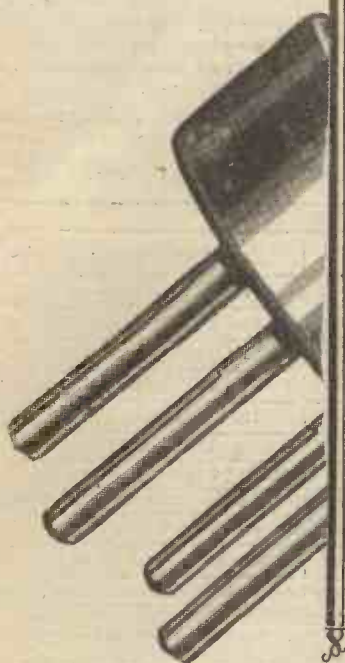
Owing to its unique filament, found in no other valve, the Wuncell is essentially a long-life valve. It is one you can choose with complete confidence, knowing that it will give you a long period of faithful unremitting service. A Dull Emitter, in fact, worthy of the reputation enjoyed by Cossor throughout this country and abroad.

Wuncell superiority is due to two great fundamental features. The first is its triple-coated filament. This filament, instead of being whittled down to the point of fragility in an effort to ensure low current consumption, is built up *layer upon layer* until it is practically as stout as that used in any bright emitter. Yet so prolific is it in electrons that at a temperature of barely 800°—less than the embers of a dying match—the Wuncell is operating at its best. Compare this with the many types of so-called dull emitters which function only when their filaments are at white heat. Because of this special process of manufacture the Wuncell filament is exceptionally sturdy and able to withstand scornfully all the rigours of everyday use.

But the Wuncell filament is only one feature. It would be of little advantage producing a perfect torrent of electrons at a low temperature if the ordinary type of Grid and Anode were employed. In any valve the only electrons of any importance are those reaching the Grid and the Anode. If the ends of the Anode are open a considerable proportion of the electron stream must escape only to be wasted.

For this reason, therefore, the Wuncell utilises standard Cossor construction. Its arched filament functions within a hood-shaped Grid and Anode. Practically every electron given off by its barely-glowing filament is usefully employed.

This greater efficiency—coupled with its triple-coated filament—is responsible for a volume and purity of tone which has yet to be equalled. It is small wonder, therefore, that wireless enthusiasts, disappointed with the fragility and uncertainty of ordinary filaments, have turned eagerly to the Wuncell—the one Dull Emitter which admittedly defies old age.



Types and Prices:

- *W.1. For Detector and L.F. use, 1.8 Volts. Consumption 3 amps. 14/-
- *W.2. (With red top) for H.F. use, 1.8 Volts. Consumption 4 amps. 14/-
- W.3. The Loud Speaker Valve, 1.8 Volts. Consumption 5 amps. 18/6
- *Also in special base with resistance to suit 2-, 4-, or 6-volt Accumulator 16/-

Cossor Valves

Issued by A. C. Cossor Ltd., Highbury Grove, London, N.5

Popular Wireless

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RADIO NOTES AND NEWS.

A Good Relay—High-Power for Hilversum—Ships' Loud Speakers— Broadcasting Rugby?—Chance for British Composers—Koo-Wee-Rup.

Clotted Cream.

ACCORDING to a report in the "Tottenham Herald," the Tottenham Wireless Society has fixed up for some interesting lectures and demonstrations in the near future. The one described as "Clotting of Valve Curves" appears to be the cream of the series.

A Good Relay.

IT is pretty generally agreed that the B.B.C. have never "put across" a better relay than that from Geneva, when the League of Nations speeches were broadcast recently. The speeches were conveyed from Geneva to Paris by land-line, where they were broadcast from the Eiffel Tower. The B.B.C. listening-post at Hayes (Kent) picked up these signals and transmitted them to 2L O, whence they were broadcast in the usual way.

St. George and "The Blue Kitten."

PART of the St. George's Day transmission from 2 L O on April 23rd will take the form of a broadcast description of the British Naval Raid upon Zeebrugge. On the same evening an excerpt from "The Blue Kitten" will be broadcast from 2 L O and other stations.

Those Seaside Airs.

THAT favourite old English song "Summer is Icumen In," has apparently reminded the broadcasting powers—that-be of the need to arrange programmes from the seaside resorts again. The first watering-place to be "visited" by London listeners this year will be Brighton, from where the band of the Royal Marines will be relayed upon April 14th.

Broadcasting Salaries.

HOW much per annum will the bosses of broadcasting receive, under the new scheme recommended by the Government's Broadcasting Committee? There has been a rumour that the chairman and members of the new Commission that will replace the B.B.C. are respectively to receive salaries of £5,000 and £2,000 a year. But these figures are being strenuously denied, though I fancy the influence of the position is comparable to that of a Cabinet Minister.

Hayes and relayed through Daventry to British listeners.

Who Started Hospital Radio?

WHEN I raised this question recently ("P.W.," No. 198), I regret that my recollection regarding Mr. Keble Howard's talk from 2 L O was at fault. His broadcast appeal upon December 29th, 1924, was not to raise a fund for the Royal Sussex County Hospital—that had been done—but was on behalf of every hospital in the British Isles.

No doubt certain hospitals were equipped before this, but a few swallows do not make a summer, and Mr. Keble Howard's was the first universal appeal for this wonderful boon to sufferers.

Waiting their Turn.

A DEPTFORD reader who knocked up the Two-valve Trinadyne described in POPULAR WIRELESS (December 19th, 1925, issue), says: "On completion London was simply deafening, while other stations seemed to be simply hanging on the dial, waiting to come in."

That's the sort of set, where the stations queue up to wait their turn in the 'phones!



2 L O's aerial. The masts of the London station as seen from the Marble Arch.

High-Power for Hilversum.

THE Hilversum station is going to lift up its voice to some purpose in the near future, as it is proposed to erect a 25-kilowatt transmitter there. Its present power is only a fifth of that proposed, but probably in future there will be a fortnightly exchange of programmes between Hilversum and 5 X X. This scheme will start on Monday, April 19th, when the Dutch programme will be picked up at

Ships' Loud Speakers

WHEN the good ship "Remuera" sailed from Southampton last month, she carried a wireless loud-speaker equipment that made the old salts blink their eyes in amazement. It was an orchestra-repeater installation, by means of which music from the ship's band can be reproduced in any part of the ship. If the band has blown itself out temporarily, a grammo-

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

phone can be switched on, and even if all the records give out wireless concerts from shore stations can be picked up and distributed to the various decks or saloons. The voyage to the Antipodes will seem weeks shorter when all the liners get their orchestra-repeaters going.

Broadcasting Rugby Radio?

THOSE Sunday morning talks between this country and the U.S.A., via Rugby Radio, are causing a lot of interest. One proposal is to broadcast them, and without a doubt this step would lead to an appreciation of the Rugby station by the general public. Everyone who reads a radio paper—or even a newspaper for that matter—has learned of the wonders of this great British wireless station, but what the great radio public wants is to hear it handing out the conversation to the States. And why not, after all?

Double-Tongued Announcements.

HAVE you noticed how many of the foreign stations are now arranging for announcements in English, as well as in their native tongue? This year has seen a great increase in the practice, and other popular languages for these alternative announcements are French and German. It's a pity that some of the European stations anxious to be picked up abroad, do not realise that, more than the language used, slow, clear, and frequent announcements are the best means of setting up good DX records.

The Ashes.

ARTHUR GILLIGAN, the great cricketer is a keen radio enthusiast as well as an aspirant for "Ashes." He was present at the Belgrave Hospital for Children recently, when his father, the vice-president of the institution, formally accepted a wireless installation provided by the "Daily News" Wireless for Hospitals Fund.

Mr. Gilligan told the children that he hoped that during the summer they would hear the announcer say, "You will be glad to hear that the English have beaten the Australians at cricket to-day." It certainly would be a far more interesting announcement than that one about the Belgian franc and the Spanish peseta, wouldn't it?

The Loughborough Carillon.

I HEAR that a land-line has recently been laid between the Birmingham station and Loughborough, to connect permanently the B.B.C. offices to the local Carillon Tower. Loughborough Town Council has been approached for permission to broadcast a trial peal of the bells on April 18th.

Chance for British Composers.

ONE THOUSAND POUNDS is being offered in prizes by the B.B.C. for original musical compositions, to be performed at the broadcasting musical festival next autumn. The chief prize of £300 will be for a symphonic work, and there is one £250 prize, two for £150, one for £100, and a final £50 for an original song-cycle for one or more voices.

After all the good music that the B.B.C. has put on the air, they ought to get some good stuff rendered back to them.

Unidyne Tablets.

THE number of applications for free Unidyne tablets exceeded all expectations, and requests are still pouring in. The scheme is so popular that some delay in posting the tablets is inevitable, but every effort is being made to send them to the readers concerned as soon as possible.

Italian Express Equipped with Radio.

FOLLOWING the Cornish Riviera experiments, a wireless train has been equipped in Italy, with excellent results. A Burdett super-het. was used in the express which leaves Rome at 7.30 p.m., reaching Naples at 12.20.

Vienna, Oslo, Berne, Budapest and Daventry were too strong, and the operator had to switch off one valve because these stations were uncomfortably loud.

SHORT WAVES.

"It is again suggested that speeches in Parliament should be broadcast. But don't we already have enough of these bed-time stories?"—*Birmingham Daily Mail.*

"It is essential that money for covering the proposed increased cost of control (of broadcasting) should not be diverted from the programmes. As things are more money might well be spent on them. Too much goes to the Post Office and too little to the B.B.C."—*Mr. Norman Edwards, Editor of "Popular Wireless."*

"Jazz gets on my nerves, and gives me a cold feeling."—*Miss Mavis Bennett.*

"Broadcasting is entitled to use for its own development the revenue which it fairly earns."—*The Nation and the Athenaeum.*

Koo-Wee-Rup.

AN old POPULAR WIRELESS reader who went to Australia some months ago has just written me a very interesting letter from Koo-Wee-Rup. He says: "Nowhere in the world is radio needed more than Australia." On still nights he puts the loud speaker outside to give folk a treat, and people living up to 1½ miles away have enjoyed the concerts. The funny thing is that as soon as he starts up the local crickets start a rival performance; but whether they chirp protest or applause nobody knows!

A Dark Horse.

THE well-known wireless firm Radio Instruments, Ltd., have during the past eighteen months lost about £4,000 worth of goods, and inquiries which were made led to the appearance of John James at the London Sessions. Apparently this John James was not only on the dole, but he possessed a banking-account, a car, a yacht, and a motor-cycle, and moreover he was a man of colour! Evidently the magistrate thought he was a bit of a dark horse, for he sentenced John to twelve months' imprisonment.

Reports on 2 R N.

RECENTLY I asked readers to drop a line to the Irish authorities reporting on the Dublin (2 R N) transmissions. In a letter of thanks the editor of the "Irish Radio Review" tells me there was a large response, reports coming from practically every county in Great Britain. Every letter was acknowledged by post, but further reports from British listeners are

always welcome and useful. 2 R N is now working upon 397 metres.

An Unpalatable Diet.

VISCOUNT WOLMER, the Assistant Postmaster-General, replying to a question re the broadcasting of parliaments, said in the House recently: "I have no official information on the subject, but I have seen reports that the proceedings of the Japanese Diet were broadcast in December last."

I have no official information either, but I'm willing to bet that the Japs were soon fed up with that Diet!

The Acid Test.

MANCHESTER Radio Scientific Society had a warm debate last month upon the comparative merits of transformer and resistance-capacity coupling for low-frequency amplification. The meeting was so evenly divided that a challenge was issued. Each side is to make up an amplifier upon its own principles, and then let the two amplifiers speak for themselves before the Society!

Good idea, that, which other societies might copy. Demonstrate the two in turns from behind a curtain, and let the members vote without knowing at the time which is pushing out the programme.

Good Friday at 5 I T.

"GOOD FRIDAY" is the name of a sacred play (in verse) by John Masefield, which will be broadcast to-morrow from 5 I T by the Birmingham Community Players. The scene is a paved court outside Jerusalem, and the characters include Pontius Pilate and Herod.

Kubelik's Startling Opinions:

THE severe opinions on broadcasting which M. Jan Kubelik expressed to me in the interview published in "P.W." last week, are not shared by many other world-famed artists.

As a matter of fact, the consensus of musical opinion welcomes broadcasting, from every point of view. Here are a few other opinions, which I have collected at random:

Famous Artists Who Disagree.

DAME CLARA BUTT: "I regard broadcasting as a modern miracle. It is a source of constant pleasure to me. So far from being a handicap to the musical profession, I consider it a perfect godsend."

Hermann Lohr: "The broadcasting of worth-while music is . . . an important factor in the musical education of the nation."

Feodore Chaliapine: "Broadcasting is destined to have a tremendous effect upon musical interest everywhere."

Sir Landon Ronald says: "Broadcasting has come to stay. Not all the King's horses nor all the King's concert-givers will kill it or stay its progress."

Decline of the Prophets.

DID you see the recent "Punch" cartoon where the two yokels (and the dog) meet under a lurid sky? The picture was called "The Decline of Local Prophecy," and underneath it said:

"Sky be very bad to-night, Jarge. What do that mean?"

"Can't tell 'e, 'Erbert. 'Us 'll 'ear it on wireless later on!"

ARIEL.

An Automatic All-Range Crystal Set

The Set designed and constructed by the "P.W." Technical Staff.

the .0005 condenser) to the other range of wave-lengths (also tuned by the same condenser), all that is necessary is to make or break the contact between the tapping at 40 turns and the bottom vane of the condenser.

It can easily be appreciated that if this latter is the moving-plate half of the condenser, the contact can be arranged so that during one half of the revolution of the dial the condenser is connected across the 40-turn section of the tuning coil.

The 110 turns are then shorted to earth by the sliding contact, and the condenser can be rotated from, say, 0 to 180 degrees, whilst this shorting contact slides from one end to the other of the metal plate concealed beneath the condenser dial.

Ordinary Components Used.

If the condenser is rotated still farther in the same direction, the spring contact will slip off the plate at 181 degrees, and the shorting connection will be broken. Then the whole of the tuning coil will come into play, until the condenser dial reaches 0 again.

In the first case the receiver would act as though it had only a 40-turn aerial coil, enabling it to tune from about 300 to 500 metres. Then by merely turning the control knob round further, the tuning range will suddenly be increased by an extra 110 turns, and the set will reach up to the 5 X X wave-length (1,600 metres).

Once having grasped the idea upon which the tuning is carried out, the constructor will turn with zest to the actual construction of the set. The list of components necessary is given on this page, and it will be seen that beyond a small piece of springy metal for the spring contact, and an old condenser vane or similarly shaped flat piece of brass or other good conductor, only ordinary components are required.

The tuning coil is preferably a home-made spider-web coil of 150 turns, tapped at the 40th turn. Any other 150-turn coil will do instead, provided it can be accommodated inside the case, but if a spider-web coil is used it should be made on the double-wound principle in order to economise in width. (That is to say, that instead of winding in and out of every slot, alternate slots should be missed, thus reducing the over-all dimensions of the finished coil.)

When the tuning coil has been made and tapped at the 40th turn, the panel is marked out and drilled as shown in the drilling diagram.

Now it must be noted that the variable condenser must have a free movement throughout a whole 360 degrees. Therefore it must not have end stops or have peculiarly

LIST OF COMPONENTS.		s.	d.
1 Panel, 6 x 6 x 1/8 in.		1	6
Cabinet (about)		4	0
1 "J.B." .0005 variable condenser		7	0
1 Burndept crystal detector		4	0
1/2 lb. 28 S.W.G. D.C.C. wire		1	5
1 Spider-web coil former		4	
4 Terminals (W.O. type)		6	
Condenser plate, screws, transfers, small piece of spring brass, etc.		2	0

shaped vanes. The standard J. B. (not square law) is quite suitable for the purpose.

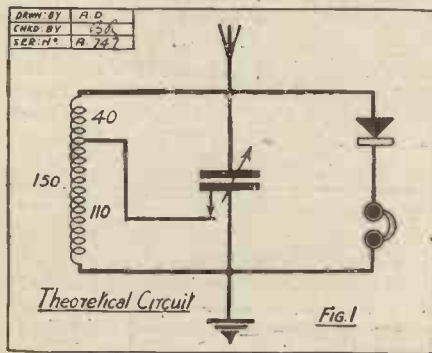
The condenser vane or brass sheet (whatever is used) should be fastened to the panel by means of those brass screws, one of which should be allowed to protrude so that a connection can be taken to it. The other two should be cut off close to the panel.

Their heads must be countersunk and filed down fairly flush, although the contact



THE little receiver described in this article can almost be said to be revolutionary in design. Impartial experts who have examined it declare it to be a one hundred per cent. combination of simplicity and efficiency. Readers will, we hope, agree that a crystal set which brings in Daventry and the local station on one revolution of a condenser dial, and that without the aid of switches, loading plugs, plugs and sockets, or even terminal "wangles," is the broadcast receiver for family use.

And all gadgets of the aforementioned nature are dispensed with in the set under consideration, and the mere turning of the one control knob automatically switches from long to short, and short to long waves.



This operation is carried out by the condenser in addition to its ordinary function, which is to tune the receiver to the particular station that is within range, whether this is the local station (short waves) or 5 X X (long waves). At first sight it is difficult to see how this can be accomplished, but the photograph on this page shows the secret at a glance. Underneath the dial a metal plate is fitted on to the panel, and the rotation of the control knob causes a spring either to make or break contact with the metal plate, thus enabling the dial itself to be used as a switching or short-circuiting device.

How the Set Works.

To understand the action of the set the reader is referred to the theoretical diagram of connections, which is given above. It will be seen that to make the change over from one range of wave-lengths (tuned by



Showing the simple mechanism of the neat little receiver.

strip should be so cut and bent that it rides over an arc that clears them.

Having mounted the variable condenser the spring contact should be fashioned. This fits on the spindle as shown in the photograph, and is situated between the nut and dial. A spot of solder on the point of contact makes for easier adjustments, and with just a little care perfect contact will be given and the presence of anything mechanical under the dial be absolutely unknown to all but the constructor.

(Continued on next page.)

ALL-RANGE CRYSTAL SET.

(Continued from previous page.)

The exact position of the arm in respect of that of the zero dial reading is not of great importance, as a little thought will show, for it will be impossible to miss obtaining the two ranges as long as a good, continuous contact is made with the plate.

The wiring diagram shows how the connections are made, and when completed the connections should be checked over from the point-to-point description.

POINT-TO-POINT CONNECTIONS.

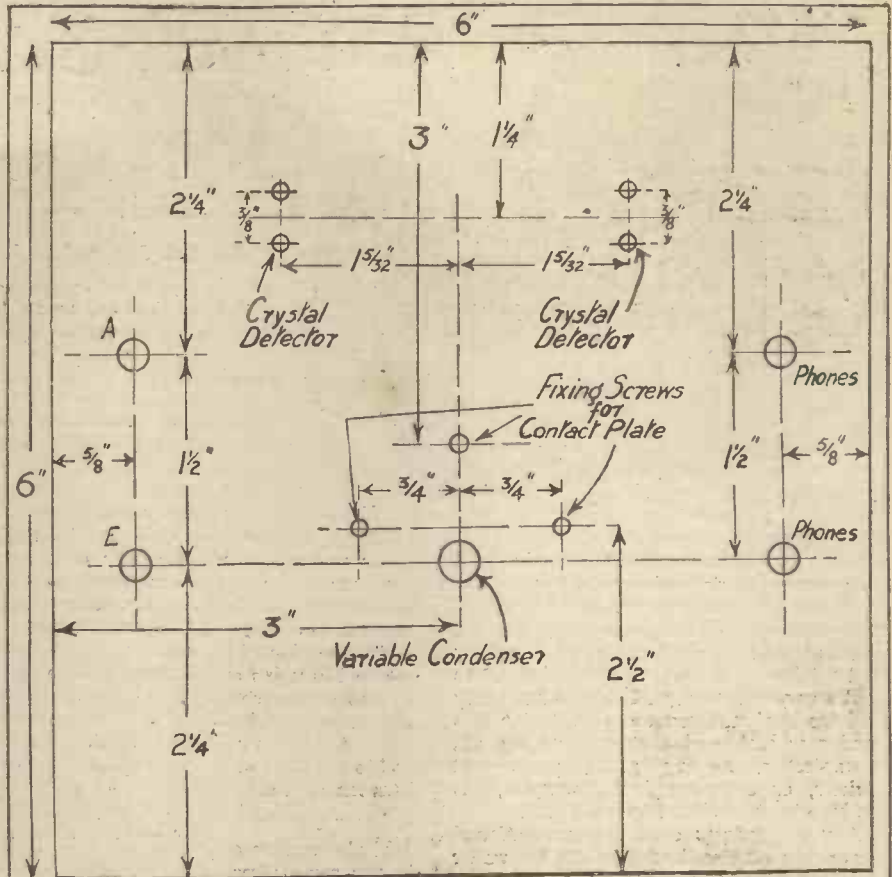
Aerial terminal to fixed plates of variable condenser, inside connection of 150-turn coil, and one side of crystal detector, other side of which is connected to one 'phone terminal. Earth terminal to other 'phone terminal, moving plates of variable condenser and outside connection of 150-turn coil.

The tapped 40th turn of the 150-turn coil is taken to the contact plate on the face of the panel.

Any form of crystal detector will give good results, the operation of this part of the set being absolutely normal.

Mysterious Change Over.

When tested out, the original model gave excellent reception of London and Daventry, and the two programmes were quite as well separated as by the ordinary single circuit crystal set, employing plug-in coils. The mysterious, silent manner in which the local station fades off and Daventry comes in is bewildering in its smoothness in view of the wide difference of their wave-lengths.



