

ANOTHER ARTICLE BY SIR OLIVER LODGE

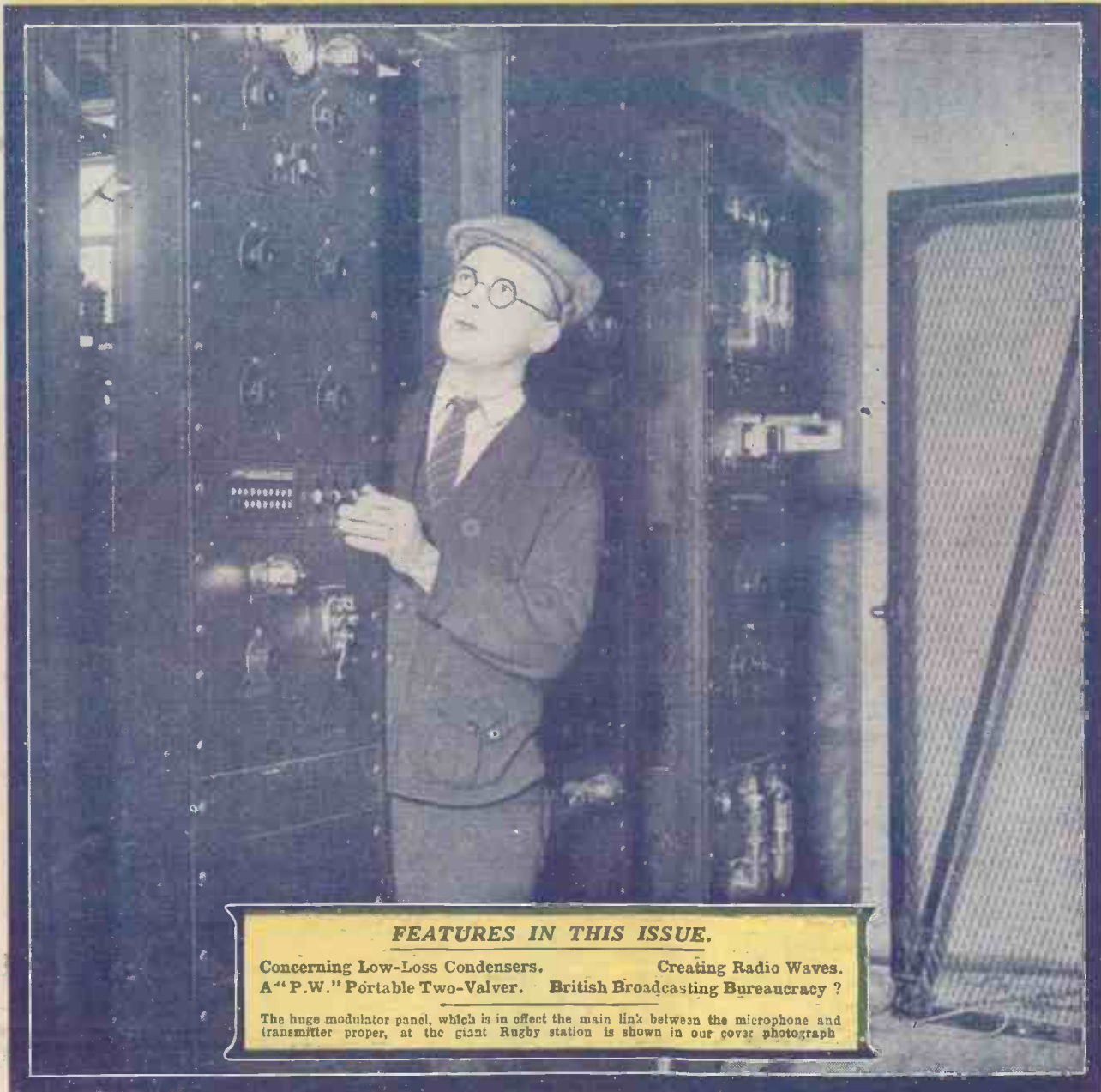
Popular Wireless

Every Thursday
PRICE
3d.

No. 208. Vol. IX.

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

May 29th, 1926.



FEATURES IN THIS ISSUE.

Concerning Low-Loss Condensers. Creating Radio Waves.
A "P.W." Portable Two-Valver. British Broadcasting Bureaucracy?

The huge modulator panel, which is in effect the main link between the microphone and transmitter proper, at the giant Rugby station is shown in our cover photograph

ARE YOU A PATIENT MAN ?

£200

IF YOU ARE



"Let's see—five separate units give five capacities, taken singly. Then I can have the first two in series or parallel—total seven. Then the first three all in series or all in parallel—two more. The first and third and second and third in series, total 9. Ditto, in parallel, 11. First and second in series, and in parallel with the third—12 And the total number of different capacities with the five units is ———— ?" What is it ?

*If you get it right,
you win £200!*

Whatever your skill in counting capacities, however, the purchase of a Dubilicon will bring you one sure reward. The Dubilicon gives any capacity up to 0.011 mfd. simply by varying the connections of the eight unit capacities of which it is composed; so that by using the Dubilicon you will be able to select with unfailing certainty the best value of fixed capacity for any desired part of your circuit.

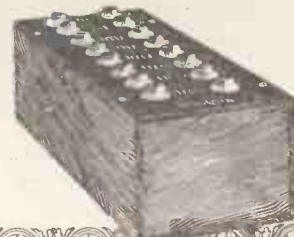
The Dubilicon is a multiple condenser containing eight separate units, the terminals of each unit being brought out to sockets on the lid. By using Clix plugs (made by Messrs. Autoveyors, Ltd., 84, Victoria Street, S.W.1) of which two are given with every Dubilicon, the units can be connected in a variety of series, parallel and combined series parallel arrangements giving a very large number of different capacities.

The uses and advantages of the Dubilicon, which we have summarised above, make it more than worth its low price of 30/-.

In addition, the purchase of a Dubilicon entitles you to enter for the £200 prize competition. All you have to do is to estimate the number of different capacities you can get by connecting up the first five units in various ways.

Ask your dealer about one to-day—and mind you enter for the £200 competition! He will tell you all about it!

*The
Dubilicon*



REGISTERED  TRADE MARK

DUBILIER

CONDENSER CO (1925) LTD

ADVERT. OF THE DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, N. ACTON, W.3. TELEPHONE: CHISWICK 241-2-3. E.P.S. 158

TO ALL RADIO USERS

A Message from
The House of Graham

IN the difficult circumstances of the recent general strike it is regretted that it has not been possible to give that attention and service which it is always the endeavour of the House of Graham to afford.

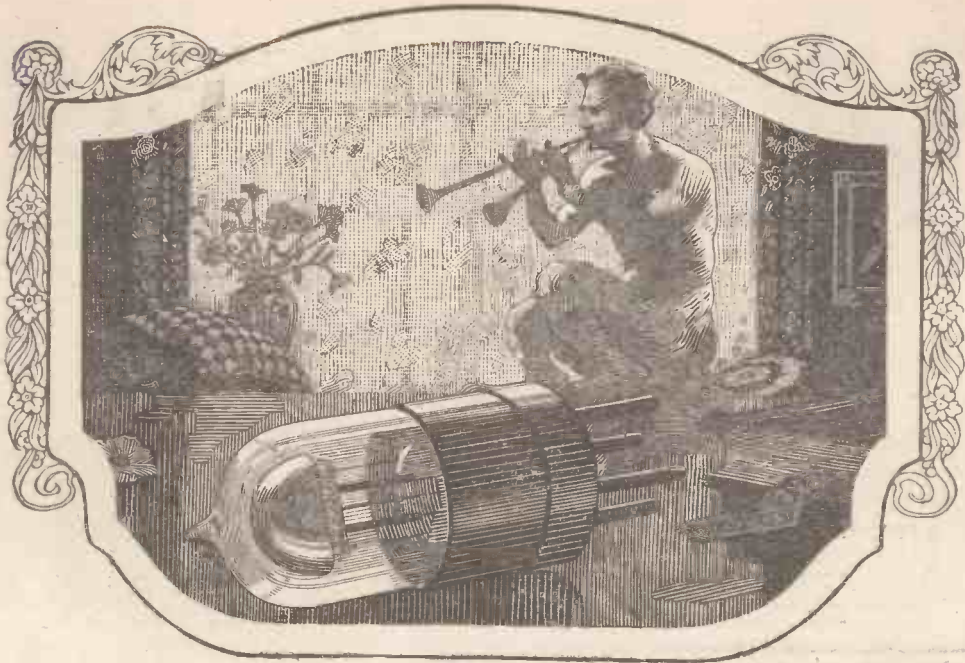
As conditions become normal every possible step is being taken to re-establish, at maximum efficiency, all production and delivery services in order adequately to meet the demand for Amplion Products.

In the meantime Broadcasting has proved itself, both as an entertainment and as a means for the dissemination of authentic news when other systems fail.