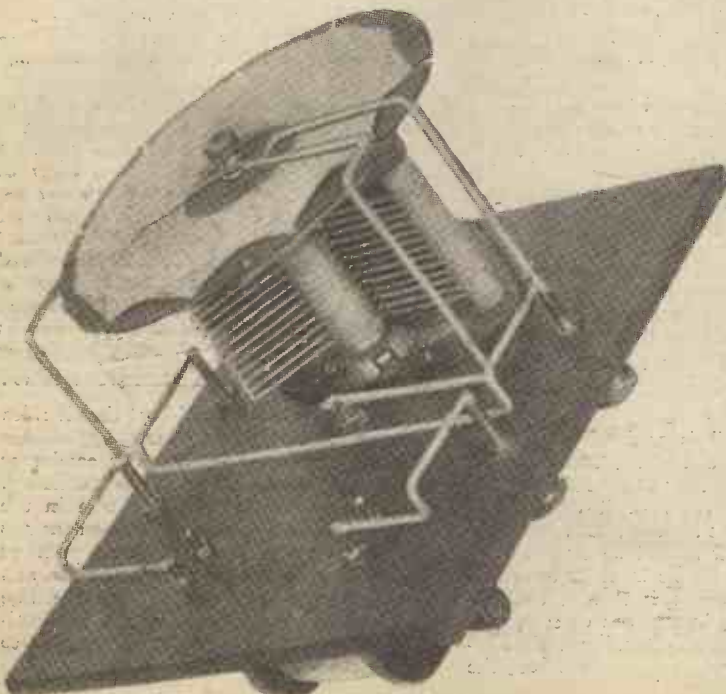
DRWN: BY	A. D.
CHRD: BY	A. D.
SER: N°	A. 748

Drilling Diagram: (Front of Panel)

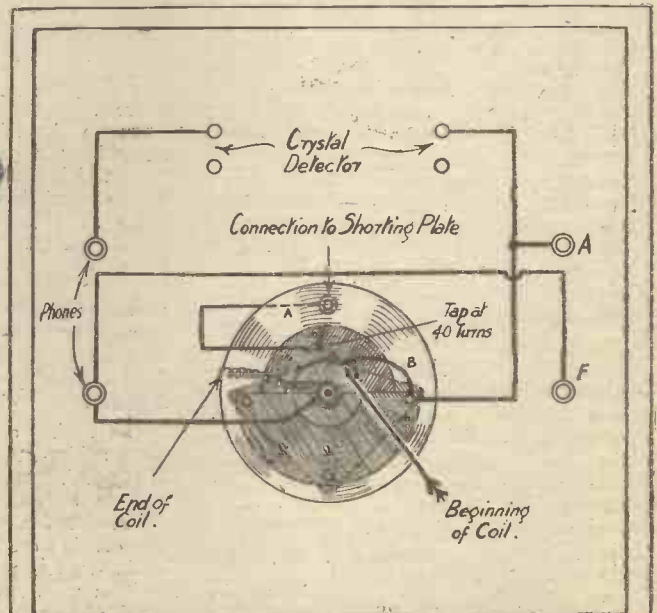
FIG. 2.

Naturally, while Daventry was relaying the London programme, it was hard to tell the one from the other without referring to the position of the dial and the shorting contact behind it.

In conclusion, we trust constructors, after having built and tested the "P.W." Automatic, will agree that it is as efficient in actual operation as it is novel in design.



Note in the photograph how the coil is fixed in position. Its centre is held firmly by the centre terminal of the variable condenser.



Note: The Coil is supported by the Condenser as shown by dotted lines A & B.

DRWN: BY	A. D.
CHRD: BY	A. D.
SER: N°	A. 749

Wiring Diagram

FIG. 3.

BERLIN'S AERO RADIO STATION



By Our Correspondent in Berlin, Dr. ALFRED GRADENWITZ.

TWO slender tapering wooden towers carrying between them four parallel wires have for some time been a conspicuous feature of the Tempelhof Field. They are the antenna system of the wireless station recently installed by the Telefunken people in connection with Berlin's new aerodrome. On closer inspection, four

of the four-wire T-antenna, 40 metres high and 85 metres long.

Regular Weather Bulletins.

The large switchboard is seen on the left of the transmitter proper, which on all sides is lined with wooden panels, thus excluding any risk of touching, during operation, any current-carrying parts.

The additional telephone amplifier arrangements are mounted on the wall to the right of the transmitter. The receiver plant, as well as the microphone for operating the transmitter in the case of telephony, and the key for telegraph service, have been installed on the receiving table.

The transmitter has been designed for a range of 500 to 2,000 metres, five wave-lengths out of this range being in connection with the telegraph service adjusted for by means of simple switching manipulations. While the same wave range could be used for the telephone service, the radio experts of the aeroplane harbour have preferred adopting a single wave-length (900 m.) for telephony.

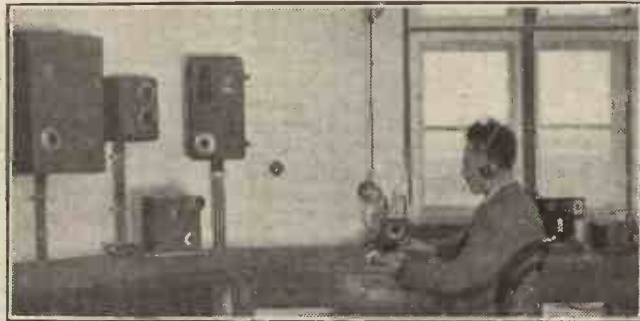
The transmitter will be worked very

hard as soon as all air routes starting from or passing over Berlin have been concentrated on the new aeroplane harbour. In fact, there are weather bulletins to be transmitted several times a day to all other aerial stations within the range of this one (i.e. within a distance of 1,000 km.); the starting and arriving times of aeroplanes have to be transmitted or received, orders for passengers' seats have to be booked, etc.

Controlling Aircraft.

Another wireless plant of great importance for the safety of trans-Continental flights is shortly to be erected in the vicinity of this station, viz. a set of several wireless compasses, designed on the Telefunken system, and installed at several kilometres apart, which is intended to transmit bearings to aeroplanes arriving at or starting from the aerial harbour, and to transfer to them useful indications on the weather and the necessities of aerial navigation, especially in foggy weather.

This latter station will prove of immense value to all aerial navigators, and by its aid it will be possible to carry on air communication when visibility is extremely bad, low clouds making flying a precarious business. It would render it unnecessary for the air pilots to drop below the clouds to see where they were, accurate bearings and flying directions being transmitted to them while they were on their journey, possibly above the bad weather.



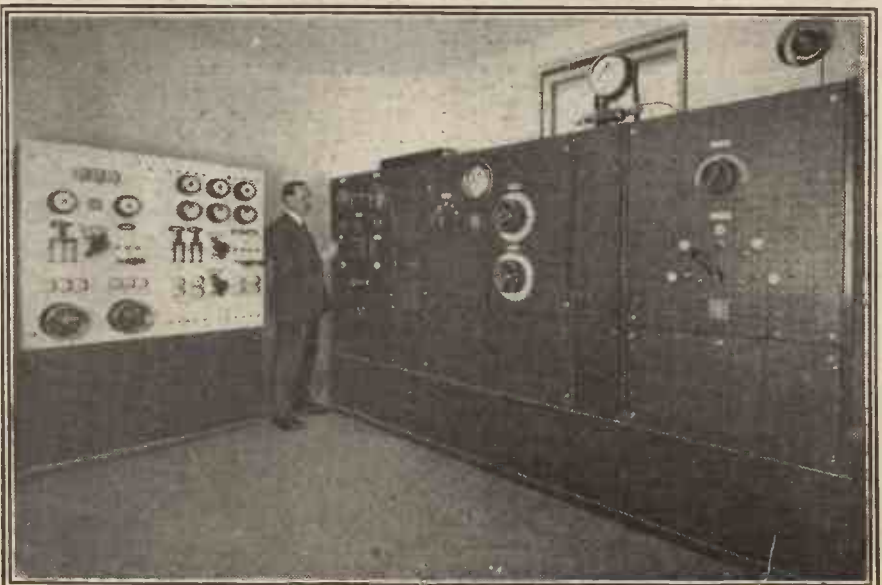
The receiving station at the new Berlin Aerodrome.

vertical wires, starting from the horizontal ones, are seen to disappear in the rear of a small octagonal building situated immediately behind the two towers and carrying on the top a small look-out tower. This is the transmitting post of the new aerial harbour.

Six rooms are arranged around the steep winding staircase leading to the look-out. One of these comprises the two converters, used to operate the transmitter and changing the three-phase current supplied by an overhead conductor to single-phase alternating current of 500 cycles and 220 volts. The large converter has an output of 5 kw., and generates the operating current of the transmitter, while the small converter has an output of 3/4 kw., and supplies heating current for the rectifier, transmitter, and telephone tubes.

The Transmitting Section.

The transmitting, receiving, and telephone plant proper is installed in the second room. An intermediate-circuit tube transmitter of 2 kw. direct output and 1.5 kw. intermediate-circuit output is used, and is sub-divided into three sections: 500-cycle alternating current is in the rectifying and tube section transferred into 10,000-volt. continuous current by two valve tubes, and after being converted to high-frequency energy, is supplied to the second section of the transmitter, viz. the intermediary circuit intended to prevent the emission of any upper harmonics, and eventually to the third section, viz. to the tuning circuits



Part of the transmitter, showing the switchboard and control panels.

THE Marconi Wireless Telegraph Co., Ltd., have recently issued a somewhat startling advertisement warning the public generally, and the amateur constructor in particular, against any unauthorised use of the Company's patent rights.

The paragraph which specially concerns the ordinary home constructor reads as follows:—

"As far back as 1922 the Marconi Company placed at the disposal of the bona-fide experimenter or amateur the use of their patents. Whilst the Company has no intention of withdrawing this, they cannot consider persons who make up receivers at home merely for the purpose of obtaining amusement from the broadcast programmes as 'experimenters,' and therefore the concession referred to above is not applicable to them."

The italics are ours and their precise significance is dealt with more fully below.

A Legal Monopoly.

The announcement further states that the Company desire to safeguard the interests of the legitimate trader "who has not only to pay royalties but also to bear the cost of heavy overhead manufacturing charges."

Finally, whilst the Marconi Company is indifferent as to whether a wireless receiver is purchased complete, or in component parts for subsequent assembly at home, it maintains that patent royalties are equally due in each case, and declares that it will enforce payment by taking legal action if necessary.

It must, in the first place, be admitted that a patentee—presuming his patent to be a valid one—occupies a peculiarly strong legal position. So long as his patent is alive, the law gives the inventor a very strict monopoly (subject only to certain definite limitations), over the manufacture, sale, and use of the protected apparatus or circuit.

From this point of view, therefore, the Marconi Company is within the strict letter of the law in treating the amateur constructor who builds a valve set using reaction, grid-leak rectification, or any other feature covered by the Company's patents, as a trespasser upon their preserves.

At the same time, however, they appear to be somewhat inconsistent in their attitude towards the public. They admit having given, "as far back as 1922," permission to the "bona-fide experimenter or amateur" to use the patents in question. The inclusion of the words "or amateur"—a term which is usually held to include anyone sufficiently versed in wireless practice to be able to construct a wireless set—is important for the following reason.

The Position of the Experimenter.

One of the specific exceptions which the law makes to the scope of the patentee's monopoly rights, is that in favour of a bona-fide experimenter. It was never intended that the monopoly rights given to any individual patentee should bar the road to further progress in the same field of invention.

The point is put very clearly in the following dictum of the late Sir George Jessel, Master of the Rolls:—

"It is no actionable invasion of a patentee's rights for another person to

PATENT ROYALTIES.

The Position of the Home Constructor.

By a BARRISTER-AT-LAW.

use the invention and thereby produce the finished product by way of bona-fide experiment or amusement, without the intention of selling or making use of the thing so made for the purpose for which the patent was granted, but with the view merely of improving upon the invention—or with the view to seeing whether an improvement can be made."

Further:

"Patent rights were never granted to prevent persons of ingenuity exercising their talents in a fair way. If there be neither using nor vending of the invention for profit, the mere making for the purpose of experiment, and not for a fraudulent purpose, ought not to be prohibited."

Progress can only be achieved by building upon the work of others, so that unless we are to come to a dead-end, inventors and experimenters must necessarily be left free to set up and familiarise themselves with the work of their predecessors in the same field of research.

Amateurs Who Sell Sets.

In these circumstances if the Marconi Company's original "concession" in 1922 is to be read as applying only to the bona-fide experimenter, they were in fact giving nothing away. If, on the other hand, by the inclusion of the words "or amateur" the Company originally intended to give a free licence to the ordinary home constructor—i.e. one who builds a set from component parts from his own personal use at home, they have now definitely changed their attitude.

So far as the genuine amateur is concerned, and by this is meant the man who has made a hobby of wireless and likes to build up and try out various forms of "straight" or reflex circuits at home, this change of front as regards the payment of patent royalties will undoubtedly be resented.

The Company may claim that they have made no change of policy, and that it was always their intention that such amateurs should pay royalty fees. As against this, however, they have not so far attempted to enforce payment from amateurs, nor have they—prior to the recent warning—publicly corrected the widespread impression that home-constructors were included in the permission previously quoted.

At the same time, certain practices have arisen against which the Marconi Company have good reason to complain. Take, for instance the case of the "amateur" constructor who builds sets not only for himself, but for all and sundry of his friends. Paying no patent royalties, he is naturally able to sell his home-made receivers at a price well below that at which similar sets can be bought from the local dealer.

This is an undoubted abuse of the

patentee's rights. In addition, it is an unfair form of competition with the legitimate trader. The latter markets his sets openly, and cannot afford to risk an action for infringement by failing to pay the stipulated royalties.

Even if an "amateur" builds a variety of sets for the love of the game, and then gives them away to his friends, he is still in the wrong. Not only is he spoiling the market available to the local dealer, but in doing so he is again depriving the patentee of royalties that would otherwise flow to him.

"Hardly Fair."

There is a further point that must be conceded to the Company. Even assuming that they intended in 1922 to give a free licence to the home constructor to use the patents which they then held, it would hardly be fair to expect that this concession should apply equally to all the later improvements that have been made, such for example as the superheterodyne receiver.

There is reason in all things. We do not expect the inventor of the latest safety razor or the author of a successful musical comedy to forego their royalty fees, and the wireless inventor is equally entitled to a fair financial return for pioneer work.

The fundamental features of the ordinary "straight" valve circuit, such as reaction and grid-leak rectification, stand on a somewhat special footing. Had the Marconi Company insisted on enforcing their strict legal rights in this respect from the beginning, many things might have happened.

In the first place, the cult of the home constructor would not have grown to its present dimensions. This would have handicapped the wireless industry as a whole, and delayed in turn the full development of broadcasting.

In the next place the Company would in practice have found it an extremely difficult thing to prevent the amateur from building his own valve set from component parts. As regards the valve itself, there are many alternative makes on the market, and the task of detecting infringers of their circuit rights would probably have involved more expense than profit.

A "Patent-Free" Alternative.

Finally, the crystal circuit, in spite of its many limitations, offers a patent-free alternative, and would probably have come into practically universal use, moulding the broadcast system still closer to its requirements than at present.

For this reason it is to be hoped that the Marconi Company will reconsider their decision, and not attempt to enforce patent royalties from the class of home constructor who is content to build a standard type of valve receiver for his own domestic use.

In return, public opinion will be on their side in whatever steps they may take to prevent illicit "amateur" trading, or any other unfair abuse of their patent rights.

NEXT WEEK—

The construction of the

P.W. "Simplicimus Receiver"

will be detailed in full,

This set strikes an entirely new note in design, and is certain to attract considerable attention.

Order Your Copy Now!

IN the previous article on this subject, the problem of eliminating distortion in the microphone and transmitter was dealt with. In the most modern type of transmitter used by the B.B.C. this has been so successfully accomplished that the low-frequency oscillations with which the carrier wave is modulated are almost exactly similar in wave form to the sound waves set up in the studio. This is due to the fact that resonance and unequal amplification are avoided, and the different musical frequencies, which range as we have seen from 30 to 10,000 cycles per second, are present in the modulated carrier wave in

THE PROBLEM OF DISTORTIONLESS RECEPTION.

PART II.

By E. J. WYBORN, B.Sc., A.C.G.I.

set up relatively larger currents than weak signals which only moves a little way up the curved part. With regard to grid-leak rectification, the distortion is increased by the trouble of finding the correct value of the grid leak, so that each accumulation of negative on the grid may leak away just before the arrival of the next. Even

when the best value has been found for a given frequency, however, it will be wrong for all others and a compromise has to be made.

Distortion in the L.F. Amplifier.

Having successfully negotiated the tuner and the rectifier, with a minimum of alteration from the original wave-form, our low-frequency oscillations reach the low-frequency amplifier which proves the undoing of many an otherwise efficient receiver. It is safe to say that in the case of those really appalling cases of distorted reproduction which we unfortunately come across occasionally, the root of the trouble is in the amplifier, as almost any type of modern loud speaker is capable of giving pleasing reproduction if supplied with an undistorted input and if not overloaded. In reality the laws governing L.F. amplification are comparatively well known, and by the observance of a few simple rules it is possible for everyone to avoid distortion in this part of the instrument.

Dealing with the methods of coupling first, we have the choice of three systems. Resistance coupling is capable of giving

Curve (a) Fig. 1, for example, may represent the fully modulated carrier of, say, Daventry on 1,600 metres, and it will be seen that the carrier covers a wave-band of 170 metres or over five per cent above and below the mean wave-length.

The response curve of a sharply tuned circuit may be similar to (b), and the more selective the circuit, the narrower will be the peak. Now when the carrier (a) is received by the circuit (b) the centre part of the carrier will be received with much greater amplitude than the "side-bands," so that the higher notes will be greatly reduced.

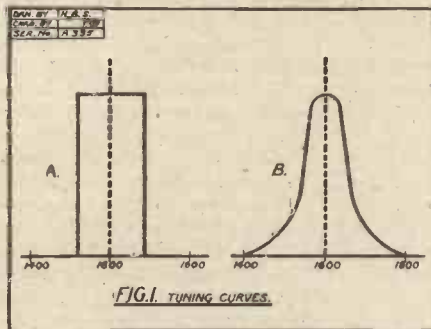
The selectivity of a circuit is increased by reducing its resistance or "damping," and one of the most effective methods of doing this is by coupling a reaction coil to it. When the reaction coupling is increased until the circuit is on the point of oscillation, the resistance of the circuit is very low and its selectivity very great and this is the cause of the "woolly" quality which is usually obtained when a set is on the edge of oscillation.

If a number of fairly selective circuits are used one after another, the selectivity of the whole receiver can be made very great without the loss of the "side-bands," and this accounts for the superiority of multi-stage H.F. receivers, such as the neutrodyne and super-heterodyne, over the simple "detector with reaction." Other sources of distortion on the H.F. side are practically negligible, so that we see that if the rectifier is to be reached without distortion, we should obtain selectivity by the use of several circuits of medium selectivity instead of a single very selective circuit. In the case of a near-by station, the problem is, of course, not so important.

Distortion Due to Rectification.

That grid-leak rectification introduces distortion is generally recognised, but many experimenters are under the impression that a crystal rectifier is distortionless. It can easily be shown, however, that all of the rectifiers in use at the present time introduce a measure of distortion owing to the "square law" of rectification, although in the majority of cases this is small compared to that from other sources.

Fig. 2 shows the current plotted against impressed voltage for a typical crystal of the galena-cat's-whisker type, and owing to the upward bend of the curve loud signals which will run up on to the straight part will

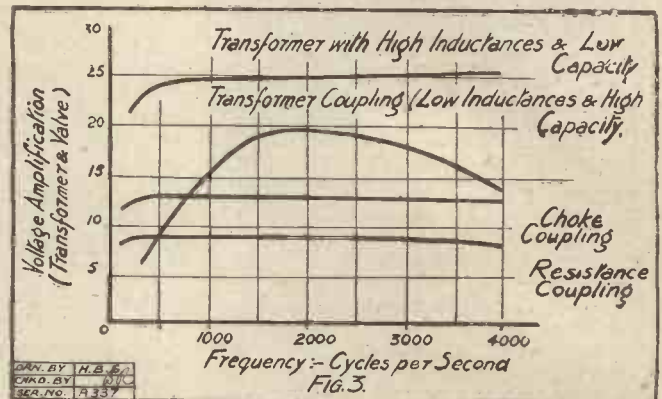
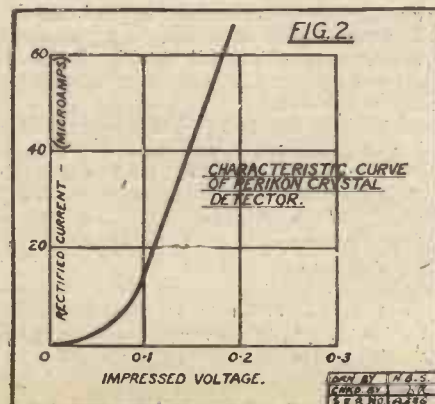


the same ratio as they occur in the sound waves.

When we come to the receiver and loud speaker, however, we find that progress, although very considerable, has not reached the same high standard as in the case of the transmitter. The problem may be divided into four stages—tuning and high-frequency amplification, rectification, low-frequency amplification and finally the conversion into sound energy in the loud speaker—the last being easily the most difficult of all to accomplish without distortion.

Tuning and H.F. Amplification.

The principal cause of distortion on the H.F. side lies in the diminution of the very high notes owing to excessively sharp tuning. A glance at Fig. 1 will make the cause of this clear. The low-frequency oscillations which are impressed on the carrier wave may cover the whole range from 30 to 10,000 cycles per second, so that the actual frequency of the modulated carrier wave is not sharply defined like that of a pure C.W. wave, but covers a band of waves which extend 10,000 cycles above and below the normal wave-length.



absolutely distortionless results, but requires an excessively high H.T. voltage, and gives a low magnification per valve. Choke coupling does not require an excessive H.T. voltage, and gives more amplification, and with chokes of high impedance and low self-capacity gives only a diminution of the very extreme upper and lower notes; say, below 250 cycles and above 4,000 cycles per second. Transformer coupling is by far the most popular system, and is also the most varied as regards results.

With the very latest "distortionless" transformers a magnification of 40 per stage is obtainable, and the quality suffers only in loss of the lowest tones, 500 cycles per second and downwards.

On the other hand, with cheap transformers having insufficient primary inductance and excessive self-capacity or magnetic

(Continued on next page.)