Its popularity stands to-day higher than ever and with an assured supply of Amplion Loud Speakers, Radio—and Radio at its best—is within the reach of every home.



**ALFRED GRAHAM & CO. (E. A. GRAHAM)
CROFTON PARK, LONDON, S.E.4**



The Dull Emitter which defies old age

LISZT'S beautiful Rhapsody Hongroise—full of dramatic fire and brilliantly contrasted passages—was being broadcast. Away in the Studio, the artiste's fingers tripped lightly over the ivory keys. At home, the family sat enthralled—captivated by the richness and emotion of the masterpiece which won for its composer a niche in the Hall of Fame.

And then suddenly . . . dead silence. A valve in the Receiving Set had burnt out.

What causes a valve to burn out prematurely? Excessive heat—nothing else—is the devastating influence. All metals when heated expand—when cool, they contract. A valve filament constantly expands or contracts as the current is turned on or off. The higher the temperature, in fact, the greater the expansion. Such treatment, in course of time, produces brittleness and inevitably renders the filament very susceptible to fracture.

This was the problem Cossor set

out to solve—and so successfully unriddled—by the invention of the triple-coated filament used only in the Wuncell Dull Emitter Valve.

Whereas in most dull emitters, low current consumption has been obtained by the use of extremely fine filaments operating at temperatures as high as 2000°, the Wuncell ensures economy by entirely different methods. Its special filament is *triple-coated* to ensure a prolific electron stream at only 800°—practically the temperature of the embers of a dying match.

Further, its filament is practically as stout as that used in any bright emitter. Because of this, and the fact that its working temperature is so much lower than hitherto thought possible, heat has little or no effect upon it.

As a result the Wuncell has already won a great reputation throughout this country and abroad among broadcast listeners as the one dull emitter "which really defies old age."

Types and Prices:

- *W.1. For Detector and L.F. use - 14/-
1.8 Volts. Consumption: '3 amps.
- *W.2. (With red top) for H.F. use 14/-
1.8 Volts. Consumption '3 amps.
- W.3. The Loud Speaker Valve - 18/6
1.8 Volts. Consumption '5 amps.

*Also in special base with resistance to suit 2, 4- or 6-volt Accumulator 16/-

Cossor Valves

Popular Wireless

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RADIO NOTES AND NEWS.

No more Halle Concerts—A Lucky Lodging—The Wave-length Changes—Unidyne Results—A Powerful Set—Broadcasting Torture—World's Short Wave Stations.

To Beam or Not to Beam ?

JUNE 11th was the date given a few weeks ago for the completion of the new "beam" transmitting station at Grimsby. I hear it is likely that, as a result of the strike, there may be a little delay ; but, in any case, this summer should settle once and for all the interesting Empire wireless query "To beam or not to beam ? That is the question."

Fire !

DIRECT telephonic communication is to be established between the B.B.C. headquarters at 2, Savoy Hill, and the Whitefriars Fire Station.

Other large concerns—for instance, the theatres—adopt this plan in case of accidents ; but in the case of the B.B.C. it is obvious that such an arrangement might prove of the greatest value to the public.

No More Halle Concerts.

MUSIC-LOVERS heard with great regret the news that it has been decided by the Liverpool Philharmonic Society, the Hallé Society of Manchester, and the governing body of the Scottish Orchestra, not to broadcast any concerts next season.

It appears that extra fees were claimed for members of the Musicians' Union, which the B.B.C. could not see their way to pay.

Listeners to Benefit.

I HEAR that a wealthy Sheffield business man has presented a two-thousand-pound Strad violin to De Groot, whose playing at the Piccadilly Hotel he has often enjoyed. It is said that the only conditions attaching to the gift were that De Groot should never lose sight of the instrument, and that he should always use it for the broadcast concerts.

Some Odd Items.

ONE of the most exclusive clubs in London—the Athenæum, in Pall Mall—has recently had a first-class wireless set installed.

The Helsingfors station (Finland) was recently struck by lightning, and suffered considerable damage.

The cost of erecting the great British wireless super-station at Rugby was approximately £400,000.

The Plate That Fell.

HAVE you ever knocked a plate on to the floor—of a valve ? A Tunbridge Wells reader tells me that he had a curious experience using a Mullard

Red Ring



Two of the transmitting valves used at the B.B.C.'s high-power station at Daventry.

bright emitter. The valve had been jerked from the set accidentally, and subsequently, although the valve lit up when the rheostat was turned on, the plate had disappeared. It was lodged against the glass tube at the bottom of the valve.

This lucky correspondent goes on to say :

A Lucky Lodging.

" I MANAGED to shake it free, and this time it actually lodged between its former support and the glass bulb. On connecting the batteries once more, the Savoy Bands came through as though nothing had happened. The valve is now just as good as ever, and it takes a really hard bang on the table to make any unpleasant noises in the 'phones."

The French "Spy" Case.

THERE was a distinct wireless flavour about the recent French espionage case, for which three Englishmen were sentenced in Paris. In one instance three years' imprisonment and a fine of 3,000 francs was the sentence, and in both the other cases a sentence of two years' imprisonment and a fine of 2,000 francs was imposed. The three accused had all been employed by the Bleriot Burndept Co.

Radio News from the North Pole.

AFTER an anxious three days' silence, the great news that Amundsen's famous airship, the Norge, had passed safely across the Arctic regions was given to the outside world by radio. The U.S. army and navy coast stations in Alaska were of the greatest assistance to the intrepid aviators, and it was through the St. Paul Island naval radio station that news of safety and success reached civilization.

Edinburgh's Aerial.

EDINBURGH station, which, by the way, has just celebrated its second birthday, has the most cornery transmitting aerial in the kingdom. There is a shortage of chimneys in the northern capital (despite its reputation as "Auld Reekie"), so the B.B.C. engineers put up a three-piece aerial, which is hung over the University like a big string of sausages. For all its appearance, the radiation from 2 E H is as good as from any of the other relay stations.

Those Wave-length Changes.

RUMOURS are going about that extensive changes in the wave-lengths of the British stations are being contemplated by the B.B.C. Don't believe them, for they are without foundation !

Probably these rumours arise out of the suggestions made in connection with the redistribution of European wave-lengths ; but as the proposals have not yet been approved, and in any case would affect Britain but little, there is no need to pay the slightest heed to the "change-of-wave-length" bogey.

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

The Ideal Hobby.

ISN'T it quaint how all sorts and conditions of men are bitten by the radio bug? Many professional men, doctors, lawyers, and so forth, find wireless the ideal recreation, whilst, on the other hand, radio has no better supporters than the working men, who live—to paraphrase it politely—by the perspiration of their foreheads.

Whatever our earthly advantages or disadvantages may be, we all stand the same chance in the ether, don't we?

From the River Bed.

THE well-known diver, Mr. F. Shield, who is "billed" to broadcast from the bed of the River Thames on June 21st, has been making his living under water for nearly twenty years. Amongst his other feats, he took part in the diving operations in connection with the salvage of the German Fleet, scuttled at Scapa Flow. His talk from 2 L O should therefore not be missed—for divers reasons!

Unidyne Results.

I HAVE had a 1-valve Unidyne set for 12 months, now," says a Kettering reader, "and at different times I have logged the following foreign stations: Brussels, Dortmund, San Sebastian, Petit-Parisien, Oslo, Prague, Madrid, Hamburg, Munster, Rome, Radio-Toulouse, Berlin, Hilversum, Königswusterhausen, and Radio-Paris—all at readable strength on 'phones."

Sounds more like a gazetteer of the world than a 1-valve set, doesn't it?

"Programmes" After Concert was Broadcast!

PRETTY well everybody in the country realises the importance of the services rendered to the State by broadcasting during the Great Strike. But the only ungracious criticism which I have seen came, curiously enough, from the "Manchester Guardian." A writer in that journal has a long grumble about the news services provided during the strike, and instances the fact that train times were announced "when the trains referred to had already started."

He thinks that wireless can never equal the newspaper, but he omits to state that about the same time one of the leading newspapers came out with a meagre supply of news, supplemented by the whole of the preceding day's broadcast programme! Verb. sap.

A Successful S.O.S.

THE many listeners who heard the recent S.O.S. appeal to the parents of Miss Ena Craigie will be glad to know that as a result of the broadcast it is probable that Miss Craigie's life has been saved. After a motor accident she was picked up and taken to hospital, but the whereabouts of her parents was unknown, although they were thought to be in Jersey on holiday.

The S.O.S. found them, and they telegraphed to Imperial Airways for a seaplane, in which they flew to Croydon. Thence they were rushed by car to the hospital, where the patient recognised them. From that moment Miss Craigie—who is a member of the chorus at His Majesty's—made rapid progress, and now there is every hope that she will recover.

A Powerful Set.

BILL: "I got a new kick out of my radio last night."

Phil: "How come?"

Bill: "The wind blew my aerial on to the high-tension power line!"—"Radio News."

Help for Hospital Fund.