THE PROBLEM OF DISTORTIONLESS RECEPTION.

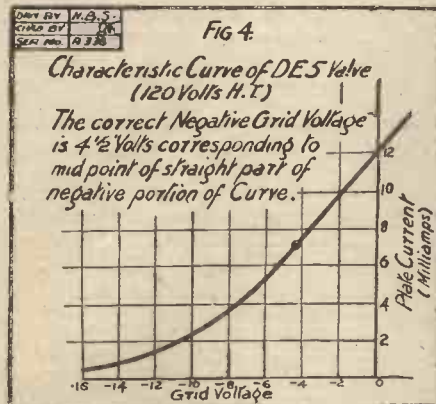
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leakage, the most hopeless distortion is produced. The curves in Fig. 3 show the difference between the performance of a well-designed transformer and that of a cheap, badly designed type, resistance and choke curves being also shown. When it is remembered that 256 cycles per second corresponds to "Middle C," the real significance of the drop at the lower end will be realised.

Apart from the coupling system, the valves must also be considered, saturation and grid current being the two undesirables. Grid current is avoided by maintaining the grid at a negative potential (relative to the negative end of the filament) by means of dry cells connected.

Using a Power Valve.

Saturation occurs when the variations of voltage applied to the grid are so great that the plate current swings right over and off the ends of the characteristic curve. The trouble is avoided by using a power valve, such as the D.E.5, L.S.5, etc., in the last stage, in conjunction with the maximum value of H.T. voltage on the last valve, and the grid negative voltage corresponding



to the mid point of the straight portion of the characteristic curve, which is to the left of the zero line. (See Fig. 4).

The Loud Speaker.

In its passage through the various parts of a good receiver in which every precaution has been taken to eliminate the two dominating evils, uneven amplification and overloading, it is reasonable to suppose that the signal has lost little of its original wave form, and there would appear to be a distinct hope of obtaining really faithful reproduction. This hope is, however, quickly shattered by the loud speaker, which remains the most stubborn of the distortion producers, and although the reproduction of a good loud speaker working off a non-distorting amplifier may sound quite satisfying, a comparison with the original voice or music will quickly show the defects. In all the ordinary types of loud speaker, the governing factor in the reproduction is the diaphragm resonance.

In Fig. 5, for example, is shown the characteristic resonance curve of a loud

speaker of the horned, Stalloy diaphragm type, and it will be seen that notes round about 900 cycles (which is the resonant frequency of the frequency of the diaphragm) are reproduced excessively. There is another resonance at 1,800 cycles, corresponding to a harmonic resonance of the diaphragm, and a third at 2,350 cycles, probably due to a resonance of part of the horn, whilst notes above 2,500 cycles, and below 500 are very inadequately reproduced. This unequal reproduction due to diaphragm resonance is now the chief obstacle to really perfect reproduction, and in the latest super loud speakers it has been largely overcome by means of an entirely new type of diaphragm which is held on a flexible support, so that it moves as a "mass" and not as an elastic diaphragm. The resonance in this instrument is very much less pronounced and is below 200 cycles, so that the very low notes, which receive diminution in the amplifier, are reinforced.

The hornless types of loud speaker in

VARIABLE TUNING-CONDENSER IMPROVEMENTS.

SO many improvements have been made of late in the design and construction of variable condensers, that purchasers and would-be purchasers are often not at all clear what all these variations mean, or what purpose they serve. Two or three years ago the really expensive tuning condenser had semi-circular plates, one knob for control, no gearing, solid insulation, and a dial not more than two inches in diameter. Now every particular has been altered and amended, and neither in external appearance nor action is the condenser of to-day comparable with its predecessor.

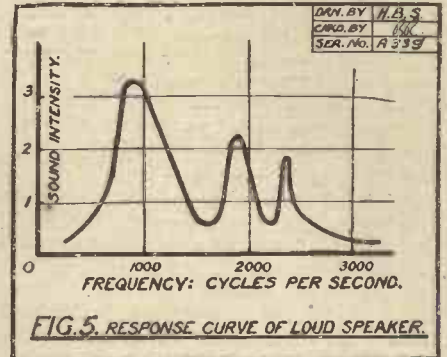
It is not generally realised that the most effective of all these alterations was the simplest and most obvious one—the addition of vernier adjustment. As compared with old-fashioned condensers this constitutes an enormous advance. Square-law and straight-line condensers are theoretically more scientific, but for the man in the street the greatest single improvement in design is the provision of vernier control, which permits of small alterations to the capacity in circuit.

"Vernier" Control.

The original method of providing such control was by means of a separately-adjusted single plate, but this had the disadvantage of upsetting the dial readings, which, of course, varied for any particular wave-length, according to whether the vernier-plate was "all in" or "all out." Furthermore, two control knobs were necessary. A better system was that of geared controls, which allows a large movement of the dial to effect a relatively small movement of the plates. By this method the main plates can be adjusted finely, and there is no need to upset the scale readings.

Apart from gearing, which is comparatively expensive, two other methods of slowing-down condenser adjustments are in general use. The first of these—the use

of extension handles—was really introduced to minimise hand-capacity effects; but it was found to have the additional advantage of giving fine condenser control on account of leverage. It has many disadvantages, including that of being cumbersome, but where the handles are securely fixed to the moving plates and there is no springiness in the handle, the improvement in ease of tuning is very noticeable.



the loud speaker is still the least perfected link of the radio chain, and it is here that further striking developments are to be anticipated.

of extension handles—was really introduced to minimise hand-capacity effects; but it was found to have the additional advantage of giving fine condenser control on account of leverage. It has many disadvantages, including that of being cumbersome, but where the handles are securely fixed to the moving plates and there is no springiness in the handle, the improvement in ease of tuning is very noticeable.

Several variations of this idea have been adopted, such as a worm-drive on the rim of the dial, or a small secondary disc pressed against the main dial-plate and imparting a friction-drive movement. The simplest of the latter devices is the Igranio Co.'s vernier-pencil, which in a few minutes can be fitted to an existing condenser.

The latest dodge, and one which has simplicity to recommend it, is to use a very big dial, say 4 to 6-inches, instead of the small ones previously in use. By manipulating this from its edges a very fine movement can be imparted to the spindle, and there is the additional advantage that the scale is much better displayed, and resetting to any particular adjustment is, therefore, comparatively easy.

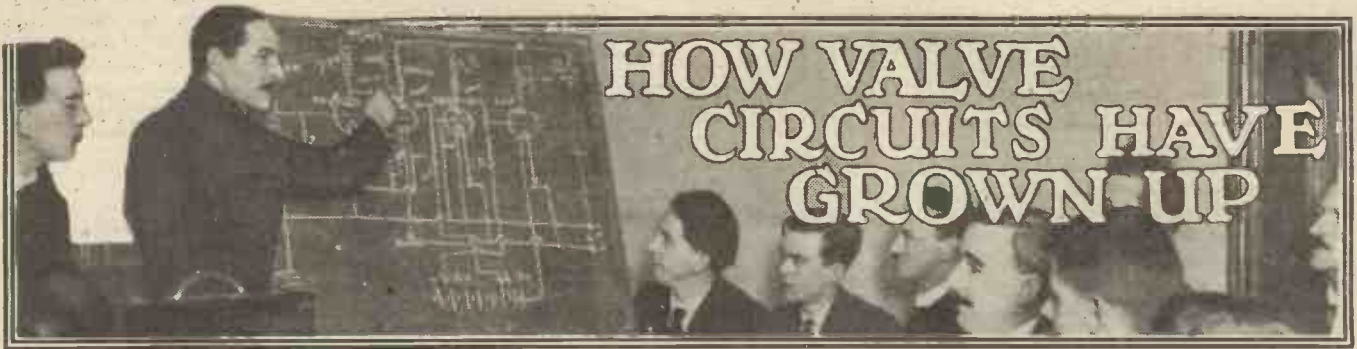
The "Low Loss" Cult.

All the foregoing are eminently practical and useful modifications, depending upon a mechanical improvement in the condenser parts, and in the fact that slow-motion of one kind or another is possible when rotating the moving vanes.

Pages have been written about the wonderful separation of stations on the condenser dial by means of square-law plates, but, after all, this only affects the lower end of the scale, and for any stations which come in at 35 degrees or more the old plain plates are just about as good as the square-law.

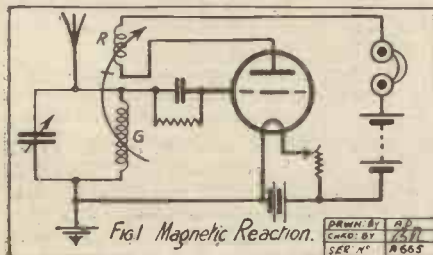
Similarly the straight-line frequency idea has been boosted widely, but the fact remains that whatever may apply in America, most sets in this country can get along quite well without it, which is more than can be said of vernier movement.

Finally, the cult of dielectric-loss is spreading, but when insulation is reduced to a minimum there is no appreciable difference on broadcasting wave-lengths, whatever may be true upon the 20-30 metre band, or lower



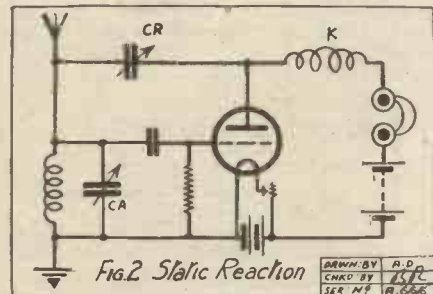
HOW VALVE CIRCUITS HAVE GROWN UP

IN spite of the apparent complexity of modern valve circuits, it will be found upon examination that most of the well-known variations are, in fact, derived from the ordinary standard circuit simply



by ringing the changes upon the method of feed-back or reaction.

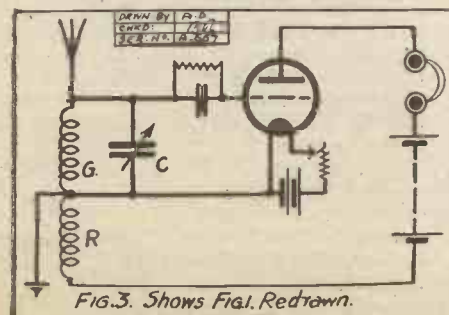
As showing the importance of this principle, it may be mentioned that for nine years before the discovery of reaction, i.e. from 1904 to 1913, the valve was very little used outside the laboratory. Since that time, however, it has developed so



rapidly that it now dominates the whole of wireless practice.

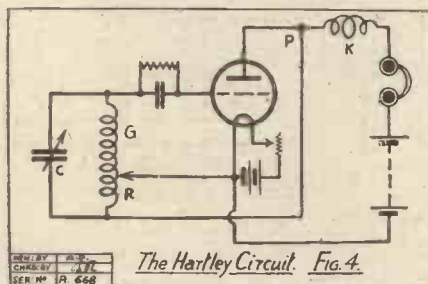
There are two standard ways of applying reaction to a valve. In the magnetic coupling shown in Fig. 1, the plate or output circuit is linked to the grid or input circuit G by the coil R, energy being transferred by the inductive action of the magnetic lines of force from the coil R.

In the electrostatic coupling shown in Fig. 2, the necessary transfer of energy from



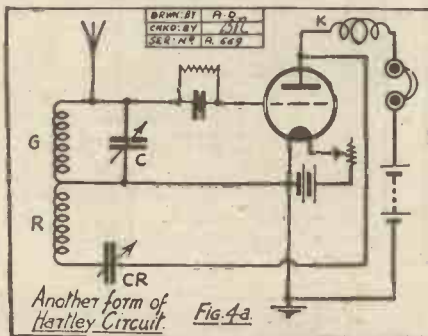
By **SEXTON O'CONNOR.**
Here is an article which will tell you more about the development of valve circuits in fifteen-hundred words than most text books tell you in fifty thousand.

the plate to the grid circuit takes place across the coupling condenser C R. It will be noticed that a choke coil K is inserted between the 'phones and the plate. This is not always necessary, except for short-wave working, because the impedance of



the telephones is usually sufficient to prevent the high-frequency oscillations from being shorted through the H.T. battery.

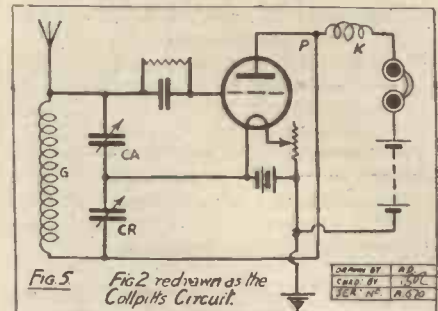
It must, however, be borne in mind that no voltage variations will be set up across the coupling condenser C R unless the plate circuit contains impedance in some shape or form. For high-frequency work, therefore, where the impedance of the



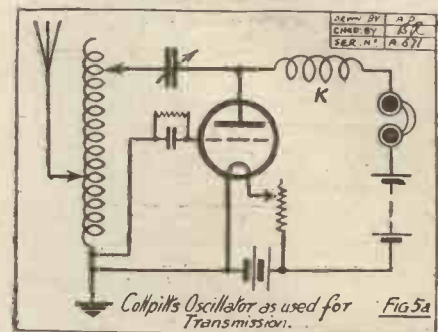
telephone becomes negligible, it is necessary to insert a choke coil as shown, in order to secure an appreciable back-coupling effect.

It is clear that Fig. 1 can be redrawn in the form shown in Fig. 3 simply by bringing back the plate coil R and auto-coupling it to the earth side of the grid coil G, without affecting the functioning of the different parts. Now, if the reaction coil is incorporated into the tuned circuit, by branching

the condenser C across both the coils G and R, we get the arrangement shown in Fig. 4, which is the well-known Hartley Circuit.



As in the case of Fig. 2, a choke coil, K, has been added for the purpose of diverting the high-frequency feed-back currents through the shunt lead from P into the reaction coil R, and blocking the by-pass through the 'phones and H.T. battery. The choke K has, of course, no appreciable effect upon the rectified components which



pass through into the 'phones in the ordinary way.

The Hartley Circuit is also sometimes set up in the form shown in Fig. 4 A, where the grid tuning condenser C is branched across only a part of the inductance instead of the whole, and the feed-back energy flows through the condenser C R and coil R in series.

The Weajant Circuit.

Reverting back to the standard circuit of Fig. 2, this can be redrawn in the form shown in Fig. 5, the back-feed from the plate to the input now passing through the branch path from P through the coupling condenser C R, the choke K, as before, preventing this energy from being shorted through the 'phones and H.T. battery. The condenser C A tunes the input circuit as a whole, whilst C R regulates the

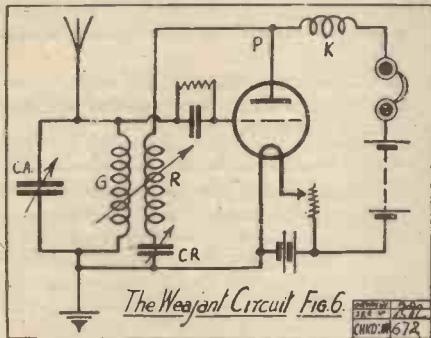
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HOW VALVE CIRCUITS HAVE GROWN UP.

(Continued from previous page.)

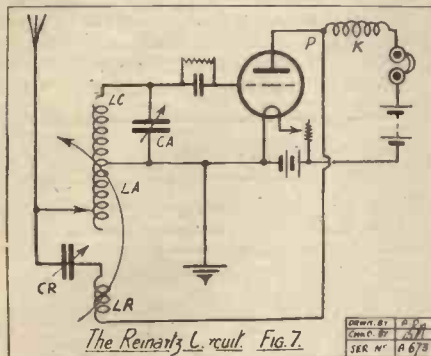
strength of reaction. In this form we have the well-known Collpitts oscillator.

The same circuit will perhaps be better recognised as a transmitter in Fig. 5 A, where the tuning condenser C A has been replaced by using a variable inductance



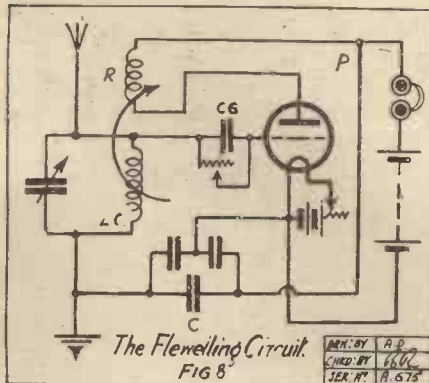
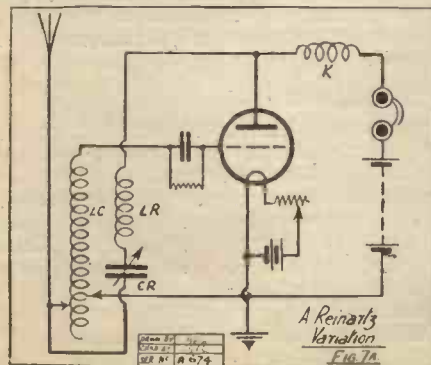
with adjustable tapplings to the aerial and plate, and the feed-back condenser C R has been restored to the position shown in Fig. 2.

Fig. 6 is another familiar variation, known as the Weajant Circuit, and closely related to the Hartley arrangement of Fig. 4a. Here the feed-back circuit comprises an inductance, R, and capacity



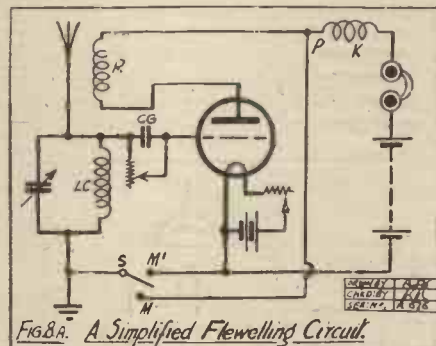
C R, arranged in series. The arrangement may, in fact, like that of Fig. 4a, be regarded as a tuned acceptor circuit, facilitating the flow of the high-frequency currents used for stimulating the input.

This circuit provides a double control of reaction, partly by adjusting the value of the condenser C R and partly through the variable coupling between the grid C



and the coil R. By fixing the two coils relatively to each other, the circuit becomes easier to manage, the condenser C R providing a sufficiently smooth control to ensure a steady building-up of signal strength.

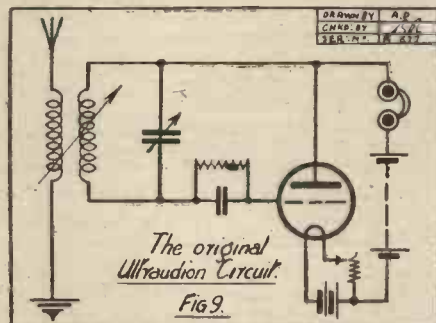
For short-wave work the series condenser C R may be a fixed one, single-control tuning being effected by the condenser C A.



The condenser C R must not be larger than .0005, or it will by-pass some of the audible frequencies.

Reinartz Modifications.

Fig. 7 will be recognised as one of the many modifications of the Reinartz Circuit. The feed-back circuit from the plate starts from the point P and passes through the reaction coil L R (which may either be fixed or vari-



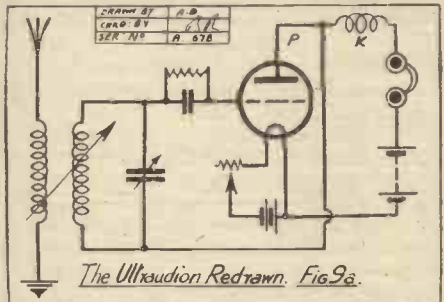
able with relation to the coil L A), and then through the coupling condenser C R and aerial coil L A back to the filament. The aerial currents flow through the coil L A to earth, and induce signal voltages on the closely-coupled grid coil L C.

Another variation of Reinartz is shown in Fig. 7a, the tuning condenser C A being replaced by a tapped inductance coil. The close resemblance to the Weajant Circuit of Fig. 6 is perhaps even more clearly noticeable in this case than in Fig. 7.

The Flewelling Circuit shown in Fig. 8 involves a different principle from any of

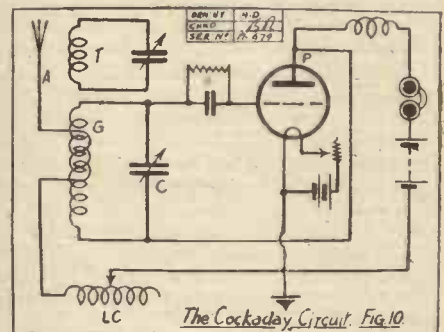
the circuits considered so far. It is closely akin in action to the Armstrong super-regenerator, where abnormal amplification effects are secured by "triggering" the grid—i.e. keeping the valve as a whole constantly on the verge of self-oscillation without letting the system "boil over."

In the Armstrong Circuits the necessary balance "on the verge of oscillation" is maintained by means of a rapid quenching frequency, introduced either by a separate valve or by a double system of back-coupling the grid and plate circuits of a single valve.



In the Flewelling Circuit the same result is obtained by charging and discharging the grid condenser at a sufficiently rapid rate. When the grid condenser is sufficiently negatively charged, the valve cannot oscillate. As the grid charge escapes, the valve approaches oscillation, but is again damped down, or paralysed, by a succeeding negative charge upon the grid.

The energy necessary to charge the grid is derived from the shunt path P from the



plate, Fig. 8, through the bank of condensers C. From one point of view negative H.F. pulses of electricity may be considered as flowing down the lead P to the condenser C, from which some reach the grid through the condenser C G. The negative charge so applied leaks away in a period of time that is determined by the resistance of the adjustable grid leak, giving rise in this way to the intermittent quenching necessary to obtain the super-regenerative effect.

The Famous Ultra-Audion.

The bank of condensers C may, in fact, be dispensed with, as shown in Fig. 8a, the negative charging of the grid from the plate circuit taking place through the grid condenser C G. In this form we see that the Flewelling Circuit comprises a combination of the usual magnetic coupling through the coils L C and R, and an electrostatic coupling through the path P to the grid condenser. The circuit shown in Fig. 8a can, in fact, be converted to an ordinary back-coupled detector simply by moving over the switch S from M to M I.

(Continued on page 258.)



CRYSTAL CHATS

By J. F. CORRIGAN, M.Sc., A.I.C.