VISCOUNT BURNHAM recently made an interesting disclosure at the annual meeting of the King Edward's Hospital Fund for London. He told the Prince of Wales, who presided, that he had that morning been handed a letter enclosing a cheque for the King's Fund, "in grateful appreciation of the splendid work of the B.B.C. during the strike." Viscount Burnham said he would like to acknowledge the obligation to the Broadcasting Company for the manner in which they had aided the committee in their work.

A "Novel" Payment.

THE first cheque to be transmitted by radio from the United States to Great Britain was one for £513. It was payable to Mr. Warwick Deeping, the

SHORT WAVES.

"Wireless Enthusiast: 'By Jove, this set was a bargain. I've got it assembled, and I've got twenty-three parts left over.'"
"London Opinion."

"Just as wireless on the small scale has become, in the shape of broadcasting, an important social influence in Great Britain, so wireless on the large scale will have a similar influence on, and strengthen the unity of, our widespread Empire."—Prof. W. H. Eccles.

"B.B.C. suggestion: Listening in to a pin dropping whilst the first ball of the first Test match is being played."—"Sunday Pictorial."

well-known novelist, for the serial rights of his new novel. The time occupied in traversing the Atlantic was nearly an hour and a half, so the cash was wireless over at the rate of about six pounds per minute!

Wireless Station from the Arctic.

NEWs and messages regarding the spring and summer activities around the North Pole will in future be transmitted by a radio station at Point Barrow, Alaska. The call sign is K D Z, and the station will operate upon 21.4, 42.75, and 149 metres.

Broadcasting Torture.

ONE of the daily papers recently came out with a story about a negro being tortured before the microphone. Apparently this extraordinary allegation arose in connection with the lynching of a negro by an infuriated mob. It happened that he was seized somewhere in the neighbourhood of a broadcasting station, and beaten to death, but I should think it extremely unlikely that even in America the microphone would have been left "on" during such a tragedy.

Wireless in a Coffin.

DURING the Great Strike, says a reader in a letter to the "Evening News," a passenger liner was lying at Tilbury, due to sail at night. Part of her wireless had been sent ashore for repairs, but the strikers refused to let it through. So two volunteers from the boat went ashore,

obtained a coffin, placed the wireless set inside, and got it safely to the boat—in a hurry!

Longfellow Up to Date.

SOUTH AFRICA now has a weekly radio paper of its own, and, looking through a copy recently, I came across the best wireless parody I've seen for months. It was an up-to-date version of "The Village Blacksmith," and the following verses give a good idea of the whole "poem":

Above a spreading chestnut tree
The blacksmith's aerial stands;
The smith, a wireless fan is he,
Whose large and sinewy hands
Control reaction coils which catch
Signals from many lands.

His aerial wire is high and long,
His earth's an old tin pan;
And on his set, a super-het,
He picks up all he can,
And sends his oscillating howls
Through all the broadcast span.

Listening, experimenting, oscillating,
Onward through life he goes,
Each morning sees new stations logged,
Each evening hears them close.
K D K A, in morning hours,
Disturbs his night's repose.

World's Short-Wave Stations.

THE Editor tells me that the list of the "World's Chief Short-Wave Stations," which appeared in "P.W." No. 204, was reproduced from "Radio Broadcast," by the courtesy of that journal. It is regretted that due publicity was not given to this fact when the list was published in "P.W.," April 24th issue.

Derby Wireless Arrangements.

AT the time of writing, the Derby Day wireless control of traffic has not been put to the test, but the arrangements are certainly elaborate. The central radio-control station at the Grand Stand is to be placed in charge of an official of the Traffic Branch of Scotland Yard.

The complete radio-network—of which the Grand Stand is the centre—spreads out to twelve other control stations, placed in strategic positions on the main roads leading to the Downs.

Creating Radio Waves.

OWING to the inclusion at the last moment of "Broadcasting and the Strike" the article "Creating Radio Waves" has had to be omitted. It will, however, appear in next week's issue.

Temporary Measure at 2 L O.

ONE unexpected result of the strike conditions was that 2 L O set up some extremely good long-distance records. This was due to the fact that for once in a way quality was sacrificed to power. The engineers deliberately over-modulated, so that the range of the station was increased, at the expense of tonal quality.

Consequently, a good many foreign listeners, to whom 2 L O was a total stranger, were surprised to pick up that station for the first time; but as soon as normal conditions prevailed the B.B.C. reverted to its old slogan "Quality First."

ARIEL.

A RETROSPECTIVE
ARTICLE.

By "ARIEL."



Broadcasting and the Strike

"THE printing trade, including the press, will cease work," they said. Including the press! Including "P.W."!

What made it all the more amazing was that it happened right under our very noses! For the Memorial Hall, Farringdon Street, E.C.—where the Negotiating Committee of the Trades Union Congress met—is practically next door to the "P.W." offices.

When "P.W." Stopped.

In those momentous days, before the strike began, there was a great coming and going outside the Fleetway House. Policemen, trade union officials, members of Parliament, and miners shared the pavements where generally the journalists jostle. A few hours before the strike was "on" a taxi drew up outside "P.W.'s" offices, and I noticed Mr. Ramsay MacDonald alight and hurry across the pavement to a fateful conference at the Memorial Hall.

Next the news, "General strike declared."

And then, for the first time in its strenuous history, "P.W." paused—and stopped! With the machines silent and the great printing works closed, the staff suddenly dwindled to a handful, but, of course, that handful had to carry on as far as possible!

There was a hurried redistribution of staff work, and amongst the duties that devolved upon me was the one of watching the wireless trade during the Great Strike. It promised to be an interesting task, so I set off to explore the city shops.

Most of the small dealers seemed to be doing good business, and the trade in batteries, loud speakers and similar accessories was brisk from the start. Arriving at the usually busy premises of Peto-Scott & Co., Ltd., I turned aside for a chat with



The Prime Minister, Mr. Baldwin, whose voice was heard by millions of listeners during the general strike.

the managing director, Mr. W. Worthington.

"Big business is practically at a standstill," he said frankly, "but there is one good thing about the situation—it just shows that wireless is not a luxury now, it's a necessity."

This was true. Lost without the daily paper, everybody made the broadcast bulletin the topic of conversation. Old sets were hastily recommissioned to pick it up, and forgotten crystals and cat's-whiskers were raked out of cupboard and reinstalled.

The Trade Rush.

The Prime Minister's message to the nation, broadcast from all stations, stamped the seal of official approval upon wireless. Once again broadcasting—the ubiquitous, all-penetrating, outspreading voice of the air—had proved itself invaluable.

A spirit of adaptability and "carry-on" was well in evidence right from the first day of the strike. For instance, Peto-Scott's, Ltd., were shorn of customers that day, but ere I left the firm was contemplating sending out vans to visit the suburban shops, which were doubtless selling out, as John Citizer replenished his H.T. batteries, etc.

Farther west, I looked in upon Radio Instruments. Here every man was in his place and orders were coming in, but transport failure was throttling the trade. Rail transport being out of the question, R.I.'s had just despatched a motor van to Liverpool. Everywhere I found that numbers of complete sets were being sold, many to firms who wanted their staffs kept in close touch with the situation.

Whilst I was with the managing director of Radio Instruments, Ltd., the Admiralty

(Continued on next page)



Preparing the loud-speaker installation on the Horse Guards Parade, which was used to convey the broadcast news to large crowds.

BROADCASTING AND THE STRIKE.

(Continued from previous page.)

'phoned up for a set; and here again I heard the slogan "People can't do without wireless—it's not a luxury, it's a necessity."

I found the West End show-rooms were mostly doing a wonderful business. At Alfred Graham & Co.'s I managed to get behind the barricade of Amplion loud speakers and asked how the firm was faring in the strike. "Transport's the trouble," they said. "But we are fitting up lots of



Lord Grey, who gave a broadcast summary of the strike situation.

large demonstration sets for the large firms. People are finding out that they can't do without wireless!" Selfridge's had installed a battery of 30 or 40 loud speakers to hawl the bulletins! And one, which addressed the street, collected such a crowd that it had to close down. (Incidentally, Selfridge's employed a 21-valve outfit, so there was plenty of punch from 2 L O, situated right on top of the building!)

How the B.B.C. Carried On.

In those recent troublous days, the strike news was sometimes late—but the announcer was always on time. The bulletins told of excitements, and of tempers running high—but the broadcast voice was cool and reasonable and level. Britain was in the throes of a breathless struggle, but British broadcasting was perfectly calm and unperturbed.

During that hectic week, when reputations went down like ninepins, the B.B.C. built up a solid example of fair-minded, even-handed public service. How was it done?

Was there Government control at Savoy Hill? Was there a strong military guard picketed in the precincts? Was it a case of a timely display of force? Not a bit of it!

The B.B.C.'s service to the nation was done by the ordinary staff, in the ordinary way of business. It is true that a few policemen were stationed at strategic points—but they weren't of the "Heroes-of-Scotland-Yard" type. They were, in fact, just Bobbies.

It is true, too, that steps were taken to prevent the supply of electric power being cut off. But there was nothing spectacular about that, either. It was just a precaution, like putting the cat out and locking the door at night!

During those nine dark days there was no fuss, no flurry, no fuming at the nerve-centre of the nation's wireless web. When Britain struck, broadcasting just carried on.

You must not suppose that it was done without an effort. It was no fluke. It was, indeed, a triumph of team-work, in which every member of the B.B.C. staff did his—or her—bit. All over the country anxious listeners were depending directly upon the



Mr. J. C. W. Reith, Managing Director of the B.B.C.

wireless for news of the strike situation. That they did not listen in vain was due to hard work.

At the B.B.C.

Walking up to the City, riding up (if lucky), sleeping at hotels (if possible), sleeping in the B.B.C. headquarters (if necessary), the broadcasting staff were all there, on time. They came up to work, they got down to work, and they worked. That was the secret. It may not sound a

bit romantic now—but remember that it sounded all over Britain then. At the time when silence might have had tragic results.

Most of us were placed in a quandary on

that morning of May 4th, when the General Strike started. None were in a worse predicament than members of the B.B.C. The great public whom they serve was either striking or struck at, and both sides would that day be listening in.

Could the scales be held impartially? Could the microphone be fair to all the parties, whilst speaking to them all, about them all?

Well Done!

Probably the best answer to that question lies in the B.B.C.'s letter-box, and in the fact that listeners everywhere have testified to the services rendered. One of the best-known men in the Labour movement, whose name is a household word to readers of the press, took the trouble to express his considered admiration for the fairness and impartiality of the broadcasting. And on the other hand, the "Daily Telegraph," usually chary of bouquets, expressed the opinion that "the British Wireless Service, from first to last, did inestimable service in maintaining the national morale, and checking the spread of mischievous rumours."

(Continued on page 500.)



The Archbishop of Canterbury, who also broadcast a special message.



Members of the police force section detailed to guard the entrance to the B.B.C. headquarters at 2, Savoy Hill during the general strike.

A "PW" Portable Two Valver

THE portable set described in this article is unusually small and compact, but it is not a "freak." It is a 2-valver that will give the DX results of an ordinary baseboard-and-panel cabinet receiver. It does not employ a frame, but in the case space is allowed for a length of wire for the aerial and an earth pin. It is very easy to erect an aerial by flinging the wire with a stone or the reel attached to one end over the branch of a tree, and the circuit is sufficiently efficient to enable good signals to be obtained on aerials only a few feet high. In fact, the tourist who has one of these little portables with him should be able to tune in one or more stations anywhere in the country even if he is able to erect only quite a poor aerial.

The set will not operate a loud speaker, for the circuit employed is a straight H.F. detector, with reaction on to the aerial. One of the unique features is, however, that four electrode dull emitter valves are used. They are employed in such a manner that only very low anode voltages are required, thus eliminating the huge and heavy H.T. battery and allowing small batteries to be used instead.

A Self-Contained Unit.

Dial-o-Densers are used, and these interesting components provide the necessary tuning while occupying only the space of two ordinary dials on the panel. Another uniquely suitable component is the Polar tuning unit, which takes the place of coils and coil-holder, and is yet no larger than a fairly small H.F. transformer. The other components are more or less standard.

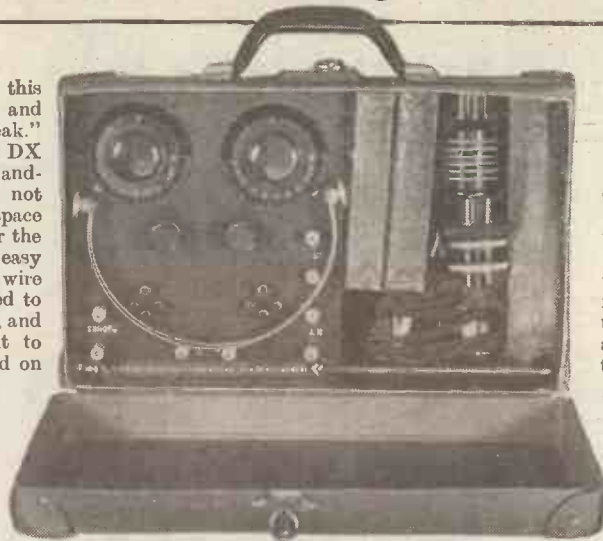
The set itself is completely contained on a small ebonite panel, which, being complete with terminals, could be lifted out of the attache-case and dropped into an ordinary wooden cabinet and used as an ordinary household receiver when not required for portable work.

A full list of the components and parts required is given separately. The attache-case cannot well be smaller in any one dimension, but it can be slightly larger, although, of course, if it is, it will be necessary to modify the panel measurements accordingly. We purchased a fibre attache-case for the original set, and it cost us 3s. ! It is quite strong and answers the purpose admirably. Lissenstat Minor filament resistances are advised, as they are of a shape that lends itself to the work.

Commencing the Construction.

A diagram of panel-drilling dimensions is given, and requires no comment except that it should be noted that holes must be provided for the flexible leads from the Dial-o-Densers as well as for the central mountings. The terminal holes should, if possible, be tapped so that the terminals can be screwed in position tightly.

The four sockets for the tuning unit and the four for the H.F. transformer should be



The set complete with all accessories and ready for use.

* * * * *

The Set designed and described by
G. V. DOWDING, Grad.I.E.E.
(Technical Editor.)

Constructional work by
G. V. COLLE and C. A. MEADOWS.
(Technical Staff.)

* * * * *

spaced similarly to valve sockets (see "For The Constructor," No. 1, under 'Radiatorial' heading). Of course, any ordinary valve sockets or holders could be used. The valve holders under the panel must be of the type

LIST OF COMPONENTS FOR "P.W." PORTABLE SET.		£	s.	d.
1	0003 Dial-o-Denser	10	6	
1	0005	10	6	
2	Lissenstat Minor filament resistances	7	0	
2	Sets of four valve sockets, "Security"	2	0	
2	Valve holders, "Aermonic" (Bulgin & Co.)	5	0	
1	Atlas .002 mfd. fixed condenser	2	6	
1	Atlas .0003 fixed condenser	2	0	
1	Dubilier 2-megohm grid leak	2	6	
8	terminals	1	0	
2	packets of "Glazite"	2	0	
2	D.E.7 valves	2	5	0
1	300-600 metre H.F. transformer (any good make)	7	0	
	65 ft. 2 mm. rubber-covered flex	2	4	
2	9-volt grid bias batteries	4	6	
1	Oldham 2-volt accumulator (Type D.L.)	12	6	
1	Polar coil carrier	2	6	
2	Polar coil units (broadcast wave-length band)	5	0	
1	Attache-case (fibre) 12½ by 7½ by 3½ in. (approx.)	3	0	
1	copper earth pin (12 by ½ in. rod)	5		

specified, for these have to hold the valves horizontally in position. The grid leak and condenser and the 'phone condenser are not mounted on the panel, but are secured by their own connections. Given careful soldering, this method provides all the rigidity that is necessary.

The wiring should be carried out with "Glazite," which is an admirable material for portable set work. The use of bare wire is not to be advised, as the set may be subjected to vibration and mechanical jars which might cause "shorts." Soldering throughout should be the rule, and "dry joints" the absolute exception. Again the constructor is referred to that 'Radiatorial' feature "For The Constructor," No. 7 of which deals with soldering. It is an art which is very simple to acquire, and there is no uncanny knack in it that many endeavour to make out.

The Extra Grid Connections.

The wiring of this little portable is very straightforward, the only deviation from the normal being the flex lead for connecting the extra grids of the valves. Now, if D.E. 7's (four electrode dull emitters) are not to be used, this flex can be ignored, whereat the circuit is normal and ordinary valves with ordinary H.T. voltages can be used. The Osram D.E. 7's have small terminals at the sides of their bases, and to these should be connected a short piece of insulated flexible wire. This lead must be taken to the H.T. plus terminal or to a lead that goes direct to that point. The back-of-panel photographs should be consulted if this point is not quite clear.

Having completed the wiring and cleaned off all traces of surplus Fluxite, dust, etc., the indicating transfers can be affixed. By the way, indicating terminals of the Belling-Lee type are deserving of consideration, for their lettering is permanent, whereas transfers seldom stand up to portable set work for any great length of time.

Two wooden fillets should be screwed into the case, and upon them the panel can rest. If it fits tightly it will be unnecessary to screw it down. A piece of wood cut to correct shape can be screwed in to act as a partition between the panel and the accessories compartment. A precaution well worth taking is to paint the whole of the inside of the attache-case with anti-sulphuric paint to protect it from any stray acid that might "creep" from the accumulator.

The Earth Pin.