(Staff Consultant.)

No. VI. FERRO-SILICON.

A LITTLE over a year ago a considerable sensation was caused in radio circles—and particularly among members of the crystal set owning fraternity—by the announcement that two French experimenters had succeeded in obtaining reception over distances of 300 miles, reception which was reported to be perfectly constant in nature and not to be considered in any respect as being freakish.

The name of the crystal which these experimenters employed was ferro-silicon, and, according to many daily journals, the star of the crystal user had become very much in the ascendant. England was to become forthwith a nation of crystal users. Valve sets were to be scrapped wholesale, and there was going to be the very dickens to play in the matter of valve manufacturers' shares. And all through the universal use of ferro-silicon.

A Valuable Rectifier.

Unfortunately, however (or fortunately, as the valve makers will say), this state of affairs happened not to come about. Ferro-silicon was tried by many amateurs. They got excellent results from it, but certainly the results were in no way extraordinary. No one ever got America with a ferro-silicon crystal. In fact, for distance-sensitivity the newly boomed material was hardly up to the high standard which is maintained by the well-known brands of proprietary galena.

Nevertheless, ferro-silicon has proved to be a welcome addition to the rectifying materials available for the use of the crystal amateur, and there is no doubt that in many respects it possesses properties which make its use for certain classes of crystal work of considerable value.

Ferro-silicon belongs to a large class of alloys which are now being commercially produced in ever-increasing quantities for various industrial purposes. For instance, silicon steels possess very hard-wearing properties, and the addition of silicon to many other alloys renders them highly resistant to the corrosive effects of acids.

Preparation of Ferro-Silicon.

In its purest form, ferro-silicon is made by heating varying mixtures of iron and silicon in an electric furnace. The percentage of silicon in the alloy is varied considerably according to the purposes for which the finished product is required. Ferro-silicon alloys to be radio-sensitive must, however, contain at least 60 per cent. of silicon.

In appearance, ferro-silicon is not unlike ordinary silicon. It is perhaps bluer and more metallic in shade, and it possesses a

far brighter and more resplendent appearance than that of the unadulterated silicon.

Ferro-silicon is very light. It is hard and non-brittle, although, with regard to the former characteristic, it is not as hard as pure fused silicon, and it will not scratch glass.

For crystal reception a piece of ferro-silicon will give good results when used with a length of fine wire. Almost any metal will do for the wire. As a perikon rectifier,



A good example of radio-active ferro-silicon.

ferro-silicon will work in conjunction with zincite, galena, and various pyrites minerals, especially iron pyrites. These contacts do not require the use of any additional local potential.

Extremely Stable Detector.

Many radio dealers do not stock ferro-silicon, but the material can readily be obtained from any firm of crystal specialists, or from any concern of manufacturing chemists, one of which is to be found in almost every large town in the kingdom.

Ferro-silicon is an interesting rectifier, particularly as it will rectify when employed in firm contact with various alloys. Of course, as such, its use will appeal more to the crystal experimenter than to the ordinary crystal set user, but nevertheless, even for the most everyday routine purposes of crystal reception, a sensitive lump of ferro-silicon will form a stable and reliable rectifier, provided the distance of reception is within reason.

For the experimenter, however, ferro-silicon may be used in contact with many miscellaneous materials. Alloys such as

aluminium bronze, Delta metal, ferro-aluminium, ferro-manganese, magnalium, platinoid metal, all give interesting results with the material.

In passing, it should also be noted that the alloys ferro-aluminium and ferro-manganese both possess rectifying properties, and that there is very great scope for experiment with these materials in this direction.

Any of these alloys, if initially insensitive, can often be made to acquire sensitive properties by heating for a prolonged period to as high a temperature as possible and then by allowing the mass to cool down slowly. Treatment in this manner, besides altering the physical nature of the alloy, tends to increase the relative proportions of the silicon content owing to the oxidation of the metallic constituent.

Need for Investigation.

Contacts between ferro-silicon and other alloys, although they may not be radio-sensitive when used under ordinary conditions, often become sensitive when they are employed with a local E.M.F. passing through them. It may perhaps be a matter of interest for the crystal experimenter to plot out the characteristic curves of various rectifying contacts consisting of ferro-silicon and other alloys and minerals. This can be done in the usual way by means of a battery and potentiometer (see textbooks for exact details), and the results so obtained will be very instructive, not only to the experimenter himself, but to the whole radio technical world in addition.

Very little investigative work has been done in the matter of ferro-silicon contacts, and therefore the seriously minded crystal amateur will find a particularly effective sphere for his activities in this direction.

FERRO-SILICON.

Composition.—Alloy of silicon and iron.

Composition varies.

Appearance.—Steel-blue colour. Bright metallic appearance.

Characteristics.—Very light. Hard and non-brittle. Does not oxidise or tarnish.

Radio sensitivity good, and is well retained.

Best contacts.—Brass or steel. Also zincite and iron pyrites.

Current price (in sensitive condition).—About 1s. per ounce. (Price varies considerably.)

CRYSTAL NOTES.

IF the crystal it is wished to use is one which will deteriorate if heat is applied it must be fixed to its cup by means of one or other of the cold cements and not by Wood's metal. Where a cup having fixing screws is employed it is a good plan to wrap the crystal in tin foil (silver paper), leaving only the upper surface. This procedure ensures an efficient electrical contact between the crystal and its container.

Many crystals of the galena type are unsuitable for inclusion in reflex sets where the rectifier is in the anode circuit of a valve, and in many cases it is necessary to resort to the perikon (two crystal) type of detector. The resistance of the crystal in reflex sets should not be too low or unstability and possible failure may result.



Conducted by our Staff Consultant, J. H. T. ROBERTS, D.Sc., F.Inst.P.

Interesting Short-wave Observations.

AN interesting discussion on some experiments in long-distance short-wave transmission is to be found in "Radio" (South Africa) in the January issue. The matter arises out of an article which appeared in the October number of "QST," the official organ of the American Radio Relay Leagues, by Dr. Hoyt Taylor and Dr. E. O. Hulbert. Many of the practical observations were made by Mr. Sydney Pleas from Johannesburg, receiving from the United States ship "Seattle," which at one time during the test was at Honolulu. It appears from these tests that a receiving station at the remotest part of the earth from the transmitter may receive remarkable concentration of signals: it happens that Honolulu and Johannesburg are almost diametrically opposite. There were two periods of the day when the signals were received with the greatest facility in Johannesburg—one was in the early morning (at the receiving station) and the other in the early evening. When the "Seattle" moved off to Samoa the signals from the ship could not be received at Johannesburg, although signals from the naval station at Honolulu continued to be received. These signals were on a frequency of about 7,500 kilocycles.

Use of Neon Lamps.

The observations also showed that it was possible to receive signals more than half-way round the world. Some of the observations were taken at a time when, for the signals to have traversed the shorter route, namely, via the Atlantic Ocean, they would have had to cover nine hours of daylight, which seems difficult to understand at the wave-length mentioned, and therefore it is presumable that the signals received were those which came via the Indian Ocean, thus travelling considerably more than half way round the world.

I have been asked by a reader of these Notes whether it would be possible to employ a neon lamp for the purpose of charging H.T. accumulators from alternating current mains and also whether the same type of lamp might be used for charging L.T. accumulators. The answer to the first part of the question is in the affirmative, although the success of the experiment will vary very considerably with the conditions. In order to make a neon lamp operate or "flash-over," it is necessary that a voltage somewhere in the region of 140 volts be applied across the electrodes, and if the voltage of the alternating current mains be,

say, 200 volts, it is evident that a 60-volt accumulator opposed against this will only just leave 140 volts to spare, so that the condition would be rather critical. If the flash-over voltage of the lamp plus the voltage of the accumulator be considerably less than the voltage of the mains, the system will work. But it should be remembered that the neon lamp is not in any case an efficient rectifier. Its rectifying property depends upon the fact that the electrodes are of different sizes, and although there is some degree of rectification, it is very far from being complete. In this



The control room of the Ecole Supérieure, Paris, Station, showing the switchboard which is connected to the various theatres and educational centres.

connection, it should also be borne in mind that when the current "reverses" there is the voltage of the H.T. accumulator added to that of the mains, whereas when the current is in the direction to charge the battery, the voltage of the H.T. accumulator is subtracted from that of the mains.

Not Practical.

As to the application of the neon lamp for the purpose of charging L.T. accumulators—this is rather out of the question, for two reasons. In the first place, the ordinary neon lamp is rated at about 5 watts, which on 200-volt mains means a current of about 1/40th of an ampere, and this, of course, is far too small for L.T. battery-charging purposes. Secondly, if an attempt be made to overcome the drawback which is mentioned by using a number of lamps in parallel—which is an idea that naturally occurs to one—the rectification is interfered with and, in fact, it is probable

that not more than one lamp will light up. In other words, it is not a practical proposition to charge L.T. batteries by means of neon lamps of the ordinary kind. It may be noted in passing that even if the lamps did rectify and operate properly carrying the necessary current, the system would still be just as inefficient as that of charging an L.T. battery from direct current mains by inserting a lamp in series to cut down the current, the point being that the current through the battery is drawn from the mains at the voltage very much higher than that which is required, so that something like 95 per cent of the energy drawn from the mains is wasted in the form of heat.

Scope for the Inventor.

In this relation it may be remarked that in connection with the charging of L.T. accumulators from direct current mains of the ordinary high voltage electric lighting type there is scope for the inventor, for at the present time the only practical device for efficient charging is the motor generator (or its equivalent machine) by which the H.T. mains current is used to operate a motor and L.T. alternating current is generated for the purpose of battery charging. The use of a rotary machine is undesirable for several reasons, firstly, because the initial outlay is apt to be somewhat heavy, and secondly, because the wear and tear and depreciation is usually considerable, especially in small machines.

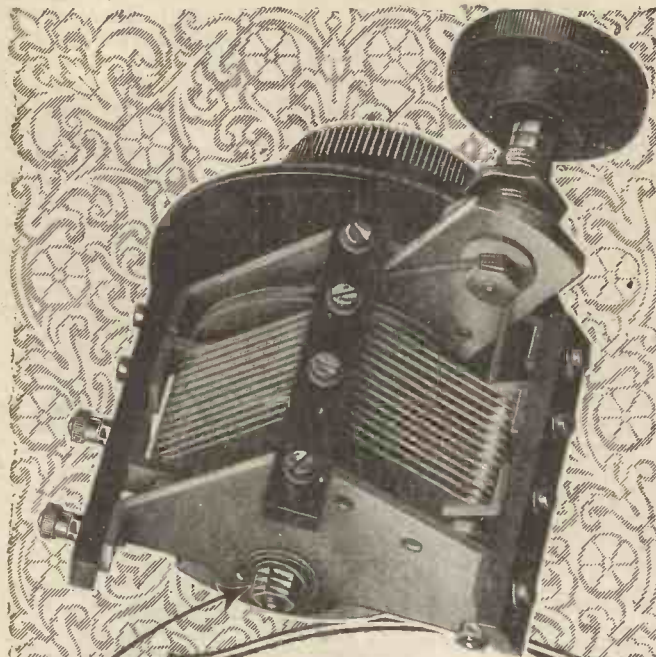
Moreover, a rotary machine requires more attention than a static or non-rotary device.

Loud-speaker Extensions.

It is a very common requirement of the amateur, particularly where the set is to be used by different members of the family, to have some arrangement by which the loud speaker may be put in a different room from that in which the set is located. Owing to the necessity for connecting the aerial and earth to the set, it is usually incon-

venient to move the set about as a whole, but if the loud speaker can be located at a distance from the set, the desired result is obtained. The simple way, of course, is to run an electric light twin flex from the set to the other room in which the loud speaker is to be used, and in many cases this is all that is necessary. Sometimes, however, various troubles are incurred in the process of connecting these twin leads, the chief of which is howling, which is sometimes set up, and the hum from alternating current electric light mains is occasionally picked up and reproduced in the loud speaker. Consequently, it is often necessary to take special means to avoid these two drawbacks. The first—that is, the howling which is liable to be set up—may be prevented by the simple expedient of introducing a transformer between the loud speaker and the output terminals of the set: that is to say,

(Continued on page 238.)



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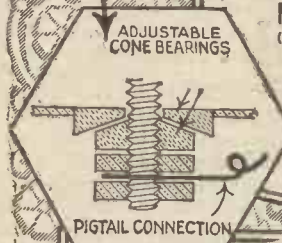
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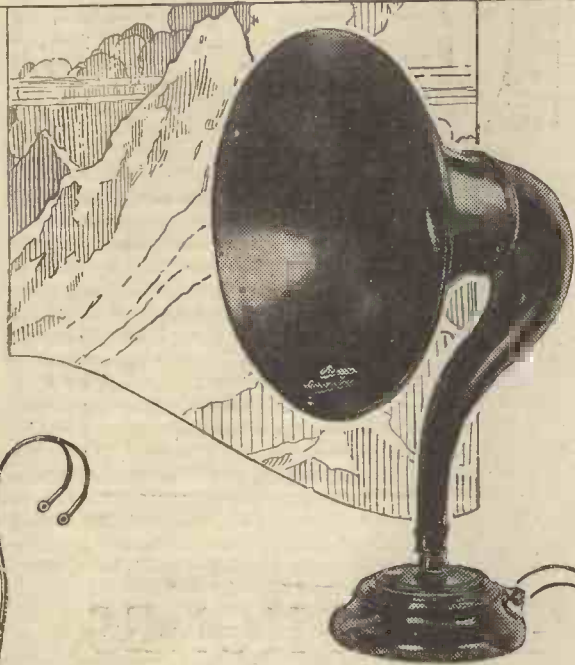
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 Be sure to see the LEW seal
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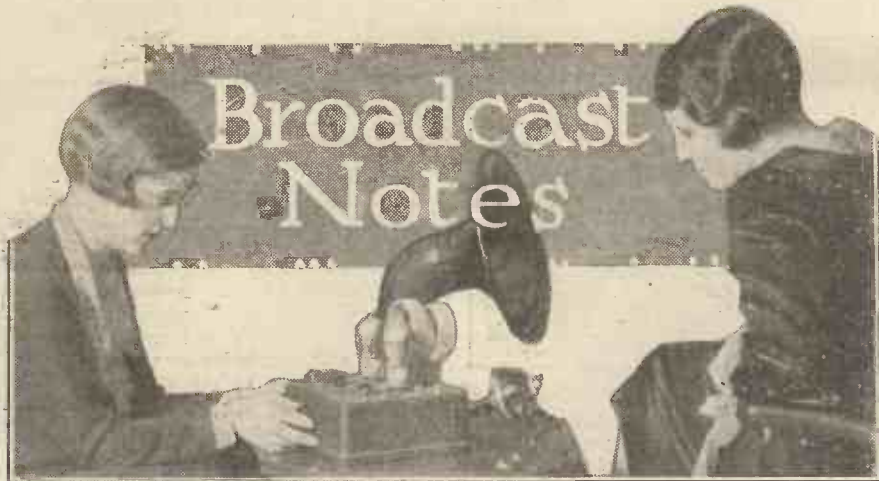
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By O. H. M.

The Future of the B.B.C.—Brightening Up Society Talks—A “Cup-Tie” Final Suggestion—A Public Speaking Contest—Extending Broadcast News Facilities.

OPPPOSITION to the report of the Broadcasting Committee continues to grow. Misgiving is being substituted by signs of active hostility. The pendulum has swung rather too far, and it is necessary to try to restore perspective. For instance, critics of the report who profess friendship for the B.B.C. are now going so far as to suggest that it would be better to have the American system of competition than the Broadcasting Commission. This is a fallacy. There has never been any real argument in favour of competitive broadcasting in this country.

The Future of the B.B.C.

Certainly the B.B.C. are dead against it, nor can I find any competent critics who can really justify leaving broadcasting permanently in the hands of a trade board. There would appear to be sound reasons for the new Commission, provided always that there are adequate guarantees for the continuity of the service with as much latitude for enterprise and initiative as it has at present. It would put an end to all reasonable doubts if it became known that Mr. Reith was to be Executive Commissioner and ex-officio Vice-Chairman of the Commission.

In the end, the vast body of listeners are not much interested in constitutional issues. They like the B.B.C., and they want the programmes to go on as at present. If they felt that the present managing-director was to have the same power and latitude under the new regime as under the old, their fears would be set at rest.

Brightening Up Society Talks.

I am glad to hear that the B.B.C. is taking steps to brighten up the talks provided by wireless and listeners' organisations. It is only right that accredited societies should have occasional access to the microphone. But the first duty of the B.B.C. is to its listeners, many of whom have had some reason to complain of the quality of these provided talks. Some alleged technical talks have been puerile. Other chats have been merely “puffs.” Then again, some of the spokesmen have been quite inaudible.

Now the B.B.C. has issued a circular to all the societies concerned, requiring them to comply with certain conditions. Their talks, to be accepted, must have some definite interest value and must be given by people with proved microphone aptitude. I

hear that some of the societies have taken serious exception to this circular.

But I am sure that a little reflection will convince them that their own interests will be served by the forthcoming tightening-up. While on this subject of wireless organisations, it does seem rather a pity that some of them do not join forces. They would then become really representative and powerful.

A notable broadcasting event is down for April 22nd. This is the secular oratorio “Trevelo,” which will be relayed from the

ends meet. It is satisfactory to know, however, that the release of the funds now in reserve will enable our broadcasters to deal a good deal more generously with authors.

In connection with the Association Football Final, the idea is mooted that the two rival captains should be invited to the London Studio to give their account of the game on the night of the great event.

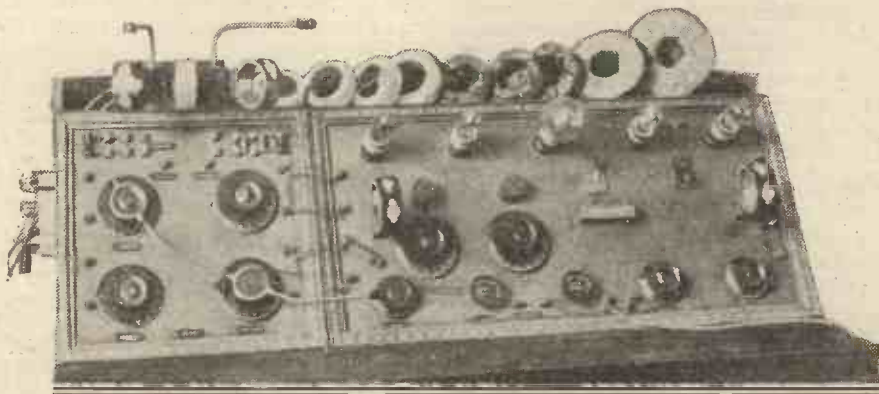
I am inclined to the view that listeners would prefer to hear an actual broadcast of part of the game, but I imagine that the newspapers would not look upon this with favour.

A Public Speaking Contest.

There is a curious swinging away from localism in the attitude of listeners. I have followed movements of this kind for the past year, and have given some account of them in these notes. There has been an intermittent ebb and flow. A popular agitation for more local programmes in one area has not infrequently been followed almost immediately by a corresponding demand for more S.B. programmes in another area.

This is not entirely accounted for by a variation in the standard of local programmes. Certain parts of the country possess much more pronounced local consciousness than others. The latest move is more widespread than any I have noticed hitherto. It is definitely away from localism.

I confess that, as a rule, I am not much interested in broadcast talks, but I am looking forward to the public speaking contest which will be put out S.B. from Birmingham on April 9th, under the auspices



A five-valve set constructed by Mr. W. Blackledge, 321, Tonge Moor Road, Bolton.

Bishopsgate Institute from 8 to 9 on that evening.

There is a revival of criticism of the B.B.C. on the score of alleged inadequate payment of authors. This is a common subject for idle banter in literary circles, but recently the complaints have become a little more insistent.

It is always easy to make capital out of isolated incidents, particularly when they are considered without reference to the attendant circumstances. I have been looking into the matter with some care, and have come to the conclusion that no real blame attaches to the B.B.C. Naturally they attempt to get their programme material as cheaply as possible.

A “Cup-Tie” Final Suggestion.

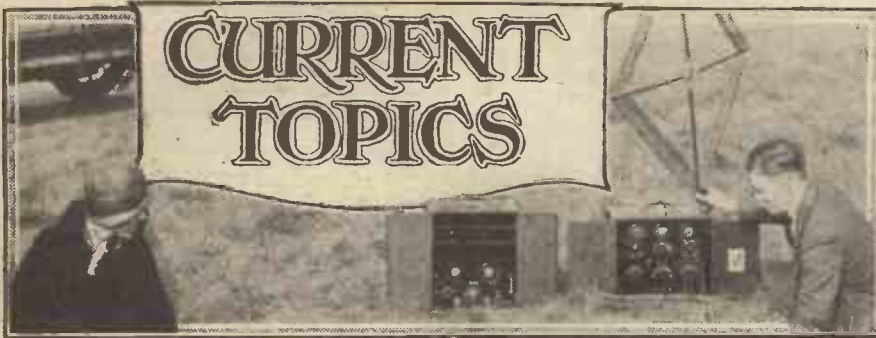
I see nothing wrong with their exploitation of the publicity value of broadcasting. Moreover, since the Post Office has restricted revenue in what is at best a questionable manner, the B.B.C. programme builders have been really hard-put to make

of the Great Western Railway Society. On that occasion listeners will have the opportunity of hearing the debating finalists chosen at the recent festival in Reading. It will be interesting to note whether the knowledge that they are being broadcast will have any effect upon the budding orators.

Extending Broadcast News Facilities.

Plans are already in hand for the extension of broadcast news facilities. The Committee in its report very wisely took the line of giving the new broadcasting authority no special privileges. But they also, with equal wisdom, suggested no restrictions. Thus, the position becomes very much what Mr. Reith was seeking in his evidence. Our broadcasters are left to make the best bargain they can with the News Agencies.

They will be expected to pay a good deal more for their news, but they will get more of it, and at more frequent intervals. I look forward to a considerable development of broadcast news this summer.



By THE EDITOR.

SO this year's Budget speech is not to be broadcast. The idea was born again this year under more favourable conditions, but has received its death-blow, and it can now definitely be taken for granted that listeners will not hear Mr. Churchill's speech when he introduces the Budget to the House of Commons this April.