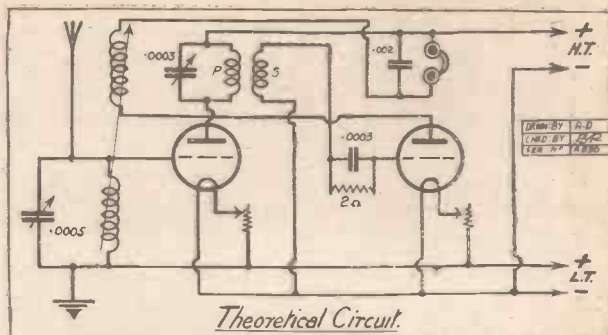
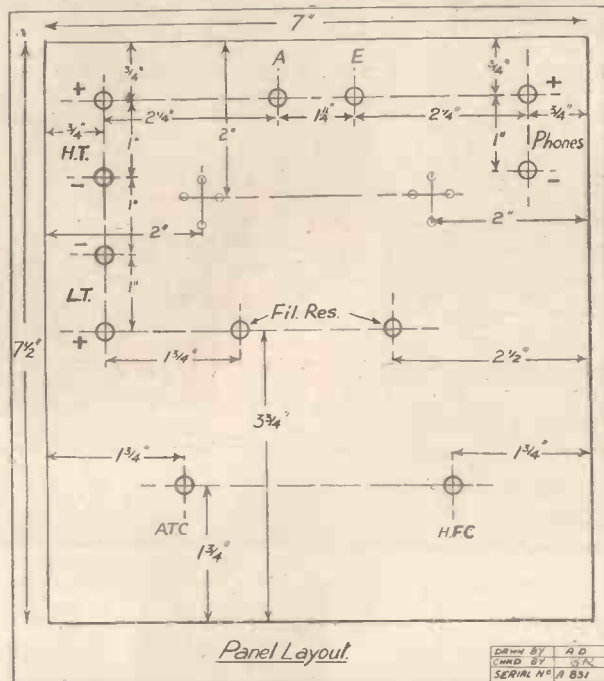
An earth pin consisting of a length of copper rod sharpened at one end and fitted with a terminal at the other should be prepared. This will provide the "earth" and, although a jack-knife or metal skewer will serve the purpose, it is advisable to have a proper device to ensure optimum efficiency.

(Continued on next page.)

A "P.W." PORTABLE TWO-VALVER.
(Continued from previous page.)

The aerial wire can consist of 65 ft. of 2mm. rubber-covered flex, and this can be wound on a wooden bobbin such as is used

for ordinary wire. Two grid bias batteries of 9 volts each will suffice for the H.T., and an Oldham portable accumulator (2-volt type) will be ideal for the L.T.



If 5XX is to be catered for, it will be necessary to carry spare Polar tuning units and a spare H.F. transformer of suitable values for the higher wavelength range. But there will be ample room in the case for such small items. Only one pair of telephone receivers will fit in, as illustrated in the heading photograph, but if the earpieces are used separately this means two persons can listen in simultaneously. Other pairs can, of course, be carried separately if needed.

Now we have the complete equipment and with everything packed into the case, the lid of this closed, all is ready for a cycle or other tour from the radio point of view. A final precaution worth taking, however, is to wrap the accumulator up in a sheet of Empire cloth. Better still, it can be slipped into a section of an old bicycle inner tube; the ends of this sealed with rubber solution will make an acid-proof envelope. The leads can be led through small holes, and these, too, can be securely sealed with small drops of solution. Naturally, the envelope will have to be opened when the time comes for charging, but it can easily be sealed up again.

Erecting an Aerial.

A few yards of wire should be carried in addition to the proper leads, just in case one of these latter should get lost, which would surely happen were no "spares" on hand! The batteries should be disconnected while the set is out of use, and care taken that their terminals are not shorted by metallic accessories or spares. The D.E. 7's will stand a fair amount of hard knocks, but the little receiver should not be subjected to too rough handling.

As mentioned at the beginning of this article, temporary aerials are very easily erected, and no great attention need be paid to insulation. The covering of the wire is sufficient.

Trees are, of course, very useful in this respect, although it is advisable to choose one that stands by itself and is not screened by masses of surrounding foliage. Although excellent results can be obtained with quite inefficient aerials if real DX is required, attention should be paid to such details. A tree standing on fairly high ground should be chosen for preference, and if it has high branches and scanty leaves so much the better.

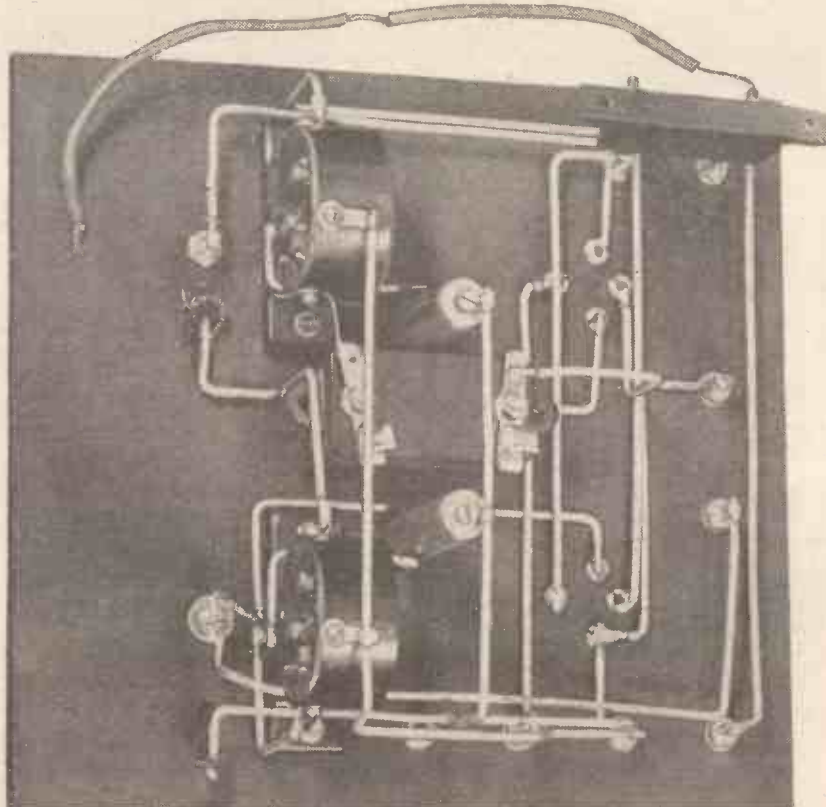
The wire should be unwound from the reel and tied to this object. The reel can then be thrown up so as to catch in a high branch.

Directional Effects.

Greater effectiveness still can be attained if advantage is taken of directional effects. That is, the aerial should incline away upwards in a direction away from that from which it is desired to receive. Such directional effects will not be so marked as with a frame aerial and would play a part only in cases of reception from very distant stations.

Where trees are not available, moderately large bushes will provide sufficient height for considerable ranges of reception, and even fences or hedges can be employed.

(Continued on next page.)



This under-panel photograph of the receiver clearly shows the wiring and disposition of components.

A "P.W." PORTABLE TWO-VALVER.

(Continued from previous page.)

In an hotel or boarding house the little set will enable the holiday tourist to while away the evenings, and aerials can easily be erected by running the aerial wire around the walls of the room. Earths can be obtained from water pipes, and in emergencies fire grates and bed spring mattresses will serve. If the room is situated on an upper floor of the building, a fairly good aerial results when the wire is merely slung out of the window.



The complete set closed up but ready for use.

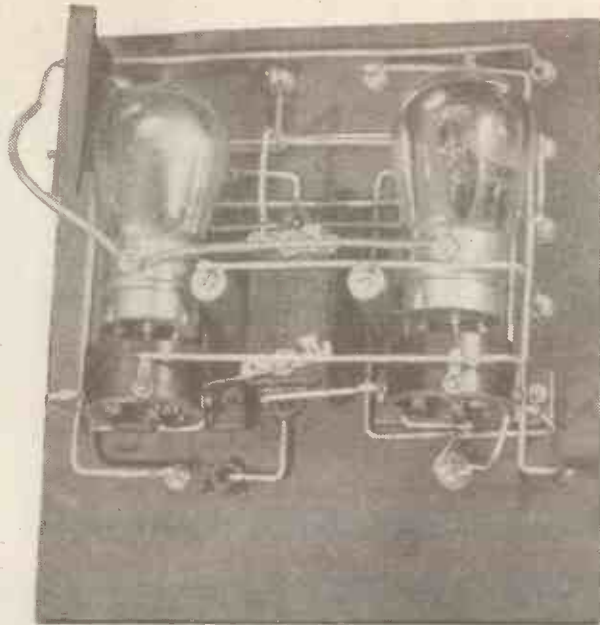
Earths out-of-doors are easy to obtain. The earth pin can nearly always be employed. It should be inserted into fairly damp ground if possible. If the temporary camp is near a ditch or lake it can be dropped into the water with, of course, the lead attached, and a highly efficient earth will result.