This is the second time that the idea of broadcasting the Budget speech has been rejected, despite the general public approval of the scheme. The chief reason seems to be that it would not be dignified. It is curious how history repeats itself, for many years ago, when newspapers demanded the right to report the proceedings in the House of Commons, the application was dismissed many times on the ground that it would be prejudicial to the dignity of Parliament.

But when one comes down to hard facts, despite all this prejudice, narrow-mindedness, and dislike of change, of which the rejection of the proposal for the broadcasting of the Budget speech is a very interesting example, listeners have not lost much except a passing novelty.

Budget Complexities.

If the Budget speech was a simple, straightforward affair, lasting not more than twenty minutes, there would be some sense in broadcasting it, but, as a rule, Budget speeches take at least one or two hours to deliver. It would have been a hopeless task to broadcast one of the Budget speeches of Mr. Gladstone; his speeches were long, complicated, and full of side issues, and would only have confused a listener not *au fait* with Parliamentary matters.

Although Mr. Churchill's speeches are probably wittier and not so complicated, they are, as a rule (especially his Budget speech, if one is to judge by last year's effort), full of statistics and other complications which the average listener would not understand at all. There might be some point in broadcasting the last few minutes of his speech, because it is a sort of tradition with Chancellors of the Exchequer to refrain, until the very last moment, from announcing to the House of Commons any reduction in the Income Tax.

There is no doubt that many hundreds of thousands of listeners in this country would don the telephones with great expectations if it were announced that the concluding items of Mr. Churchill's speech were to be broadcast. No man or woman who is in receipt of Income Tax forms could deny himself, or herself, the exciting sensation of listening-in to Mr. Churchill at the time when he was about to announce that another sixpence was to be taken off the Income Tax, or, more likely, that another sixpence was to be added.

Budget speeches in Japan and in certain states of the American Union have been broadcast already, but, as was pointed out in the House of Commons the other day by the Assistant Postmaster-General, there is "no information available as to the results of this experiment!"

Many people deprecate the idea of broadcasting political speeches. It has been suggested that a loud speaker braying a red-hot Tory speech into a red-hot Socialist home might very easily lead to family complications of a serious nature, and vice versa we could conceive the effect of a speech by Sir Alfred Mond being received in the household fastnesses of a staunch Liberal.

There is certainly an advantage in broadcasting political speeches, but there is just as much disadvantage in broadcasting such speeches. Yet when one con-

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By Our Own Correspondent.

siders the small percentage of the population which polls at a general election, broadcasting might, if carefully handled, prove an excellent propaganda weapon for increasing interest in parliamentary matters among the population of this country.

A New Source of Humour.

Question time could easily be broadcast, and would make a most interesting feature of the programme. Of course, the best idea of all would be to have a permanent "broadcast watcher" in the House of Commons—a man who would be invested with powers to switch on the microphone at any given moment when something "broke loose" in the House of general interest to all listeners. We can conceive it to be almost worth while to create such a post and to give such an official power to break in on any other broadcast programme.

The House of Commons is the greatest source of interest in the world. What could be more exciting, what could be more illuminating and more worth one's ten-

shilling licence fee than to broadcast some of the hectic retorts between the various parties. Here are potential sources of amusement and excitement of unparalleled interest. There is no doubt that the day will come when speeches will be broadcast from Parliament. To-day we have the suspicion that members are a little frightened at the idea of a microphone picking up their remarks and hurling them into the "vastness of outer space." We can conceive that a microphone in the House of Commons would have the effect of a dominating schoolmaster among a class of small boys. Probably half the fun of Parliamentary life would disappear, and so we cannot blame the Prime Minister for vetoing this idea of broadcasting the Budget speech.

Broadcasting for Prisons.

It has been suggested that wireless programmes should be introduced into prisons. According to Mr. J. Hugh Jones, writing in the "Daily News," many people will answer: "Certainly, because they only see or hear in wireless a form of punishment. Switch on to every cell, and the gaolbird will cease wrong-doing for ever."

The writer pertinently remarks that the recent epidemic of escapes from Pentonville followed on a vocal concert for prisoners.

On the other hand, there are many people who will say that broadcasting in prisons will make the life more attractive, and then they will object on the grounds that convicts are pampered enough already.

It has already been proved that broadcasting has a most beneficial effect on patients in hospital. Tedious hours of suffering in a bed are materially eliminated when one can wear a comfortable pair of telephones and listen to a lively, sparkling entertainment.

Now, it is purely hypothetical when we come to consider the effect of a "lively, sparkling entertainment" on gaolbirds. It may make them "sparkle" so much that, by association of ideas, their minds may turn to "sparklers" of another kind. It may make them so lively that hectic demonstrations in prison chapels will become more frequent and even more hectic than the recently reported debacle in a prison chapel.

A Risky Experiment.

On the other hand, items such as "De Profundis," "Invictis," "In a Monastery Garden," and other touching melodies of a religious character might have an effect on the psychology of prisoners less detrimental to their morality than one would imagine.

Broadcasting might, indeed, prove exceedingly effective in reforming those who have outraged the laws of society. But it is a very risky experiment, and it all depends upon the choice of programmes which are broadcast and received in prisons. Perhaps one day a special broadcasting station will be erected for the benefit of his Majesty's prisoners. In the old days of the Fleet Prison (which stood on the very site of the office in which this article is being written), we can imagine the debtors in the prison being regaled with an interesting discourse on financial economy by Mr. Churchill; we can imagine Mr. Ramsay Macdonald delivering heartening speeches into the microphone on the question of equality of riches, and we can imagine that certain speeches broadcast to-day might, in like sense, have a very heartening effect and, we hope, a real benefit on the many inmates of our prisons.



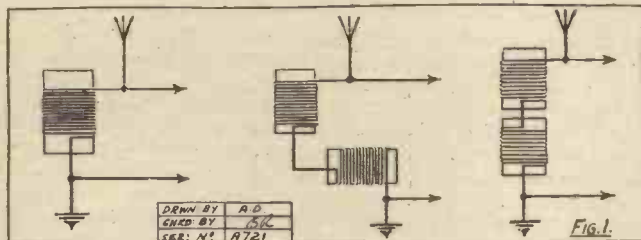
Variometers in Valve Circuits

The First of Two Special Articles by
C. E. FIELD, B.Sc.
(Staff Consultant.)

THE amateur who possesses a multi-valve receiver is apt to look askance at the humble variometer, perhaps for no other reason than that it was the type of tuner which he employed upon his original crystal set.

to increase the wave-length of the circuit, we would require a larger coil, or alternatively, another coil in addition to the first. Thus we might employ two equal coils as in the second diagram, and their total inductance would be twice that of the single coil, and the wave-length would be very much increased.

windings as close together as possible in the extreme positions, so that the two as nearly as possible entirely neutralise each other, or share the whole of each other's lines of force. For this reason the coils are usually mounted in such a way that one can rotate inside the other, and variometers consisting of forty or fifty turns of wire, wound one say, a 2½-inch cardboard former, rotating, inside a larger former similarly wound, will be quite familiar to all readers.



It must be borne in mind, however, that a crystal receiver, possessing no local source of energy such as a high-tension battery, depends entirely upon the efficiency of its components to make the most of the energy it receives from the aerial.

Principle of Operation.

The variometer, therefore, which is undoubtedly one of the most popular tuners for crystal reception over the broadcast wave-band, at least merits careful consideration before the tuning systems for valve sets are finally decided upon. Let us see what are the advantages to be derived from a variometer, what are its limitations, and what are its various uses.

The operating principle of the variometer is extremely simple. Let us suppose that we wish to tune an aerial circuit by means of an inductance coil, as shown in the first diagram in Fig. 1. If we now desired

Now, consider what would happen if we brought the two coils close together, as in the third diagram, so that practically all the lines of magnetic force produced by the first coil passed through the second, and vice versa.

One of two things may happen. Firstly, the lines of force in the first coil may be acting in the opposite direction to those in the second, with the result that the two neutralise one another, and we have, in effect, practically no inductance in the circuit, and hence a very short wave-length.

Secondly, the lines of force due to the two coils may be acting in the same direction, resulting in a double number of lines through each coil. We then have two coils, each with twice its normal number of lines of force passing through it, giving us an inductance four times as great as that of the single coil in the first diagram.

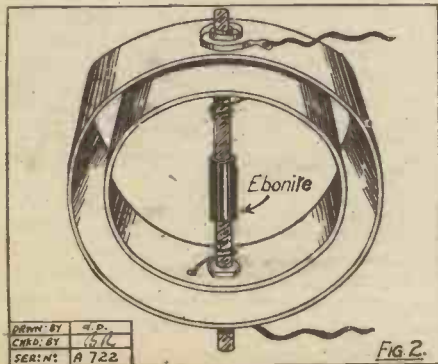
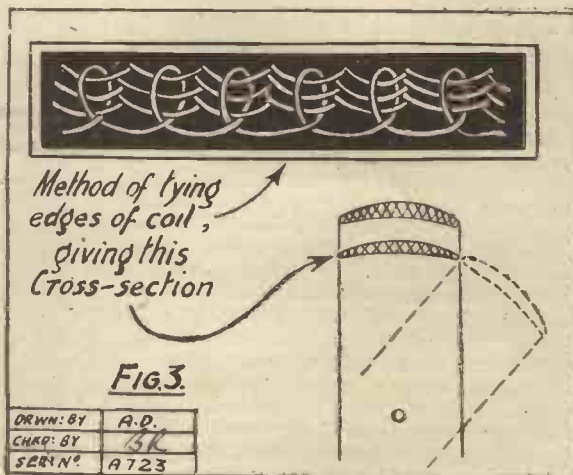
Thus we have a means of widely varying the inductance (and therefore the wave-length) of a circuit by dividing the tuning inductance into two approximately equal portions, and varying their relative positions, so that their individual properties either assist or oppose one another.

This is what is carried out by the variometer, which consists simply of two coils, the windings of which are joined end to end, and so arranged that their relative positions may be changed.

In order to obtain the maximum efficiency and wave-length range from a variometer, the coils should be arranged with their

Close Coupling Essential.

In such a tuner, however, there is of necessity a large space between the windings in order to allow the inner coil to rotate. Consequently, the most efficient type is constructed with the rotating portion (or rotor) in the form of a sphere, the stationary windings lying on the inside of a closely fitting shell. By this means the gap between windings may be reduced to one eighth of an inch or less, and the result is a tuner with a very wide wave-length range.



Unfortunately, the construction of a variometer of this type is somewhat beyond the scope of the average amateur, although spherical rotors can now be obtained ready for winding, and one of these rotating within a closely fitting coil wound upon a cardboard former is much more satisfactory than a combination of two cylindrical coils.

(Continued on next page.)

VARIOMETERS IN VALVE CIRCUITS.

(Continued from previous page.)

A cause of unsatisfactory operation in a badly designed variometer often lies in the method adopted for making connection between the rotor and stator windings. This is most conveniently carried out by constructing the spindle in two insulated portions, as, for instance, by screwing two lengths of brass rod into a short piece of ebonite rod lying inside the variometer rotor. The ends of the rotor winding are then joined to the two portions of the spindle, and connection is taken from the two brass bushes in which the spindle rotates.

This method, however, is a poor one, on account of the bad contact which may exist between the spindle and its bearing, especially when the former is of screwed rod, and has become worn with use.

Probably the best method for making connection to the rotor windings consists in joining the ends to the two insulated halves of the spindle, and connecting directly to the latter by means of a spiral of spring copper strip with its inner end joined to the spindle, as shown in Fig. 2.

When there is a fair amount of clearance between stator and rotor, connection from the latter may be made simply by lengths of flex brought out from the inside—a method which enables a straight-through spindle to be employed. In both these cases, of course, a stop must be provided to prevent the rotor from turning too far in either direction.

An Efficient Broadcast Tuner.

Variometers may be constructed in many ways, other than by mounting two cylindrical or spherical coils one inside the other. For instance, perhaps the simplest form consists of two honeycomb or, preferably, basket coils connected in series and mounted in an ordinary two-coil holder. Such a tuner covers only a small wave-length band, but is quite efficient when the coils are close together.

A very compact and efficient tuner for short-wave broadcast reception may be constructed from two home-wound honeycomb coils, one rotating inside the other. The difficulty of obtaining a close coupling between the coils may be overcome in this way. A coil of forty turns of No. 18 or 20 S.W.G. wire is wound on a spoked former, and lightly shellacked while in position. Strips of paper, tape or empire cloth are then wound over the top of this coil to a depth of about one eighth of an inch (not more). This provides a former for the outer coil, which should be wound with the same number of turns, and varnished. The spokes and packing tape can then be removed, and we have two coils with a very small gap between them. This space, however, will

be too small to allow the rotor to turn inside the stator when mounted.

In order to overcome this difficulty the layers of each coil should be tied together at the edges by a length of thread looped into the spaces previously occupied by the winding spokes. When the hitches are pulled tight the diameter of the coil is reduced at the edges, and by a little manipulation the coils will be given a cross-section somewhat as indicated in Fig. 3, which also shows the method of tying the edges.

Thus we have practically a very compact

show the construction and method of winding more clearly than a written description. In order to obtain tight coupling the stator end-shields should not be more than $\frac{1}{4}$ inch greater in diameter than those of the rotor, and the former should be made of $\frac{1}{2}$ -inch ebonite in order to bring the ends of the two windings close together.

When a circuit is tuned by means of an inductance coil shunted with a variable condenser, signals are strengthened as the capacity of the condenser is reduced, and the size of the coil correspondingly increased. It would appear, therefore, that a variometer, which is all inductance, without a shunting condenser, should be the ideal.

Variometer Losses.

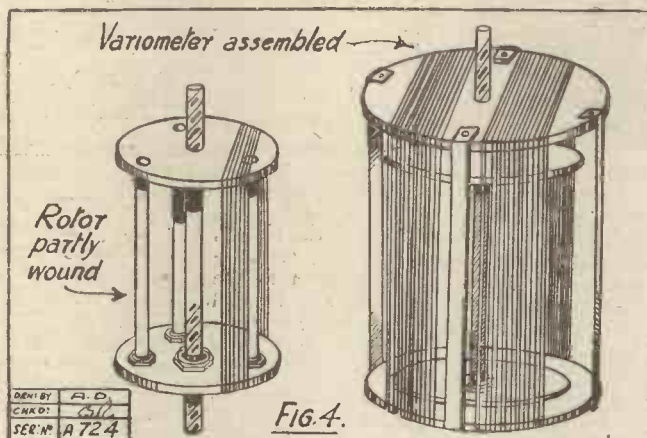
This is not absolutely true, however, for the self-capacity of the variometer windings has the same effect as a shunting condenser, and this may considerably reduce its efficiency. Moreover, an increased number of turns in a coil gives increased losses due to resistance, and this is particularly the case when a variometer is being used upon its shorter wave-lengths.

Suppose, for the sake of argument, that we were to construct a variometer capable of tuning our aerial circuit from 300 to 3,000 metres, and in order to make it compact we wound both coils with two or three layers of No. 40 S.W.G. wire. Such an instrument would be poor on long wave-lengths, and hopelessly inefficient for the reception of broadcasting.

Similarly, an ordinary broadcast variometer is not suitable for very short-wave work, as good reception below 150 metres calls for the use of two-circuit tuning and air-spaced coils. However, from considerations of signal strength, variometer tuning will usually be found slightly more efficient than the coil-and-condenser method for the broadcast wave-band, provided that the variometer is well in—that is, near to its maximum wave-length setting—and that it is a well-made instrument.

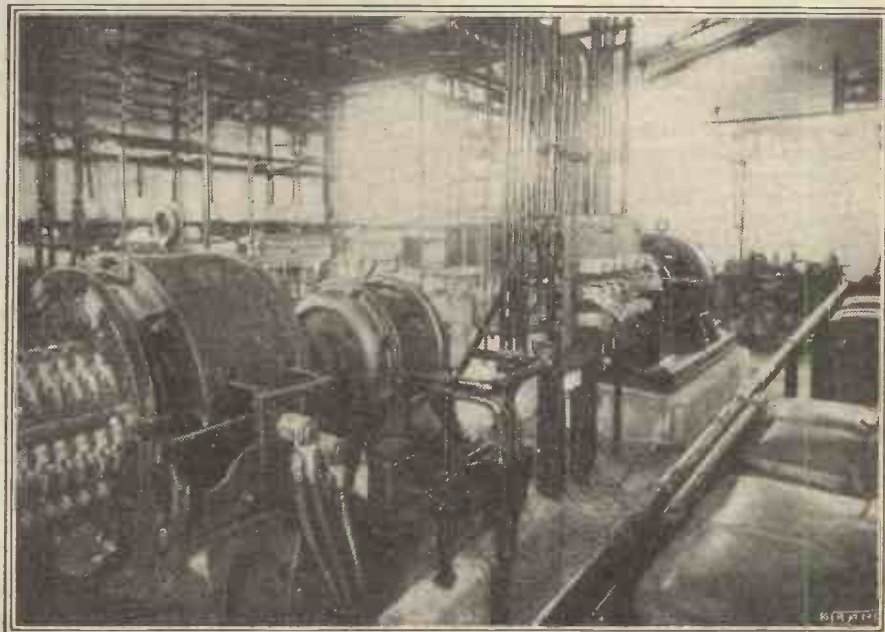
In another article we will review some of the modifications, and various uses, of the variometer.

(To be concluded.)



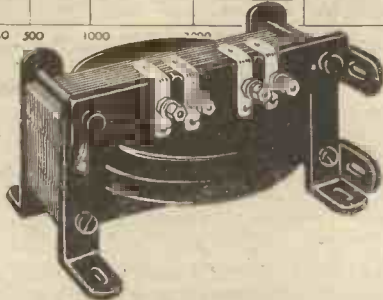
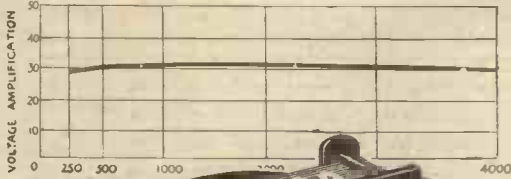
spherical variometer, and, moreover, the coils are rendered very rigid, no further taping or binding being necessary. The slight crushing of the coils is more than compensated for by the tight coupling obtained.

For the reception of longer wave-lengths, as from 5 X X, without the use of a loading coil, the usual type of variometer becomes unwieldy, and the home constructor is recommended to make one of the cage type. In this construction both stator and rotor may consist of two circular discs of ebonite, rigidly held apart by stays, to form two cylindrical cages, one rotating within the other. The winding is put on across the end-shields, and parallel to the axis, forming a coil of rectangular section. Fig. 4 will



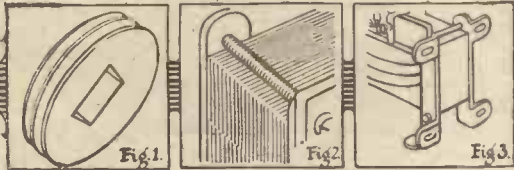
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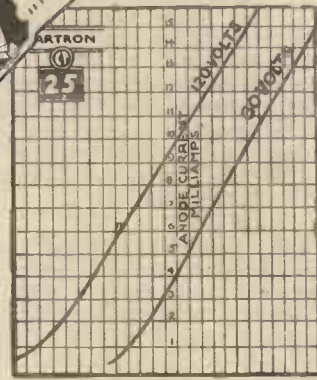
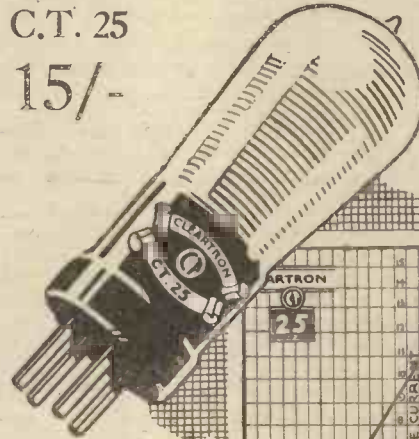
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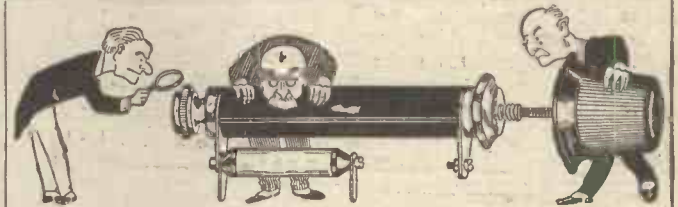
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THE congested state of the ether has long made DX reception a difficult matter, especially if loud-speaker results are required. For such reception it is generally realised that a "straight" circuit (as opposed to a reflex or other similar circuit) is necessary if good results are to be obtained.

The question then arises as to how many valves will be required, and how they shall be arranged. The answer will depend upon the individual requirements of the listener: how many stations he hopes to get, whether he wants them on the loud speaker, battery charging facilities, ability to handle more or less critical receivers, etc.; but for

 The Set Designed and Described by
 K. D. ROGERS.
 Constructional Work by
 C. A. MEADOWS & J. WHEATLEY.
 (Technical Staff.)

The L.F. side of the set was designed from the point of view of quiet operation and purity of reproduction, so the second stage is coupled by means of resistance capacity (a Polar unit being employed) while the first stage is transformer coupled. In this case a novel feature is included by the use of the new

R.I. multi ratio L.F. transformer. This instrument allows a variation of ratios with three different primary impedances, so that the constructor can vary his coupling to suit the valve he is employing until he obtains the best results.

It will be noticed from a study of Fig. 1 and the photographs that four different switches have been included in the set, and these provide a very

flexible receiver, for by their use either two, three, four or five valves can be used in varying combination.

LIST OF COMPONENTS.		£	s.	d.
1	Panel, 24x8x1/4 in. (Peto-Scott)	0	12	0
1	Baseboard, 24x9 in., and cabinet (Peto-Scott)	2	0	0
6	baseboard mounting valve holders (Benjamin)	0	15	8
5	Lissenstats (majors) (Lissen)	1	17	6
1	Neutrodyne condenser (Lissen)	0	4	6
1	.0005 variable condenser (with vernier) (Wates)	0	11	6
2	.0003 variable condensers (with verniers) (Peto-Scott)	0	18	6
2	.0003 fixed condensers (T.C.C.)	0	4	8
1	.5 megohm grid leak (Dubffier)	0	2	6
1	1-megohm grid leak (Dubffier)	0	2	6
1	baseboard mounting single coil holder (Peto-Scott)	0	1	6
1	2-way coil holder (Lotus)	0	8	0
1	Polar R.C.C. unit (Polar)	0	15	0
1	Reaction reverse switch (D.P.D.T.) (Goltone)	0	3	6
3	S.P.D.T. switches (Nesthill)	0	4	6
1	L.F. transformer (New type R.I.)	1	7	6
4	indicating terminals (Belling Lee)	0	1	6
6	W.O. type terminals	0	0	9
1	terminal strip, 9x2x1/4 in.	0	0	6

For instance, with the first switch to the right we have 2 H.F. and Detector, and either none, one or two L.F., according to the positions of the last two switches.
 (Continued on next page.)



The "Fleetway Five" has an extremely attractive appearance, and the disposition of the controls makes for very easy handling.

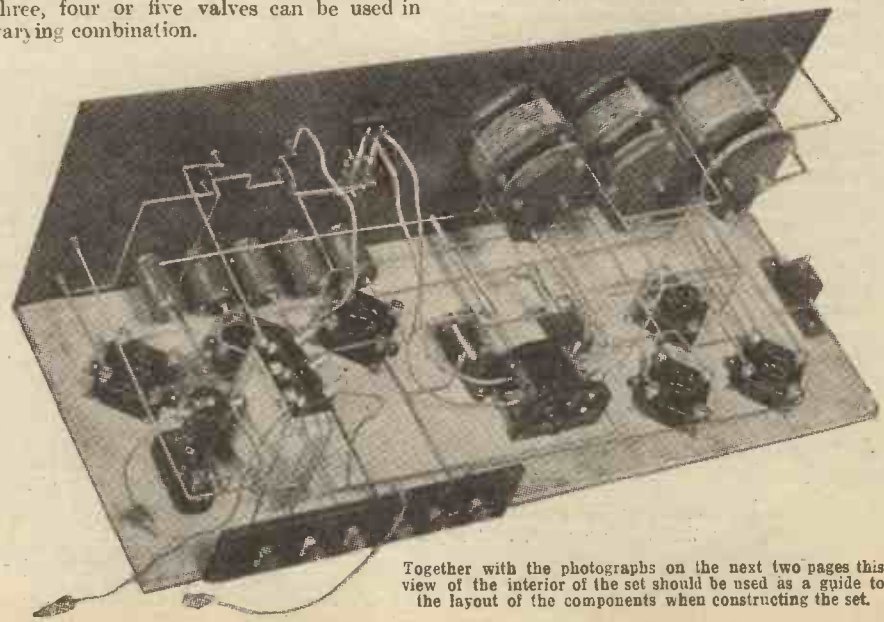
general purposes it is difficult to beat a five-valve set, where two H.F. and two L.F. stages are employed.

The main difficulty with such a receiver is to keep it free from any tendency to self-oscillation, besides keeping it selective, and to arrange the L.F. stages so that good amplification is obtained without any noisy background.

Neutrodyne Tuned Anode.

These points have all been accomplished in the "Fleetway Five," described and illustrated in these pages. In the first place, when considering the design of the set, it was realised that either the H.F. valves would have to be potentiometer controlled or else they would have to be neutrodyne; it was, of course, impossible to have them aperiodically coupled, as this would at once lower both the sensitivity and selectivity of the set.

In order to obtain the maximum amplification, tuned anode coupling is employed in each stage with reaction on to the anode coil, and the first stage is neutrodyne, providing added selectivity and stability.



Together with the photographs on the next two pages this view of the interior of the set should be used as a guide to the layout of the components when constructing the set.

THE "FLEETWAY FIVE."

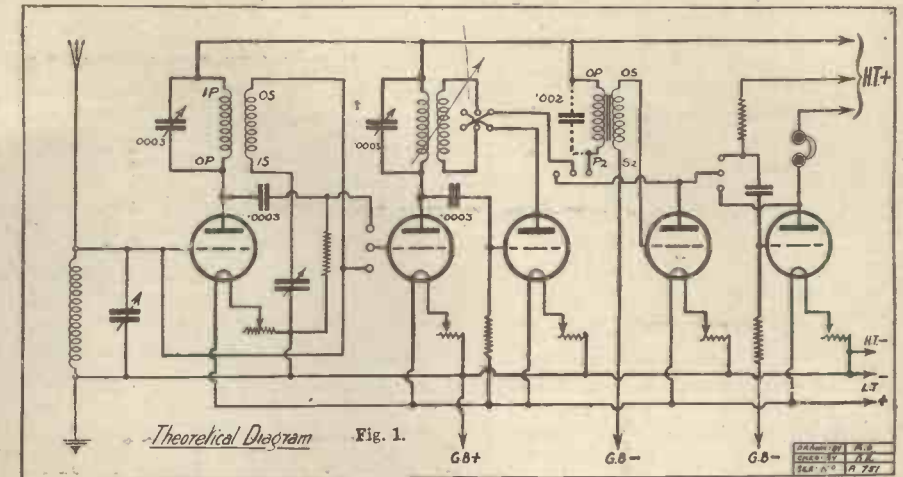
(Continued from previous page.)

With the first switch to the left we cut out the first H.F., and can obtain H.F. and Det., or H.F., Det., and 1 L.F., or H.F., Det., and 2 L.F. The remaining switch is a reverse reaction switch which has to be brought into use every time an H.F. stage is switched on or off.

Concerning the Components.

Either an outdoor, indoor or frame aerial can be used, but in the case of the latter the aerial coil plug on the left of the baseboard must be shorted.

The range of the set on the different aerials will vary with the efficiency and type and with local conditions; but on an outdoor aerial of good construction most of the B.B.C. stations should be received



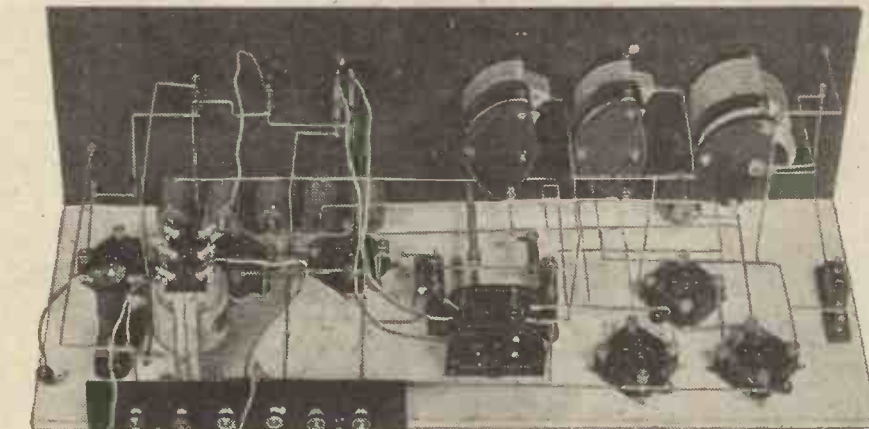
former on the market, and the constructor is advised to use one or other of these.

The panel measures 21 in. by 7 in. and is 1/4 in. thick. Condensers with verniers are required, and the coil holder must be capable of easy and smooth adjustment, or reaction will be difficult to control. On test the Lotus coil holder with long handle proved extremely satisfactory.

Wiring-up.

The constructor will find that the illustrations will act as sufficient guide for the lay-out of the baseboard, while the panel-drilling diagram (Fig. 3) shows the positions for the holes in the panel, provided the components mentioned in the list are employed. Other components will necessitate a revision of Fig. 3, and the constructor will have to readjust the dimensions to give approximately the same results if he diverges from the list mentioned above.

The wiring is simple and will provide no "snags" if the constructor takes care to make every connection secure. The greatest (Continued on page 249.)



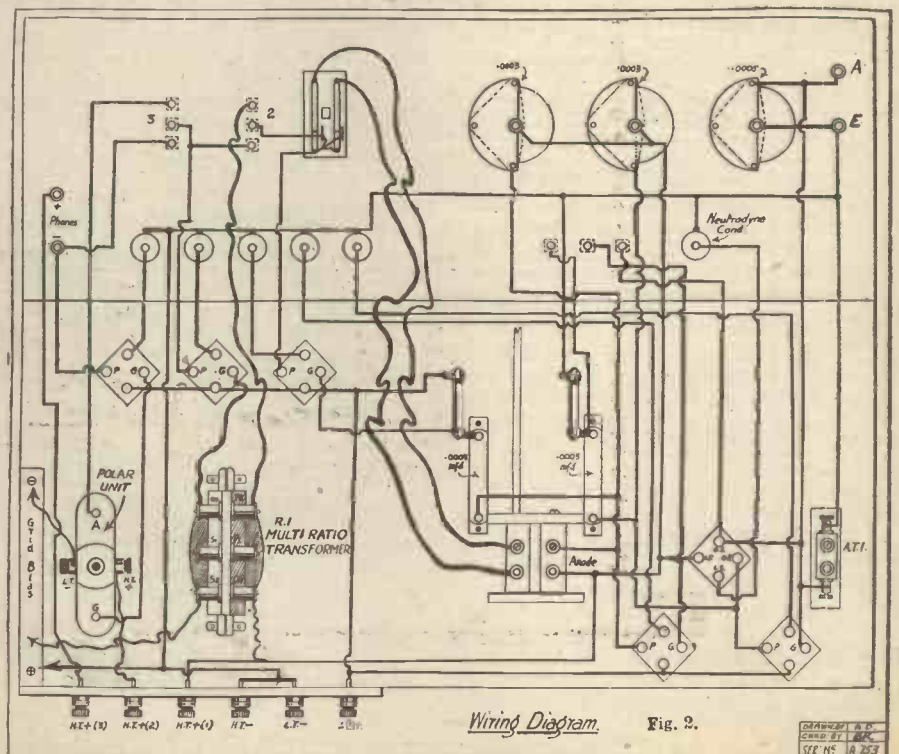
Another illustration of the "Fleetway Five" which gives a good idea of the wiring.

and many Continental transmissions. That is, for the sake of overseas readers, the set has a range which is practically only limited by atmospheric and local conditions. Under favourable conditions one or two thousand miles or more should be possible on headphones, this being decreased if a loud speaker is used or if an indoor or frame aerial is employed.

For its construction the "Fleetway Five" needs the components given in the list, or if the same makes and types are not to hand some similar items will be required. It will be noticed that an H.F. transformer is used for the coupling between the first and second valves, although it has been stated that the set is "tuned anode" coupled. The reason for this is that the primary windings of the transformer are used as a tuned anode coil, and the secondary as a close-coupled neutrodyne coil in conjunction with a neutrodyne condenser.

Special Type of H.F. Transformer.

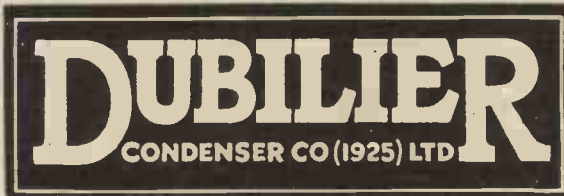
As the two windings are so tightly coupled it will be found that the ordinary 300-600 metre transformer will not "go down" to anywhere near 300 metres, probably not below about 380 metres, and so, to cover the required wave-band, it is necessary to use a transformer having a range of about 250-500 metres. Many firms place a special neutrodyne trans-



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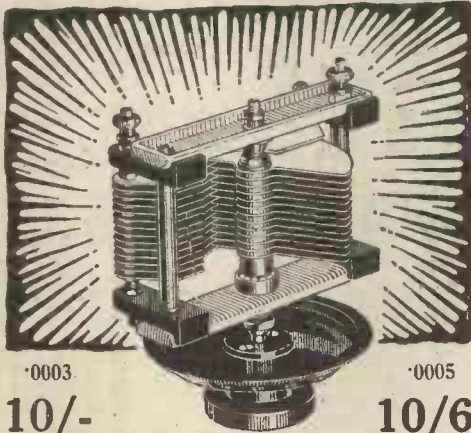
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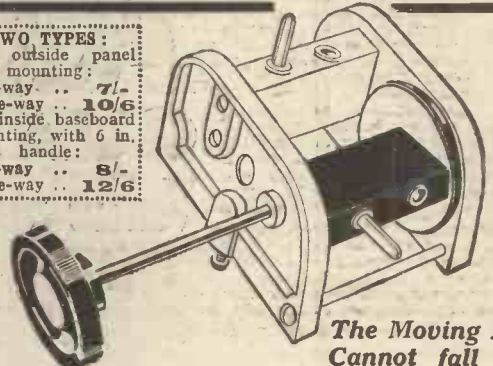
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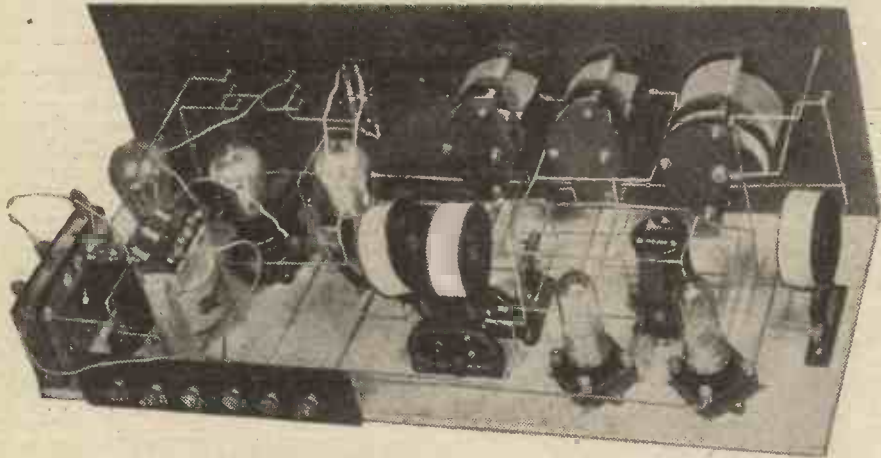
It is made from finest rubber and sulphur and is guaranteed free from surface leakage.

It proves its quality in every test. Its polish will also please you—ask to see it.

THE "FLEETWAY" FIVE.

(Continued from page 246.)

trouble in sets of this kind is to keep the wiring clean and the joints efficient. There is a great tendency amongst many constructors to hurry things up towards the end of the task—to be able to test the set "before 2 L.O. closes down," and so on. This very often leads, if not to wrong connections, to poor joints, where "dryness" causes noisy reception or total failure. Constructors must remember to keep the iron hot, and not only hot, but clean. It is also essential that all traces of flux and loose beads of solder be removed before the set is tested. The former is best cleaned off immediately after a joint is made and while the wire is still hot.



The five-valver complete with coils, etc. The valves shown are 2 Cosset H.F., Mullard D.F.A., D.F.A.4, and a D.E.5. The H.F. transformer is a "Magnum."

One point must be carefully watched while the connections are being made, and this concerns the leads taken to the H.F. transformer. These must be spaced enough to allow the transformer to be plugged in its holder, or removed at will and without straining the wires apart. No space is wasted, and unless such little points are watched the constructor may find his leads too close together and will have to undo some of his work. Finally, the point-to-point connections given in this article should be used as a final check on the wiring before the set is connected up for test.

Reception of Long-Wave Stations.

With regard to valves, we have found any well-known valve works well in the set provided the valves chosen are suitable for the individual tasks they have to perform. H.F. valves should be used for the first two stages and L.F. valves for the last two. Either 2, 4, or 6 volt valves can be employed, the rheostats being suitable for all types. Plug-in coils of low self-capacity are advised, and on test we found the Atlas and Energo coils gave very good results.

To broadcast wave-lengths a 35 aerial and 75 anode, together with a 50 reaction, gave best results. If Daventry is required the listener can either plug in another H.F. transformer (1,200-2,000 metres) or cut out his first H.F. stage. As a matter of fact we prefer to do the latter, for unless he is a considerable distance away from 5 X X the extra H.F. stage will not materially assist reception.

Neutrodyning the Set.

When the batteries, etc., have been connected up and the valves and coils placed in position, the set should be switched on so that four valves are operating (2 H.F., Det., and 1 L.F.) and then the nearest station tuned in. When signals are at their loudest the first valve should be turned out and the neutrodyne condenser varied until signals diminish to a minimum, or disappear altogether. The tuning must be varied throughout this reaction to keep the signals at maximum strength for any given setting of the neutrodyne condenser.

Next tune in (with first valve on) a distant station, and then turn the valve out, readjust tuning, and

impedance valve is used here and the signals received are of strong intensity, it may be unable to carry the volume, so that, although such valves as the D.E.3B. are usually advised for resistance coupling, it is sometimes found that on near-by stations these will not carry the voltage variations without distortion, and so it would be safer to use valves having slightly less impedance. The last valve should have an impedance of about 5,000 ohms, and should be provided with negative grid bias of from 3-7½ volts.

POINT-TO-POINT CONNECTIONS.

Aerial terminal to one side of A.T.L., A.T.C. grid of 1st valve, O.S. of H.F. transformer and right-hand contact of 1st S.P.D.T. switch.

Other side of A.T.L. and A.T.C. to earth-L.T.—, H.T.—, G.B.—, one side of each Lissenstat, neutrodyne condenser and one side of 1st grid leak.

Remaining side of each Lissenstat to one filament pin of its valve holder, other filament pins of each valve holder joined together and taken to L.T.— and one side of 2nd grid leak.

O.P. of H.F. transformer to plate of 1st valve, fixed plates of 1st .0003 variable condenser, and one side of 1st grid condenser. Remaining side 1st grid condenser to remaining side of 1st grid leak and left-hand contact of 1st S.P.D.T. switch.

I.S. of H.F. transformer to remaining side of neutrodyne condenser.

I.P. of H.F. transformer to H.T.+1, one side of anode coil and the two sets of moving vanes of the .0003 variable condensers.

Other side of anode of coil to fixed vanes of 2nd .0003 variable condenser, to one side 2nd .0003 fixed condenser and plate of 2nd valve.

Grid of 2nd valve to centre contact of 1st S.P.D.T. switch.

Remaining side of 2nd .0003 grid condenser to remaining side of 2nd grid leak and grid of 3rd valve.

Plate of 3rd valve to bottom left-hand contact of reaction reverse switch to right-hand centre contact of same switch. The two top contacts of this switch are joined by flexible leads to the reaction coil.

Right-hand bottom contact to left-hand centre contact and to centre contact of 2nd S.P.D.T. switch.

Top contact of 2nd S.P.D.T. switch to one side of primary of L.F. transformer.

Other side of primary to H.T.+1.

Bottom contact of 2nd S.P.D.T. switch to centre contact of 3rd S.P.D.T. switch and to plate of 4th valve.

Grid of 4th valve to one side of secondary of L.F. transformer, other side of secondary to G.B.—1.

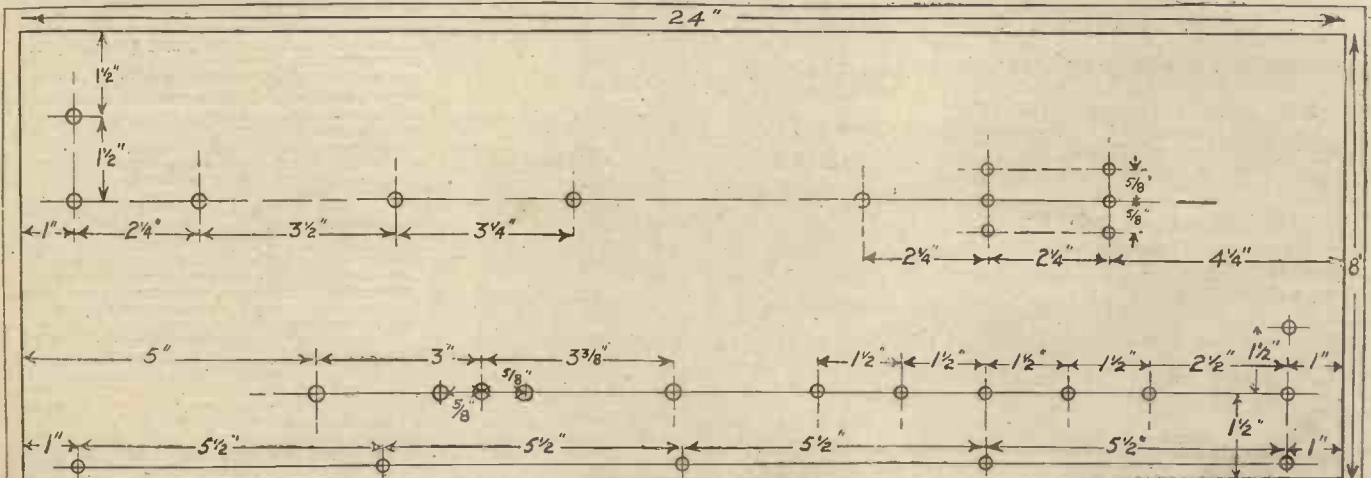
Bottom contact of 3rd S.P.D.T. switch to plate of last valve and bottom phone terminal, remaining phone terminal to H.T.+3.

Top contact of 3rd S.P.D.T. switch to A contact of Polar R.C.C. unit. G contact of Polar R.C.C. unit to grid of 5th valve. L.T.— contact of Polar R.C.C. unit to grid bias —2. H.T.— contact of Polar R.C.C. unit to H.T.—2.

repeat the process. When the minimum has been reached the set is correctly neutrodyne for the particular valve in use in the first stage. If another valve is to be used the whole process must be repeated, because the self-capacity of the new valve will be different from that of the original one and so the neutrodyning effect of the condenser will be nullified.

If a larger transformer is used for Daventry this can again be neutrodyne, but on that wave-length the neutrodyning will probably not be necessary, and so we advise the constructor to leave the setting to suit the B.B.C. band and merely plug in the fresh transformer, providing, of course, that both the H.F. stages are to be used.