As in normal practice, it is advisable to make the earth wire as short as possible.

The little portable set is very simple to handle. After the aerial has been erected, and this and the earth connected up and the batteries and 'phones brought into operation, the tuning unit and H.F. transformer should be placed in position. Care should be taken that these are correct for the wavelength range it is desired to cover and that the filament resistances are well out towards their "off" position.

The Set in Operation.

Reaction is controlled by revolving the little knob on the Polar tuning unit. Reaction can be reversed in a second, if necessary, by pulling off the top section, turning it round, and replacing it. The reaction coupling will probably require to be fairly loose. The variable condenser dials should be rotated until the station desired is brought in and the reaction adjusted until loud, clear signals result. Actually

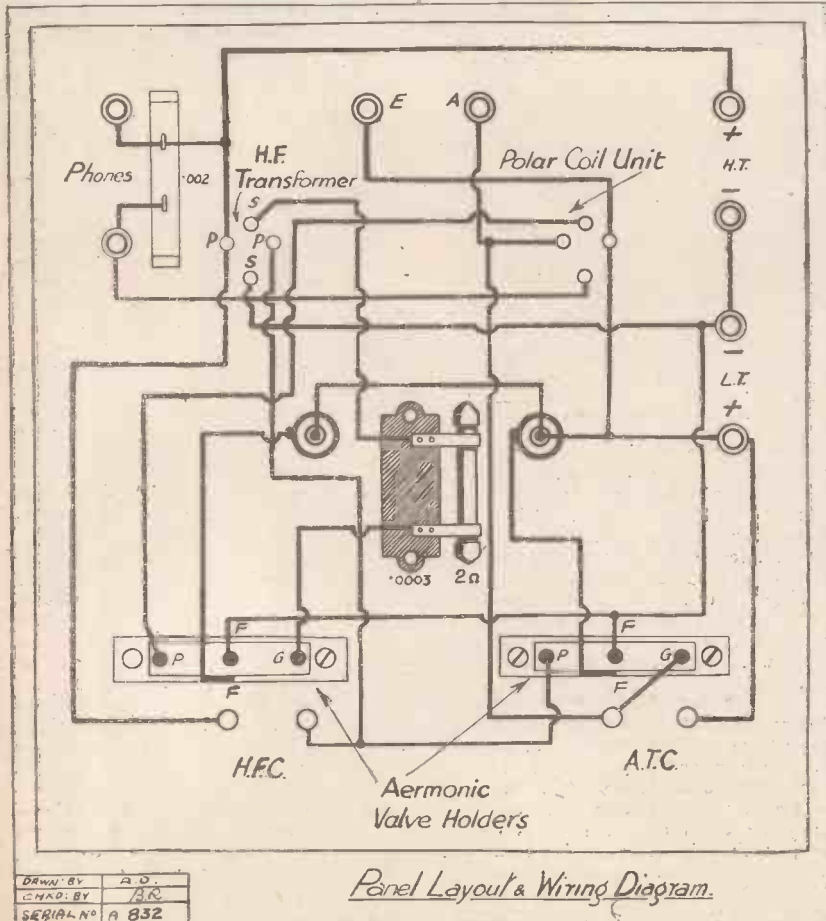


Note in this photograph the flexible lead used for the extra valve grid connections.

the three controls should be handled more or less simultaneously, and although this sounds an involved business in practice the "knack" is very easily acquired.

The valves can be run at almost a maximum voltage. And, by the way, readers are again reminded that ordinary valves and ordinary H.T. voltages can be used in this set.

All that it is necessary to do in this case is to remove the "flex" lead employed as connections to the extra grids of the D.E.7's. The set then becomes quite a normal "H.F.-Det.," and slipped into an ordinary case can be used for ordinary "household" reception.



Panel Layout & Wiring Diagram.

DRAWN BY	A.D.
CHECKED BY	A.R.
SERIAL NO.	A 832

POINT-TO-POINT CONNECTIONS.

Aerial terminal to one side of aerial coil, aerial tuning condenser and grid of 1st valve.

Earth terminal to remaining side of aerial coil and A.T.C. and to L.T. +.

Note.—The filament pins of the Polar unit correspond with the A.T.I., and the reaction coil with the grid and plate pins.

One filament pin of each valve to L.T. — and H.T. —.

Remaining filament pins via their respective rheostats to L.T. +.

Plate of 1st valve to one side of primary of H.F. transformer and one side of .0003 variable condenser, remaining side of primary and .0003 variable to H.T. +.

One side of the secondary of the H.F. transformer to one side of combined grid leak and condenser, other side of combined grid leak and condenser to grid of 2nd valve.

Remaining side of secondary to L.T. —.

Note.—The filament pins of the H.F. transformer correspond with the primary winding, and the grid and plate pins with the secondary winding.

Plate of 2nd valve to one side of reaction coil, other side of reaction coil to one side of 'phones, remaining side of 'phones to H.T. +.

Across the 'phones is connected a .002 fixed condenser.

BROADCAST NOTES.

B.B.C. and the Strike—Future Broadcasts—New Experimental Station?—
B.B.C.'s Financial Position.

By O. H. M.

IN one of its announcements immediately after the termination of the General Strike, the B.B.C. remarked that the full story of its part in the Emergency, if ever known, would be of considerable interest. I heard this announcement and naturally was "intrigued." I spent several days in doing little else than trying to dig up the story so enigmatically referred to. I cannot say that my efforts have been successful. The whole business is so involved that all I have managed to do so far is to bring to light a few of the chief facts.

First of all a decision was taken by the Government to commandeer the B.B.C., but this decision was never fully applied. The reason was the personality of Mr. J. C. W. Reith, the managing director. As soon as broadcasting came under the serious consideration of the Government in connection with the Emergency, Mr. Reith's personality manifested itself to such effect that it was considered undesirable to apply a commandeering order. The Government revised its policy, and gave Mr. Reith practically a free hand.

B.B.C.'s Success.

The fact that the B.B.C. was allowed to retain its entity and freedom of action during the Emergency means a great deal to the future of British broadcasting. Had the commandeering order taken effect, and had the B.B.C. become as much a mouth-piece of the Government as was the "British Gazette," the whole tradition of the service would have been largely destroyed. As things are, my opinion is that the B.B.C. comes out very well on the whole. Its position would be a good deal stronger if it had managed to bring to the microphone one or other of the responsible Labour leaders.

It is true that this would not have been possible after the High Court decision declaring the General Strike illegal. But this decision was not taken until the Strike was nearly over. Even the appearance of closing the microphone to one side in a dispute damages the broadcasting service in the eyes of a large section of the community. But, on the whole, I repeat that I think the B.B.C. did extraordinarily well, and that all the credit is due to Mr. Reith.

Foreign Countries Impressed.

It is good that the B.B.C. is trying to keep on some of the features of the news bulletins built up during the Emergency. One did not realise how unsatisfactory the old bulletins were until one heard the special bulletins. Classification was an excellent idea. The editorial summary was capital, and the moralising, although a trifle overdone, certainly had a good effect throughout the country. I gather that foreign opinion has been more impressed by

the B.B.C. strike bulletins than by anything else connected with the recent Emergency.

The very success of the B.B.C. bulletins, and the apparent ease with which the Savoy Hill people supplemented the material supplied by the agencies and by Government departments have had a prompt reaction in the newspaper world. For nearly two years the B.B.C. and the Press have carried on side by side in growing amity.

Future Broadcasts.

Much of the original prejudice of Fleet Street was overcome by the definitely conciliatory attitude of the B.B.C., particularly on its publicity side. But now events have revived the old boogies. Through no fault of its own the B.B.C. suddenly found itself the only reliable national medium for the transmission of news to the public. A



Mr. De Groot and his famous two thousand pound Stradivarius violin.

large new section of the public took up wireless, and there are signs that many people discovered they could get on quite well without their newspapers. This being the case, there was a natural temptation to the B.B.C. to exploit the position to their future advantage. It speaks well of the statesmanship of Savoy Hill that no such attempt is being made. The policy there has reverted to pre-strike lines, and the printed word need have no anxiety yet awhile.

Among interesting future broadcasts of which I have heard is Pousnoff for Thursday, June 10th, and a special Mendelssohn Violin Concerto on June 14th. It will take the programmes some little time to settle down again after the recent dislocation, but they should be running normally in about a fortnight. During the present process of re-adjustment, it is, of course, impossible to speak definitely of prospective

fixtures. Another attempt will be made to broadcast the sounds and atmosphere of the Derby, and I hear that the Imperial Conference in the autumn will provide a fertile field for broadcast programme material.

New Experimental Station?

Now that the Emergency is over, our broadcasters should be able to get down to the new distribution scheme upon which so much depends. Although there is the usual barrage of official excuses from various quarters, I have a shrewd suspicion that all is not well with this scheme. We heard some time ago that authority had been given for the erection of a new experimental station at Daventry, and that this would be all the action necessary for the rest of 1926. If this is the case, the whole thing smatters of a woeful lack of comprehension somewhere.

If 1926 comes to an end with only one paltry experimental station of the new system authorised then it will be 1928 or 1929 before the British Broadcasting service really takes its next step forward. This would be altogether lamentable. There is no valid reason whatever why the British listening public should not have its alternative programme by the end of 1927. I am sure the B.B.C. realises that it has only to invite public support in its efforts to expedite the new scheme of distribution.

The extension of the Spanish Talks to include 5 X X as well as Manchester is a sign that the B.B.C. is acceding to a general demand for the use of wireless as a means of instruction in foreign languages. Hitherto the B.B.C. has been somewhat behind Continental broadcasters in the teaching of languages. But now that French and Spanish are definitely included as a regular morsel of our broadcast fare, and as instruction in other languages is also contemplated, the deficiency should be more than made good by the autumn.

B.B.C.'s Financial Position.

Appropos the financial difficulties of the B.B.C., to which I referred in these columns, I heard the other day from a B.B.C. official on the Programme side that they were hard put to it to find the money necessary to keep up the programmes on their present standard.

My informant complained that he had to abandon a modest scheme of expansion in his own particular work because he was informed that his allowance could not be increased. This is a very serious state of affairs, particularly when it is realised that there is about £130,000 of licence money idle at the Post Office. Apparently, the silly embargo on all licence money above £500,000 a year is still maintained.

It is said that Parliament is seeking some way to give appropriate acknowledgment to the B.B.C. for its work in the Emergency.

The best way certainly would be to hand over to the B.B.C. all the licence money that has been and is being collected. There would then be a chance of that steady improvement in programmes which the B.B.C. is capable of providing.



The Principles of Wireless Tuning

By Sir Oliver Lodge F.R.S.

This is the third of a series of articles by our Scientific Adviser. In this article Sir Oliver begins his explanation of the "N" Circuit.

THE EDITOR.

A FREE vibrator is one which has a definite frequency of its own and is not coupled to anything: it cannot give continuous vibrations, for there is nothing to maintain it. Once excited it is left to itself, like a bowed string or struck tuning-fork; and the vibrations gradually die away. They would be plotted as a sinuous curve of diminishing amplitude, the amplitude of the vibrations diminishing logarithmically or exponentially.

Any closed circuit possessing inductance and capacity in series is a free vibrator, if there is nothing else near it. Its vibrations are simply harmonic, except that they die away. The resistance only affects the frequency in a very subordinate manner; the main effect of resistance or damping is on the amplitude or extent of the excursion, which may be measured either by the maximum potential to which the capacity rises or by the maximum current round the circuit.

Forced Vibrations.

The average current round such a circuit is zero unless it is rectified, for the positive and negative phases are equal and opposite. A hot wire in such a circuit does not measure the average current, but the average square of current, which is independent of sign.

So such a circuit can be used as a wave-meter, if the resistance of the hot wire is not too great, for it can be tuned up so as to give a maximum response. But directly any circuit is tightly coupled up to something which is going to excite it, it is no longer a free vibrator; its vibrations are forced.

The difference between forced and free vibrations is very important. A receiving circuit in wireless is always a case of forced vibrations; and the strength of the oscillations excited in it depends on the accuracy of tuning. Anything may be forced to vibrate by a sufficiently violent stimulus, irrespective of tuning. A child might be able to set a church bell ringing by timing its impulses properly, provided the friction is small enough, though it would take him some time to work it up. An elephant could set it swinging by a single pull.

Similarly, a strong singer is said to be able to shatter a pane of glass or a bowl by accurately singing the note corresponding to the free vibration of that glass; a charge of dynamite could shatter it without any adaptation. No receiver can be immune from a forced vibration of sufficient amplitude; but, even if the vibration is continued

for a long time, the response of an untuned vibrator will be only feeble.

An equation can be written down for a vibrator of any period or frequency, excited by a forced vibration of some other period or frequency, and it would be found that unless they were in tune the effect was small. The ultimate rate of vibration would depend not at all on the free rate, but on the forced rate; the discordance between the rates would merely keep the amplitude small.

A Curious Phenomenon.

When the tuning is improved, so that the two vibrators are nearly of the same pitch, a curious phenomenon happens at first. The free vibrator tries to vibrate in its own period, and does so, until those vibrations have died away and the forced vibration takes control. During that period

the two frequencies are superposed and we get a kind of incipient heterodyning or beats. In a short time, however, the forced vibrations are dominant, and we then get a response of a certain amplitude.

Obtaining Big Amplitudes.

Improve the tuning still further, the amplitude increases in strength and presently as the tuning becomes exact, the tone swells out loudly. The two are now in agreement. This is experienced during the operation of tuning in. The beats die away and disappear; the tone becomes smooth and continuous, with an amplitude depending on the resistance, or rather the conductance, of the circuit.

If the circuit is of low resistance there is hardly any limit to the amplitude of the vibrations which can be thus produced when the tuning is perfect. If the forced vibrations have the frequency p , and the free vibrations the frequency n , the resulting amplitude, when there is no resistance, is a certain fraction of E (the amplitude of the original disturbance) divided by $n^2 - p^2$.

So that when n and p are in agreement the resulting amplitude is infinite. This, of course, in practice is not possible, for there must be some resistance. By making the resonating circuit a very good conductor, however, its amplitude may be made as big as we please; there is hardly any limit to the vibrations which can be thus aroused.

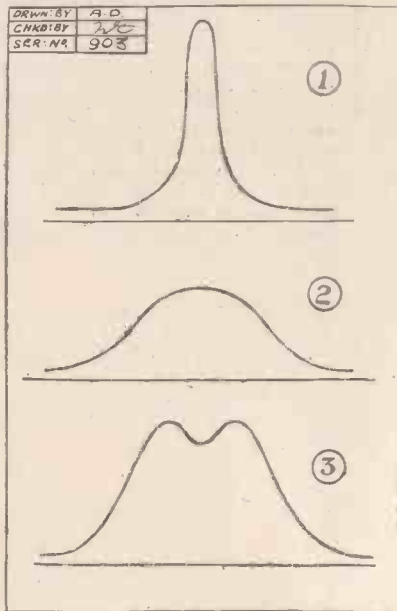
When two circuits are coupled together, they are, neither of them free. They interfere with each other more or less, and the combination cannot attain the energy of a really free vibrator. To get really big amplitudes in reception, therefore, the right plan is to use a circuit of very low resistance and arrange so that it shall be disturbed by the forced vibrations coming from a distant station in only a very gentle or slight manner.

Practical Application.

However feeble the received disturbances are, they can be worked up to any amount, by resonance in such a circuit; and then they can overflow and give the desired signal through a coherer or valve or any other detector, a detector which is not in the circuit itself but is an appendage to it, so as not to interfere with it until it responds, the resistance of the side or detector circuit up to that time being practically infinite. All this, it is needless to say, takes place in a minute fraction of a second, with the rapid oscillations used in wireless.

Moreover, if such a circuit receives vibrations of many frequencies from different stations, being stimulated in this feeble manner by all, it will only respond to the one to which it is itself in tune.

(Continued on next page.)



(1) Diagram of a sharply tuned, very slightly damped resonating circuit, freely vibrating. The narrow part of the curve near the top may be used; though it can be made too narrow for best results.
 (2) Resonating curve of a damped circuit with broad reception and moderate maximum of response without sharp tuning.
 (3) Resonating curve of coupled resonator, with a double maximum owing to reaction, but with forced and free vibrations.

PRINCIPLES OF WIRELESS TUNING

(Continued from previous page.)

The others will be discarded or eliminated. Such a circuit acts as an admitter or responder to vibrations of one frequency, and as an ignorer of all others.

If we use a circuit of large capacity and small inductance, it is analogous to a light pendulum or violin string which can easily respond to any disturbance, though it responds more fully to some than to others.

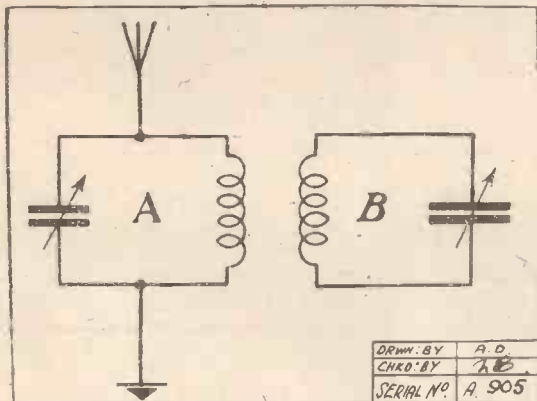


Diagram of an ordinary coupled resonating circuit in which B is forced to vibrate at the same frequency as A, though with diminished amplitude unless they are in tune.

But if, instead of being a light thing, like a string or a wooden bob pendulum, it is a massive thing like a tuning-fork or a pendulum with a heavy lead bob, then it will not be disturbed appreciably by anything except a synchronised disturbance of exactly the right frequency.