An H.T. battery capable of giving 120 volts should be available, about 50-80 being used on the first two valves, 50-60 on the detector, and 80-120 on the first L.F. The last valve should have about 100-110 volts and should be a power valve. While discussing the L.F. stages, it must be pointed out that as one stage of resistance coupling is used (the last stage) the fourth valve should have a fairly high impedance, say, of from 20,000-30,000 ohms. If a very high

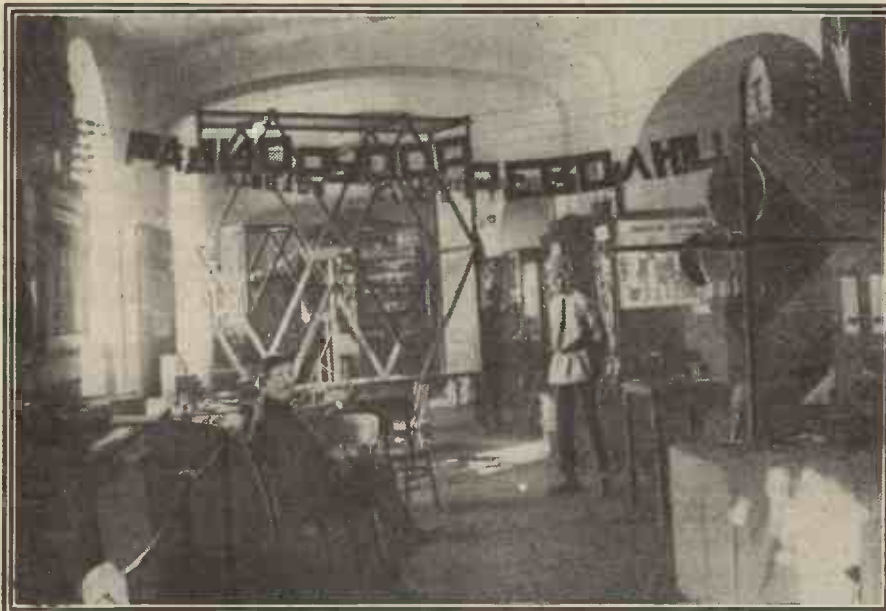


Panel Layout Fig. 3

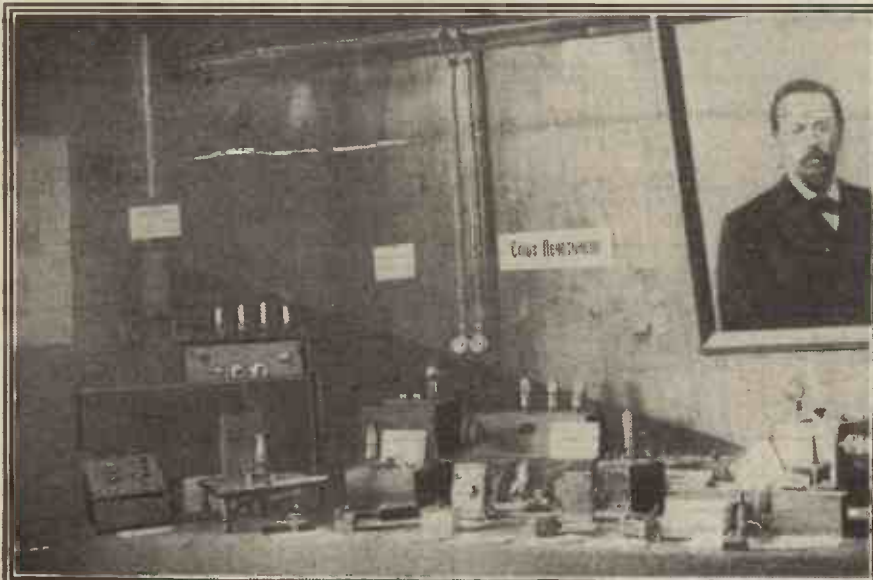
DRAWN BY	A.D.
CHG. BY	311
SER. N°	A.752



A corner at a recent Radio Exposition held at Moscow.



Another view of the Radio Exposition at Moscow.



Russian Receiving Sets on view at the Moscow Exposition.

Correspondence

Letters from readers discussing interesting and topical wireless events or recording unusual experiences are always welcomed, but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—Editor.

DX LOUD SPEAKER RESULTS.

The Editor, POPULAR WIRELESS.

Dear Sir.—With regard to Mr. A. A. Pratt's letter in a recent issue of "P.W.," wherein he states that his family, who use a three-valve straight (O-V-2), are quite envious of his Chitos one-valver.

Does he mean by that that the Chitos is superior to the O-V-2 in range, volume, and ease in tuning in distant stations? If so, then his family three-valver must be badly constructed or some big fault must exist in it.

I have experimented with straight detector circuits plus two stages of L.F. amplification for years, and one I have in use at present gives me Glasgow, Edinburgh, Dundee, Aberdeen, Belfast, Newcastle, Daventry, Bournemouth, Swansea, London, Manchester, Radio-Paris, Prague, Toulouse, San Sebastian, Berlin, Hamburg, Hilversum, Königswusterhausen, Brussels, and I must not forget Dublin. Numerous others have been received, but not identified. The whole of the above are received on the loud speaker, for I seldom use headphones even for tuning in. (I take loud-speaker strength to mean where one has to raise one's natural speaking voice to make oneself heard while speaker is switched on.)

With regard to Mr. R. Robinson's experience, I used to tune to the same wave-length as that of a crystal set in a house 50 yards away when all broadcasting stations were closed down, and I was able to reproduce quite loudly on the speaker all music and speech which was made in the room where the crystal set was placed.

In concluding, I may state my results are not exceptional, for I have helped others to obtain similar results here.

Wishing "P.W." every success,

Yours sincerely,
JAMES MCLEOD.

P.S.—Local conditions for reception are fairly good, and the nearest broadcasting-station is Edinburgh, which is twenty-odd miles distant.

50, Well Road, Lochgelly, Fife, N.B.

LOW-FREQUENCY TRANSFORMERS.

The Editor, POPULAR WIRELESS.

Dear Sir,—I should like to call your attention and the attention of your readers to what is apparently becoming a common and misleading practice in Press references to low-frequency transformers. I refer particularly to the question of impedance, which, as every engineer knows, depends in a reactive circuit, such as a transformer winding, to a vast extent on the frequency at which it is measured.

This point is not appreciated by the average radio enthusiast, and therefore any statement of transformer impedance which does not give the frequency at which it is measured is as misleading as it is useless.

Any transformer may have a comparatively high impedance at, say, 500 cycles, but this does not indicate that it will give good results, since the whole of the male and female speaking voices and the major portion of the fundamental notes are below this frequency, so that for an impedance value to be of any real use it should be stated at a periodicity of not higher than 100 cycles.

If the impedance is reasonably high at that frequency, good reproduction, particularly of the low notes, is assured.

It is sometimes suggested that the impedance of a transformer primary and that of the valve preceding it should be matched, and one must say at once that this is quite wrong, and such a state of affairs should be avoided if at all possible.

The object at which one must aim is to make the transformer impedance as high as possible, so that it is infinitely great with reference to the impedance of the preceding valve, and under these circumstances the full amplification of the valve is obtainable and the true amplification per stage may be calculated by multiplying the valve amplification factor by the ratio of the transformer.

It is only with transformers of comparatively low ratio, say, from 3-4/1, that the above high impedance is possible, for which reason high ratio transformers should, as a rule, be avoided unless they are used following valves having very low impedances, under which circumstances the transformer impedance is still comparatively high compared to that of the valve; but in any case really good results cannot be obtained under any circumstances unless the transformer impedance is very great, which cannot be the case with a high ratio transformer.

Yours faithfully,
JOHN BAGGS.

45, Northfield Road, New Moston, Manchester.

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Operating Characteristics :

- Filament Current - - 0.25 amps.
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Weco valves, each 16/6
P.A. 4 Power Valve 45/-

Standard 'phones are the choice of experts who know them to be absolutely reliable.

There is always room for improvement and it is more than probable that the indifferent results you are experiencing are due only to inferior head receivers.

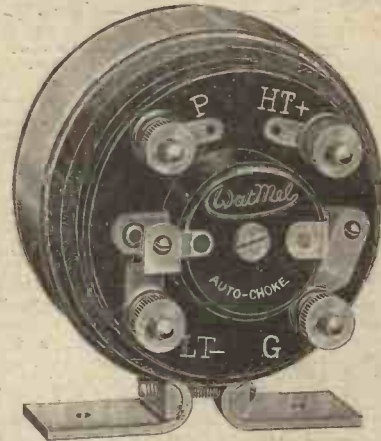
Ask your dealer to demonstrate a pair of Standard head-receivers to you and note the difference.

Head receivers, per pair 20/-

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Ask your dealer for a demonstration or send a postcard for booklet telling you more about "the Interval-coupling with the 'straight-line' curves."

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ANOTHER USE FOR FLUXITE. Hardening Tools & Case Hardening. ASK FOR LEAFLET on improved methods.



Apparatus Tested

Traders and manufacturers are invited to submit wireless sets and component parts to the "P.W." Technical Dept. for test. All tests are carried out with strict impartiality in the "P.W." Test Room under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

RECENTLY we received one of the new Celestion loud speakers for test. It is a handsome hornless type of instrument, measuring 14 x 14 x 6 in., and its main structure consists of a tastefully carved, polished cabinet, having apertures in the form of ornamental tracery. The mechanism is quite concealed and the terminals and adjusting knob are placed at the back, so that the leads need not untidily obtrude.

It will be remembered that the original Celestion gave very good results on test and the latest model is even more effective. It is still more sensitive and operates with excellent volume on a Det.-L.F. two-valver. The tone is mellow, and voices and strings come through with unique faithfulness. The speaker does not appear to have any appreciable resonance and reproduction is commendably distortionless throughout the whole scale.

A feature of this new Celestion is that it is almost non-directional and sound is projected with almost equal intensity in all directions. It can also handle considerable volume without developing "chatter."

It is certainly a high-class instrument in appearance, and throughout, both externally and internally, the workmanship and finish are above reproach. This, together with its undoubtedly high electrical and acoustic efficiency, render the Celestion well-worthy of the serious attention of all contemplating the purchase of a loud speaker. It is available in mahogany or oak at £6 10s., in walnut at £6 15s., and in an ebony finish at £7 7s. The makers are the Celestion Radio Co., 29-31, High St., Kingston-on-Thames.

The Athol Engineering Co., of Corner St., Hr. Broughton, Manchester, who recently introduced the "Tiger" single

coil holder for panel mounting, have now produced a version of this neat little component suitable for baseboard mounting. It consists of a square inch of glazed porcelain, 1/4 inch thick, which is provided with two countersinking screw holes and nickelled plug and socket fitted with soldering tags. It is a clean, accurately assembled article, and at the extraordinarily low price of 9d. has, in our opinion, no serious rival on the market.

From J. Martin Blair, of Amberley House, Norfolk St., Strand, W.C. we recently received three Purson grid leaks for test. They are marked "1/2 meg," "1 meg," and "2 meg," and are of the conventional "cart-ridge" type. On test, their values were found to be reasonably accurate and they gave good results when inserted in place of standard types in various receivers.

Messrs. Bell Wireless Crystals of 108, Dale End, Birmingham, have sent us a number of samples of their Bell crystal, drawn from stock. Sold in small boxes at 1/- per pair under a money-back guarantee, the Bell is a good example of the synthetic galena type of rectifier. It is sensitive and stable and operates well in conjunction with all the usual types of contacts.

Messrs. J. I. Eastick & Sons, of Eelex House, 118, Bunhill Row, E.C.1, have placed a range of standardised plugs and sockets on the market. These are all excellent little articles and their use makes for neater and more efficient external wiring. But it is the T.2 L. terminal which demands

(Continued on page 254.)

Choose your Valves by comparison

1. Compare the characteristics of the S.P. 18 Valves with the published figures of other makers. Take the Voltage Amplification Factor, multiply it by the Mutual Conductance in micromhos. The square root of the product is the figure to use when comparing the relative merits of valves.
2. Compare the filament details. How many cells are required?
3. Compare the prices.
4. Compare the actual results, tone, quality, volume, etc. These particulars for "Cosmos" SHORTPATH Valves are given in the adjoining panel.

METRO-VICK SUPPLIES, LTD.
(Proprietors—Metropolitan-Vickers Electrical Co., Ltd.)
 4 Central Buildings, Westminster, London, S.W.1.

1. The characteristics of S.P. 18 Valves are:—

	RED SPOT	GREEN SPOT
Voltage Amplification Factor	7	15
Impedance	7,000	17,000
Mutual Conductance, micromhos	1,000	850
Figure of Merit	84	113

2. S.P. 18 Valves consume only 0.3 Amp at from 1.6 to 1.8 Volts, and require only a single cell 2-volt Accumulator.
3. S.P. 18 Valves cost only 12/6 each. Red Spot or Green Spot.
4. S.P. 18 Valves provide a SHORTPATH to better results.

Cosmos

RADIO VALVES

'As stable as a valve.'

That's what one enthusiast said about the "Brownie Wireless" "Permatector." We are hard put to it to find a better description.

Set it for the loudest signals, then shake the receiver or the table it rests on and you'll find reproduction entirely unaffected. You can pick up the 'phones with the certainty that your crystal will always be set to give the loudest possible results.

From your Dealer

3/-

The "Permatector" is the outcome of much experiment and research, during which time two wonderful rectifying minerals were discovered. These, in conjunction with the unique spring action, ensure utmost stability and voluminous reception.

The "Permatector" has been built to fit instantly any model "Brownie Wireless" Receiver, and brackets, screws and nuts are provided in each box to allow it to be fitted to any other crystal set in a very few minutes. The outer case is turned out of solid brass rod and heavily nickel-plated, the finished product being a handsome addition to any receiver. And lastly, it is sold at the moderate price of 3/- complete.

For trouble-free crystal reception use

THE PERMATECTOR

—the always ever-set crystal detector.

Built by the makers of the famous "Brownie Wireless" Crystal Receiver.

THE BROWNIE WIRELESS CO.
(of Great Britain), LTD.

(Incorporating the J.W.B. Wireless Co.)

310a-312a, EUSTON RD., LONDON, N.W.1.

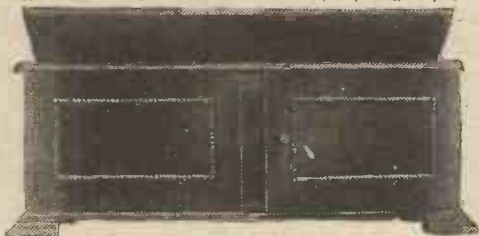
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UNAFFECTED BY VIBRATION



CAXTON 4-VALVE CABINET

Made for Sets "All Concert Receiver,"
"Fieldless Coil Three Valve Set."
"Any Valve Low Frequency Amplifier."
Special Cabinets made to customer's measurements.
Prices Quoted.



Cash with Order. Fumed Oak ... £1 5 0

Dark or Jacobean Oak ... £1 10 0

Real Mahogany ... £1 14 0

Detachable 7" deep Base Board to mount 16" by 8" panel to slide out of Cabinet front.

The two beaded front doors as illustrated, placed 2 ins. in front of the enclosed panel at 10/- extra.

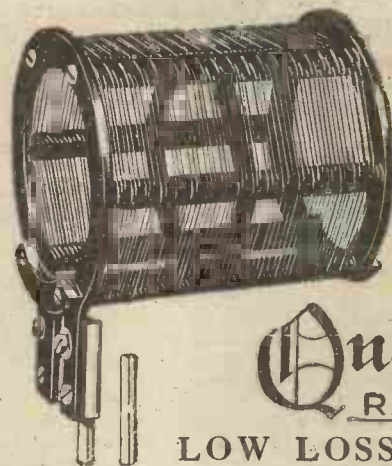
Ebonite or Radion Panels Supplied and perfectly Fitted at low extra cost.

All Polished with the new enamel that gives a glass hard surface that cannot be soiled or scratched. SENT FREE.—Catalogue of standard Wireless Cabinets in various sizes and woods.

Packed and delivered free in U.K.

No. C2

CAXTON WOOD TURNERY CO., Market Harborough



Quality RADIO

LOW LOSS COIL

for use with ordinary coil holder

THIS "Quality" Low Loss Coil is designed for use with any ordinary coil holder. It is wound in accordance with the latest results of low loss research. It has flexible plug and socket to allow for variation in the spacing of the corresponding plug and socket on your coil holder. The plug is interchangeable with either socket so that the coil can be used with right or left handed holders.

With an '0005 variable condenser this Quality Coil covers all wavelengths between 200 and 600 metres.

PRICE 5/6

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Absorbs shock—protects the valves



You know it's good because of the name 'LOTUS'

Don't have your valves spoiled by shock. The Lotus Valve Holder has been specially designed to counteract the microphonic elements that are so injurious to the delicate valve filaments.

The unique and original springs of the Lotus Valve Holder absorb any shock and eliminate all microphonic noises. Protect YOUR valves by fitting the Lotus Holder.

Valve sockets and springs are locked together by a mechanical process, making a definite and permanent connection. Bakelite mouldings, nickel silver springs and phosphor bronze valve sockets. Nickel plated.

LOTUS

BUOYANCY

VALVE HOLDER

ANTIMICROPHONIC

From all Reliable Radio Dealers.

GARNETT, WHITELEY & Co. Ltd.,
Broadgreen Road, Liverpool.
Makers of the famous LOTUS Coil Holder.

2/3
With
Terminals 2/6

APPARATUS TESTED.
(Continued from page 252.)

special mention. This device is so designed that it will take pin or spade terminals, ordinary wire or plugs, and by including the last it will be seen that it is very novel in its adaptability.

It is supplied with a coloured top, six different colours being available; or lettered such as "Earth," "Aerial," etc., etc. There is one small criticism we would like to make and that is that the indicating letters twist round when the terminal top is screwed up or unscrewed. Just a little more ingenuity in design would remedy this and the result would be practically a perfect terminal.

Messrs. Ward & Goldstone, of Frederick Road, Pendleton, Manchester, have sent us one of their new double reading voltmeters for test. The instrument has been designed specially to meet the requirements of the wireless amateur and listener, and is styled the Combined Radio Meter. It has a central zero point, the scale reading to 10 volts in one direction, this being suitable for testing the voltages of L.T. batteries or sections of H.T. batteries, and to 100 in the other for complete H.T.'s. The instrument is of the popular watch type and is supplied with a flexible lead for making contacts with the one battery pole, one or other of two feet points provided being used for the other pole according to which range is required.

We tested the Combined Radio Meter against our standard calibrated voltmeters,

and could detect no appreciable error on either side. A very important feature is that the instrument has a very high resistance, and this enables it to give accurate readings of the voltages of run-down H.T. batteries.

The Combined Radio Meter is retailed at 10s. 6d. and, being a precision production, is cheap at this price. We can fully recommend it to our readers.

From Messrs. H. Clarke & Co. (M/C), Ltd., of Old Trafford, Manchester, we recently received a number of "Atlas" fixed condensers. Of the well-known oblong, flat shape, they are provided each with two "ears" with counter-sunk holes for mounting, and nickelled soldering tags and terminals. The insulation throughout is provided by bakelite, which, besides being impervious to atmospheric variations, does not soften under the action of making soldered connections. It is a tough ma-

terial, too, and will not crack easily as does pitch-blend composition or even ebonite. Copper foil and mica are employed. On test the "Atlas" condensers held their charges extremely well and were found to have capacities practically exactly as stated.

They are well made and are neat in appearance. Prices are attractive, varying from 2s. for the .0003 mfd. and 2s. 3d. for the .001 mfd. according to values. They can be thoroughly recommended.



Lady Lauder listening to Sir Harry during his recent broadcast on a Marconiophone receiver, the "Straight Eight."

EDISON BELL RADIO

THERE IS NOTHING BETTER THAN THE BEST—WE SUPPLY YOU WITH THE BEST

USE THESE JACKS AND BE SATISFIED



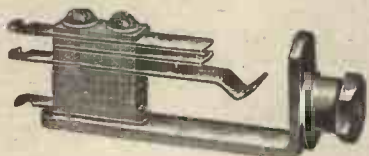
S.O. No. 1. Single Open. Price 1/8



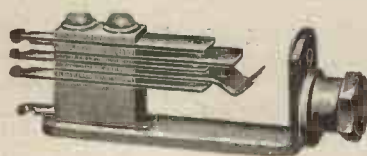
S.C. No. 2. Single Closed. Price 2/2



D.C. No. 3. Double Closed. Price 2/9



S.F. No. 4. Single Filament. Price 2/6



D.F. No. 5. Double Filament. Price 3/4



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BRITISH THROUGHOUT

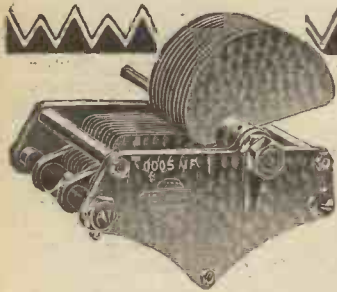
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J. E. HOUGH, Ltd., Edison Bell Works, LONDON, S.E.15, & HUNTINGDON

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THEY ARE BRITISH MADE AND GUARANTEED BY A NAME WITH 30 YEARS REPUTATION BEHIND IT



Igranic Low Loss Square Law Variable Condenser (Pat. No. 220372).

6

points

that make Igranic Variable Condensers the choice of experts

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- 2.—Accurate Square-law characteristic.
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- 5.—Accurate rated capacities with extremely small minimum.
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149, Queen Victoria St., London, Works: Bedford.

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If repaired by **THEY ARE** Lustrulux Ltd. **We Guarantee Satisfaction**

The Pioneers of valve repairs were Messrs. Crowther and Osborn. We have acquired their plant and goodwill and many of the original staff are working for us.

With an accumulated experience of this class of work and having plant of the most modern, descriptions we can guarantee the perfect results in tone reproduction and high-emissivity that are such notable features of Lustrulux Valves.

Thanks to a thoroughly efficient organisation we can do this at prices considerably lower than those usually asked, and easily maintain our Premier position as valve repairers.

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Bright Emitters - 4/6

(Double-grid valves, 7/-)

Dull Emitters - 7/-

POWER VALVES according to price when new, i.e.: valves costing 20/- or more repaired for 10/-; Valves costing less than 20/- repaired at half original price.



The Better British Valve

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No. 10. Rich Antique Mahogany Lacquer. Height 21 inches. Diameter of Flare, 12 inches.

There is a wonderful Baby "Red Seal," No. 7, price 30/-

Obtained at all good Wireless Dealers. Ask yours to let you hear both, or write direct to the sole Manufacturers:—

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Complete Amplifier Price

38/-

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3 to 10 fold AMPLIFICATION WITHOUT VALVES from any Crystal or Valve Set at small cost, by the NEW **MAGNETIC MICROPHONE BAR**

(Prov. Patent. No 8574/25)

LOUD-SPEAKER RESULTS from CRYSTAL RECEPTION of average strength.

WEAK RECEPTION MADE STRONG & CLEAR.

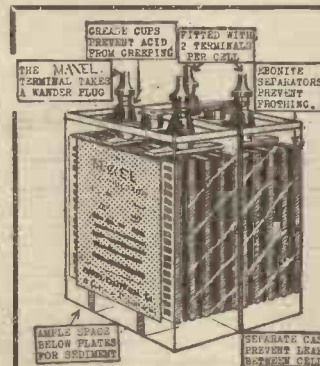
Not a Microphone Button. Entirely free from distortion and microphonic noises. No valves, accumulators, or H.T. batteries. No fragile parts. Nothing to get out of order. A child can adjust it. Operates on one or two Dry Cells lasting 3 months.

EQUALLY EFFICIENT ON VALVE SETS.

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Specially designed for Wireless.

GUARANTEED TWELVE MONTHS. If you live too far away to call and see the Battery Mail your Order to us for the size you want. We will willingly return your money if you are disappointed. Now fitted with NON-CORROSIVE Wander-plug Terminal.

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2 VOLT ..	7/6	9/6	11/9
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H.T. BATTERIES 60 VOLT 7/6 post free

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RADIOTORIAL

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As much of the information given in the columns of this paper concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject 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.

Readers' letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers. The envelope should be clearly marked "Patent Advice."

TECHNICAL QUERIES.

Letters should be addressed to: Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4.

They should be written on one side of the paper only, and **MUST** be accompanied by a stamped addressed envelope.

Queries should be asked in the form of the numbered questions: (1), (2), (3), etc., but may be accompanied by a short letter giving any necessary additional particulars as briefly as possible.

For every question asked a fee of 6d. should be enclosed. A copy of the numbered questions should be kept, so that the replies may be given under the numbers. (It is not possible to reproduce the question in the answer.)

BLUE PRINTS. A series of 20 Blue Prints can be obtained from the Query Dept., price 6d. per Blue Print.

Only a limited number of circuits are covered by this series, and full details of the circuit arrangements available in Blue-Print form are published fortnightly in the advertisement columns of this journal.

All other back-of-panel wiring diagrams are specially drawn up to suit the requirements of individual readers, at the following rates: Crystal Sets, 6d. One-Valve Sets, 6d. One-Valve and Crystal (Reflex) 1s. Two-Valve and Crystal (Reflex), 1s. Two-Valve Set: 1s. Three-Valve Sets, 1s. Three-Valve and Crystal Reflex, 1s. 6d. Four-Valve Sets, 1s. 6d. Multi-Valve Sets (straight circuit), 1s. 6d. Except SUPER-HETERO-DYNE DIAGRAMS, all of which irrespective of number of Valves used, are 2s. 6d.

If a panel lay-out or list of point-to-point connections is required, an additional fee of 1/- must be enclosed.

Wiring diagrams of commercial apparatus, such as sets of any particular manufacture, etc., cannot be supplied. (Such particulars can only be obtained from the makers.)

Readers may submit their own diagrams, etc. for correction or for criticism. The fee is 1/- per diagram, and these should be large, and as clear as possible.

No questions can be answered by phone. Remittances should be in the form of Postal Orders.

Questions and Answers

THE TWO-VALVE TRINADYNE.

W. B. (Guildford).—I notice that when I disconnect the crystal detector on my two-valve Trinadyne there is an alteration in tuning, but when I readjust the tuning I can obtain signals just as loud as ever. Surely this means that the crystal detector is doing no useful work?

(Continued on page 258.)

SCRAP HIGH-TENSION BATTERIES!

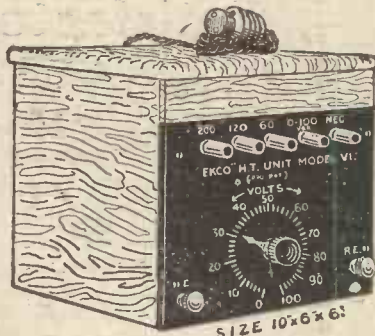


"EKCO" H.T. UNITS

(Patents applied for).

Derive High-tension from your Household Electricity Supply (DIRECT CURRENT) by just attaching adaptor to electric light lamp-holder.

ENSURE PERFECT RECEPTION—NO NOISE, NO "HUM"—RUNNING COSTS NEGLIGIBLE—SAVE COST IN A FEW MONTHS—LAST A LIFETIME—VARIABLE AND FIXED VOLTAGES.



USERS' OPINIONS: "... I received your 'Echo' Unit, which has proved most satisfactory under careful test. Reception is decidedly clearer than with ordinary dry batteries. The Unit is extremely silent in use, there being no sound from the Generating Station which is in close proximity. I am sure there is a ready sale for the Unit once it becomes known."—A. W., ELECTRICIAN, NOTTINGHAM.
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1	1	1 to 3 valves without Power Valves	35/-
1a	1	1 ,, 3 ,, with ,, ,,	42/6
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VI	1 Variable and 3 Fixed	3 ,, 8 ,, " " " " " "	£6 : 17 : 6
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Postage and Packing, 1/6.

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MEDIUM
with or without
Cork Tips
10 for 6d.



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10 for 5½d.



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OF

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RHEOSTATS



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With Solid Bakelite Knob and Dial 3/9
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and Dial - - - - - 2/6
Resistances in 6, 10, 15, & 30 ohm. at same price.

The Philmore incomparable Grid Leak, glass enclosed with Knurled Brass Ends, extremely constant in use, and tested by experts before leaving factory.
1/2 to 10 megohms graduated in 1/2 megohms.
Price 1/6 each.

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HOW TO WASH OUT AN ACCUMULATOR!

If your accumulator is not giving satisfaction, and has a thick sediment at the bottom, it needs washing out.

Empty the acid, then with brace and bit cut three 3/4-inch holes, one in the centre and one at either side of the carrier bars. Swill out with tap water, drain thoroughly, and seal up the holes with a strip of Celluloid fastened with our PERFECT CELLULOID CEMENT. This Cement is infallible for repairing any article made of Celluloid, such as Motor Side Screens, Imitation Tortoiseshell and Ivorine Brushes, Mirrors, Combs, Toys, and a host of other articles. 1/6 per bottle, with strips of Celluloid, Post Free.

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A POCKET KNIFE FOR EVERY WIRELESS CONSTRUCTOR. Contains screw-driver, file, insulation scraper and one useful blade. Made for me in Sheffield by a firm renowned for the quality of its Cutlery. Satisfaction guaranteed. 3/3 post free from H. OSBORN, 27, High St., DAVENTRY.



RADIAX H.T. ACCUMULATORS
Give a perfect H.T. Supply for many months with one charge. Improve reception wonderfully.

10 Volt Unit.....6/9
60 Volt Battery.....50/-
RADIAX LTD.,
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2-VALVE AMPLIFIER, 35/-
1-Valve Amplifier, 20/-, both perfect as new;
Valves, 4/6 each; smart Headphones, 8/6 pair;
new 4-Volt Accumulator, celluloid case, 13/-; new
66-Volt H.T. Battery guaranteed, 7/-; 2-Valve
All-Station Set, 24/- approval willingly
P. TATLO 57, Studley Road, Stockwell.

ALL WIRELESS GADGETS

MAP

SMALL PARTS TO THE TRADE.

MAP Co. 246, Gt. Lister St., Birmingham.

RADIOTORIAL
QUESTIONS & ANSWERS.

(Continued from page 256)

Not necessarily, for if you listen carefully you will probably notice that reproduction is much clearer when the crystal is in action. But it is within ranges of about 15 miles from a broadcasting station that the real "punch" is obtained from a Trinaryne, for in this case the circuit acts with the full efficiency of a crystal—2 L.F. with reaction. Its stable DX qualities depend upon the introduction of a crystal of a suitable nature. You should experiment with this—try one or two different types of crystal, it is generally well worth while.

CRYSTAL SETS ON FRAME AERIALS.

H. R. S. (Cardiff).—I have been told that it is possible to use a frame aerial with a crystal set. Is this so?

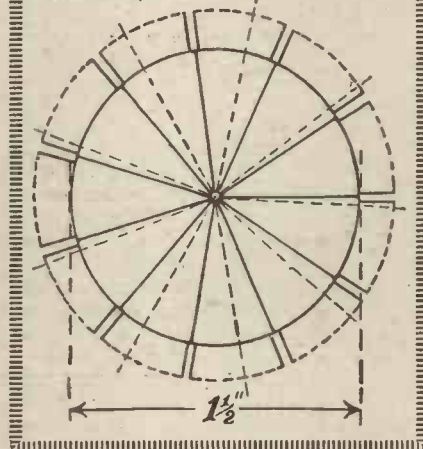
It is possible, just as it is possible for a one horse-power petrol engine to pull a five-ton lorry—downhill! But it is necessary to be very close indeed to a broadcasting station to be able comfortably to operate a crystal set on a frame aerial. People residing under the shadow, as it were, of a transmitting aerial might obtain satisfactory results, but, generally speaking, the crystal set is limited either to an outdoor aerial or a very good indoor aerial.

For the Constructor

NO. 4—TEMPLATE FOR SPIDER-WEB COILS.

Spider-web coil formers having a centre diameter of 1 1/2 inches can be made from this sketch.

The heavy lines show how eleven segments should be marked out, and how the slots are cut down towards the centre. The dotted lines show the arrangement for nine slots.
(Note:—The angles are the same for Basket coils.)



ACCUMULATOR TROUBLE.

J. B. (Newcastle).—My accumulator is giving very poor service lately. I get it charged, and it only lasts a few hours and then runs down. Is this due to insufficient charging?

Probably it is due to sulphation. If the plates show signs of a whitish substance adhering to them this is undoubtedly the trouble. Anyway, we should advise you to change your electrician, for if he was fully qualified technically, and took an interest in his work, he would have spotted the sulphation and taken steps to reduce it or told you that the battery requires a thorough overhaul.

THE "P.W." SUPER HET.

R. D. K. (Birmingham).—I have received an oscillator coupler for the "P.W." Super Het. from Messrs. Peto-Scott, but it does not appear to have a fixed condenser inside it. Surely this is the wrong component?

Yes, undoubtedly, because in the correct coupler a condenser is most certainly required, and it will be quite plainly visible inside. Perhaps you did not plainly stipulate an oscillator coupler for the "P.W." Super Het. in your order. No doubt the firm in question will change the component for you, if you return it to them carriage prepaid, enclosing cost of return postage.

TECHNICAL NOTES.

(Continued from page 236.)

the ordinary loud-speaker terminals of the set are connected to the primary of a suitable transformer and the secondary of this transformer is connected to the twin leads mentioned above. The ratio of impedances of this transformer will depend upon the loud speaker which is used, but generally a 1 to 1 transformer is suitable. It is usually desirable to shut the primary of this transformer—that is, the output terminals of the set, by means of a fixed condenser, to bypass the H.F. current. Another simple arrangement, in the absence of a transformer, is to connect a choke (such as is used for choke-coupling) across the output loud-speaker terminals of the set, and then to run the leads straight on from the terminals of the choke to the loud speaker, a large capacity condenser being, however, included in one of the leads, in series with the loud speaker: this condenser should have a capacity of about half a microfarad. If a choke of the ordinary kind is not available, it will generally be found that one of the windings of a discarded transformer will serve the purpose. The condenser referred to may, of course, have a capacity considerably higher than half a microfarad, even of one microfarad or two microfarads.

HOW VALVE CIRCUITS HAVE GROWN UP.

(Continued from page 234.)

Fig. 9 shows the original form of the De Forest Ultra-audion Circuit, which, although not particularly suitable for the standard type of British valve, has enjoyed a wide vogue in America, giving very good results when used with valves of the audion or gas-filled type.

The curious point about this circuit is that the input coil is connected across the grid and plate terminals, instead of being inserted between grid and filament as usual. The effective difference is, however, more apparent than real, as the high-frequency voltage variations reach the filament across the internal capacity path between the electrodes, and also via the telephones and H.T. battery, which are in practice usually bridged by a by-pass condenser. In another modification of this circuit a condenser is inserted in series with the A.T.I. directly across the grid and filament.

If the Ultra-audion Circuit is redrawn in the form shown in Fig. 9a, its general resemblance to the family of valve circuits already considered becomes more evident. For instance, it is practically the same as the Hartley Circuit of Fig. 4, apart from the mid-point connection to the filament.

An interesting derivative of the Ultra-audion arrangement is the Cockaday Circuit, shown in Fig. 10. Here the aerial A is loosely coupled to a tuned secondary G C, which is branched across the plate (through the lead P) and grid of the valve. The aerial loading coil L C is sometimes omitted in favour of a purely aperiodic aerial coupling.

The circuit T is a wave-trap or absorber circuit closely coupled to the tuned secondary, to the action of which (combined with the aperiodic aerial coupling) the high selectivity of this type of circuit is largely due.

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19, 2, 26. Messrs. Raymond. Whilst in town a short time ago I purchased 3 of your Low Loss Straight Line, etc., condensers, viz.: '0003, '0005 and '0005 with vernier. I did not have an opportunity for testing these until Wednesday evening last, when I banked up a straight one-valver incorporating the '0005 without vernier. The results were absolutely astonishing, because I got a station with almost every degree of the dial. I got as far as Stockholm. The other stations were London (of course), Berlin, Bournemouth, Breslau, Brussels, Hamburg, San Sebastian, Paris, Hiltzsum and Daventry. I almost forgot to include Dublin. This station is rarely heard in this district, but it came in well on two pairs of 'phones. I have never used a better condenser and I felt that you would like to know. The hook-up was on a piece of board. (Signed) A. BOWER.

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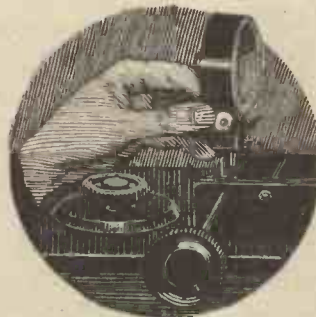
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RADIO NOUVELLES POUR LES AMATEURS FRANÇAIS.

Cristaux Oscillants.

M. LOSSEV a déjà démontré que le M. détecteur à galène possède des propriétés génératrices et amplificatrices, c'est-à-dire qu'il peut communiquer l'énergie à un circuit d'accord et produire des oscillations entretenues à haute fréquence.

D'autre part, on a découvert qu'un morceau de quartz était susceptible de produire des vibrations mécaniques sous l'influence d'un courant à haute fréquence.

La vibration a, naturellement, un caractère moléculaire, la disposition des molécules étant changée et rétablie avec une rapidité extrême et une constance remarquable. Cet effet peut être utilisé pour uniformiser le train d'ondes d'un poste transmetteur.

Une propriété analogue du cristal, connue sous le nom de "piezoélectricité," a été utilisée récemment comme un couplage sélectif pour relier deux lampes amplificatrices. Dans ce cas, les voltages en rapport sont transformés en efforts mécaniques, qui influent ainsi le voltage appliqué à la grille de la lampe suivante. On se sert d'un circuit sélectif pour transmettre les vibrations d'une fréquence connue et rejeter toutes les autres, empêchant ainsi toute interférence.

Progrès de Télévision.

Le plus récent essai fait pour résoudre le problème de transmission des effets de tableaux mouvants par sans fil consiste à convertir les onds lumineux en ondes de haute fréquence équivalentes, par un procédé similaire à celui utilisé dans le récepteur à superhétérodyne. En d'autres termes, les ondes lumineuses extrêmement courtes sont combinées ou hétérodinisées avec d'autres ondes d'une fréquence légèrement différente. Le résultat obtenu est la production de vibrations d'une longueur d'ondes pouvant être utilisées par un appareil de radio.

La méthode est inversé au poste récepteur, les longueurs d'ondes étant, à l'arrivée, réduites à leur dimension préalable, de manière à donner naissance à des effets lumineux.

Ce système peut être employé pour la reproduction de couleurs naturelles. Le procédé est analogue à celui dont on se sert pour les impressions en trois couleurs. Au poste transmetteur, trois cellules photo-électriques sont utilisées, chacune d'elles répondant à une seule couleur. Au poste récepteur sont trois sources de lumière correspondant au trois couleurs primitives. Chaque lumière est contrôlée par un obturateur, et les rayons qui en émergent sont mélangés et projetés sur un seul et même écran.

T.S.F. au Gramophone.

Récemment on a perfectionné un appareil pour recorder directement les répétitions T.S.F. Un courant émis par une lampe amplificatrice fournit l'énergie à un relai électromagnétique qui, à son tour, gouverne le mouvement d'un style en contact avec un rouleau ou un disque enregistreur. L'appareil peut être utilisé pour recorder toute transmission de T.S.F. d'intérêt particulier, en vue de sa répétition postérieure par un gramophone.

Le télégraphe inventé il y a quelques années par Vladimir Poulsen avait le même but. Dans ce cas les signaux sont imprimés, comme une réplique magnétique des sons, sur une bande ou un ruban de métal mobile. Pour obtenir la reproduction des signaux, la bande métallique est simplement déroulée devant les pôles d'un electro-aimant. Malheureusement, la réplique magnétique sur la bande n'est pas absolument permanent, mais disparaît graduellement avec le temps.

Avis Pour Souder.

Il arrive quelquefois, qu'on ait besoin de parvenir jusqu' à un endroit que le fer à souder est trop épais pour atteindre. En ce cas, on se sert d'un morceau de fil de fer à section carrée que l'on enroule plusieurs fois autour de l'extrémité du fer à souder, en laissant dépasser une pointe en saillie qui peut être droite ou courbé suivant que le demande les circonstances. Le tout est fortement chauffé et, si la main de l'opérateur est suffisamment experte, l'extrémité du fil métallique conservera une chaleur suffisante, pendant le temps nécessaire pour terminer l'opération.

Le Téléphone Comme Antenne.

En cas de nécessité une ligne téléphonique peut être utilisée comme antenne réceptrice par un procédé très simple consistant à placer un disque ou une feuille de métal, tel qu'un plat creux, sous le récepteur téléphonique. Une connexion est soudée au disque, puis reliée à la borne antenne de l'appareil T.S.F. La borne terre de ce dernier doit être reliée à une prise de terre selon la manière ordinaire. La plaque d'étain forme la plaque extérieure d'un condensateur placé en series avec la ligne téléphonique, en permettant le passage de courants à haute fréquence à travers le poste T.S.F.

Une Bonne Prise de Terre.

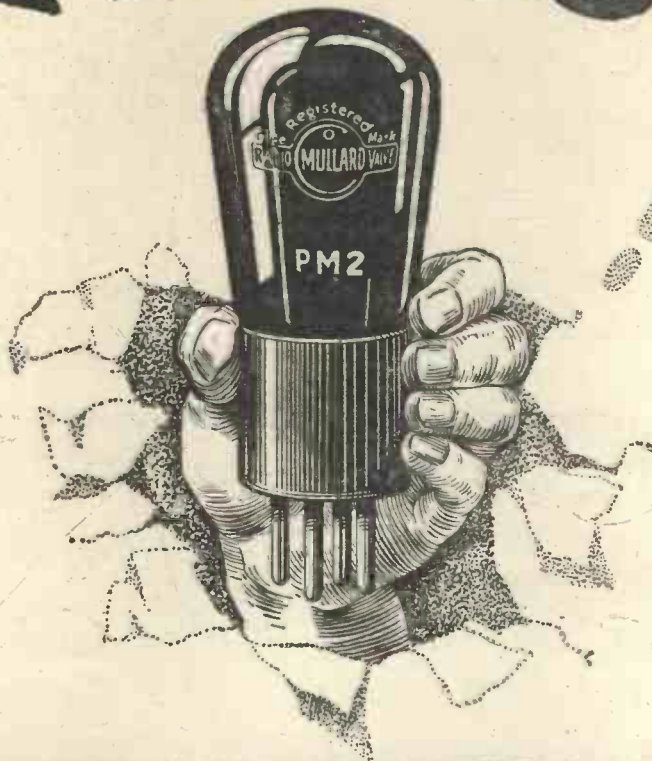
Il serait inutile d'attendre de bons résultats d'un poste récepteur lorsque la prise de terre constitue une résistance élevée qui, à son tour, accablent le circuit de l'antenne qui devrait être le circuit d'accord. La résistance est défavorable à la résonance et est, par le fait, quelquefois provoquée de propos délibéré afin d'empêcher l'auto-oscillation causée par la réaction de deux circuits bien accordés. Un rouleau de vieux treillage en fil de fer, pourvu qu'il ne soit pas rouillé, constitue une des meilleures prises de terre qu'il soit possible d'obtenir.

Chocs Electriques.

Les effets préjudiciables d'un haut voltage varient énormément suivant les personnes. Ils dépendent, entre autres choses, de l'humidité relative (conductibilité) de la peau, de l'état de santé, et aussi des particularités du système nerveux. L'habitude de leur maniement est encore un autre facteur; après une longue pratique, on peut, sans danger, manier des voltages qui causeraient des troubles graves, sinon fatals, lors d'un premier essai.

Bien qu'il soit connu que le choc causé par un courant réputé inoffensif de 120 volts—courant employé normalement pour les usages domestiques—puisse déjà être fatal, le voltage utilisé aux États Unis pour les electrocutions publiques est de 2,000 volts. Cette force est fournie par une dynamo, est électrodes étant appliquées respectivement sur la tête et les jambes de la victime assise sur la chaise funeste.

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2-1	60,000
	7,000
3-1	28,000
	60,000
4½-1	28,000
6-1	7,000
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