The electrical analogy to big inertia and great stiffness is a circuit of high inductance and small capacity. Such a circuit responds just as freely as any other to a periodic disturbance of exactly the right pitch, but takes no notice of those with wrong pitch. Such a circuit I call an N circuit.

The N Circuit.

An N circuit is one of high inductance, low capacity, and resistance as small as it can be made; and is to be stimulated by very feeble disturbances collected from the ether and communicated to it by the smallest amount of communication possible. It is to be left almost free from the aerial; it must be connected to it to some degree, or it would not respond at all, but the slighter the connection the better. It is not to be coupled up in any ordinary way. Coupling, in fact, is to be avoided. A single-wire connection, with a small capacity interposed, suffices to join the N circuit to the aerial.

The aerial should have no tune of its own, so that it can pick up any ether waves which exist. They are all equally transmitted, in the feeble manner described, towards but not to the N circuit; for that takes no notice of any of them except those of the right frequency, and to that particular kind it vigorously responds. The detectors are set into action by the oscillations thus worked

up in the N circuit, and are not themselves connected to the aerial at all. The aerial is a mere collector; the N circuit is the responder. After that come the detector, rectifier, magnifier, and telephone arrangements, as usual.

By this means very pure reception is attained; and one particular station can be listened to, while all the others are ignored. The tuning, however, has to be very precise, so that the received stimulus shall always act in one direction, and shall never oppose or destroy what it has begun to excite. The only limit to the selective response thus obtainable is the resistance of the N circuit.

It was shown by Kammerlingh Onnes that at a very low temperature, approaching that of absolute zero, the resistance of metals became nothing. Some day I feel sure that an experimenter will immerse his receiving N circuit in liquid hydrogen or helium, and thereby get a response, far beyond anything which has as yet been attained. But it may not be good for signalling, which requires a certain breadth or variety of tone. The lateral frequencies would be too much excluded if the resonating circuit were too sharply tuned.

Reaction.

Meanwhile a device has come into use which has practically the effect of abolishing the resistance of a responding circuit, though at the same time it does not leave it as completely free as it would like to be. This is

the device called reaction. It cannot be applied with a crystal; but it can be applied by a valve, where the high-tension battery introduces fresh local energy into the circuit, so that the anode part of the circuit is vibrating in a forced manner with extra amplitude due to the introduced energy.

These enhanced vibrations are usually made to react upon the aerial, which is usually a tuned collector; and this reaction it is which sets up the extra stimulated vibrations of the same frequency as those received, and causes howling.

A circuit can, in fact, be made to excite itself in this way, just as a telephone speaking to its own microphone transmitter can set up a howl. Any slightest initial disturbance is magnified by reaction between the telephone and transmitter; its own sound, however feeble, operates the mouthpiece, and thereby increases the response of the telephone, which again reacts on the mouthpiece, and again on the telephone; and so on, until the disturbance is worked up.

When a circuit is thus on the verge of howling it is exceedingly sensitive, almost, though not quite, as sensitive as a receiving circuit cooled to near absolute zero; and yet a sufficient breadth of response is permitted: the tuning need not be too sharp. In using reaction the object of the experi-

menter should be to bring it near to the sensitive condition, but not to over-pass it so as to get self-excitation.

For self-excitation is a nuisance to all stations in the vicinity, since the self-excited howl cannot be tuned out if one is trying to receive vibrations of that particular frequency.

No Effective Re-radiation.

To cure this there should be no reaction on the aerial at all. Whatever regeneration there is should act upon the N circuit only. The aerial should not be in tune with it, and, moreover, it should be so little connected, not really coupled, that it has no temptation to respond.

The aerial must have some tune of its own, since it is a conductor connecting two capacity areas, one the aerial, the other the ground; but if it is thoroughly out of tune, so as to respond, let us say, only to very much longer waves, it will be stimulated only by forced vibrations, which, being of wrong frequency, produce hardly any amplitude of vibration.

There is then no effective re-radiation; the aerial is not acting as a transmitter. If there is any self-excitation in the station itself the howls produced will be limited to that station, and will not be transmitted through the aerial to other stations.

This result is attained by an aerial entirely out of tune, very feebly connected to the circuit which it is able to excite, but which it can only excite by continued vibrations of exactly the right frequency. In other words, the desired waves can be received by the resonating circuit, and no others.

Melinsky's Method.

If the forced vibrations received by the aerial are exceedingly strong, as, for instance, by those from a lightning flash in the neighbourhood, or by some very powerful station, it will not be possible wholly to

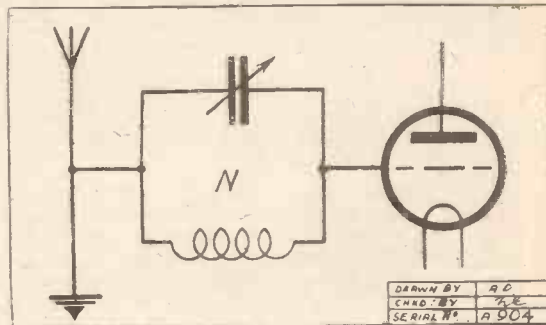


Diagram of a free vibrator stimulated by impulses from a collector (aerial), which may or may not be earthed, and transmitting those which it-magnifies to the grid of a valve.

exclude them; but it is easy to exclude any ordinary station, even a fairly near one, and listen to a distant station instead.

Regeneration thus judiciously applied to the N circuit has to be very small in amount, so that it may be left free and uncoupled to anything else; and Melinsky's device of earthing the anode of the first valve gives the required stimulus in slight but sufficient amount, so that there is no loss of sensitiveness, in spite of the fact that re-radiation is avoided, so that the set is a receiver and a receiver only, a selective receiver and not a spurious transmitter.

LADY ASKWITH'S criticism of the proposed reorganisation of the B.B.C. has been fairly extensively quoted by a certain section of the Press. She was kind enough to see me when I called on her at her house in Cadogan Gardens to ask her what exactly her attitude was and what the cause of her disapproval.

Lady Askwith is President of the National Citizens' Union, consequently her views on the B.B.C.'s new organisation are of importance and interest.

Lady Askwith has the courtesy and tact that put one at one's ease, but it is not merely her social gifts of which one is conscious. There is something more. Here is a woman of personality and intelligence, balanced, calm and opinionated—in the best sense of the word—a woman whose broad interests and sympathies are applied to the welfare of the community.

Question of Political Propaganda.

Such women are a symptom of the age we live in, and certainly a much more important one than the other type with rouged lips, short hair and skirts, and long cigarette-holders, who have so much publicity heaped upon them—one might almost say that they are thrust down one's throats while they pour cocktails down their own. It is just as well to be reminded now and then that these, though more obvious, are not the only representatives of modern womanhood. Indeed, their activities are of their very nature fruitless, while women like Lady Askwith are doing work which has real influence and permanency.

The National Citizens' Union is a non-party organisation which, Lady Askwith reminded me, was once called the Middle Class Union.

"It is really as one of the public that I speak about broadcasting," she said. "I know nothing about the technical side of it."

"Is it," I asked her, "because you think there is a danger of broadcasting being used as a party organ in politics that you object to the proposal to put it under Government control?"

"I certainly do think there would be danger of that. For instance, if a Socialist or Communist Government were in power, I don't think they would hesitate to use broadcasting for political propaganda were it under their control.

"An Expensive Government Department."

"But that is not my only objection to the scheme. It seems to me so extraordinary that apparently, under the proposed arrangement, the opinion of literary, musical and theatrical people—who, after all, are the most nearly concerned and the most experienced in matters pertaining to broadcasting—will neither be consulted nor represented.

"I really don't know what they mean by their report, but it would seem that their object is to convert wireless into yet another expensive Government department and hand its conduct over to people whose qualifications are 'business acumen and experience of affairs,' but who must be amateurs in this field, both from a practical and an artistic point of view.

BRITISH BROADCASTING BUREAUCRACY? DANGERS OF THE NEW REGIME. LADY ASKWITH'S VIEWS.

In this interview with "Ariel," Lady Askwith, President of the National Citizens' Union, offers some interesting opinions on the Broadcasting Committee's recommendations.

"I suppose the idea is that broadcasting is such an important educational factor that it ought to be under Government control. But one doesn't want to put the pulpit, and the theatre, and the whole world of art and thought under Government control.



Lady Askwith.

And I do think that the people most concerned should at least have the right to appoint their own commissioners.

"The grand council of the National Citizens' Union is having a meeting shortly, and I am proposing a resolution on this very subject. I'll show it to you, if you like."

Lady Askwith kindly fetched her note of the resolution and allowed me to make a copy of it. It ran: "That the National Citizens' Union view with disapproval the recommendation of the Broadcasting Committee that this industry should be put under the control of five Commissioners appointed by the Crown as likely to lead to bureaucratic control, undue influence by the Government of the day, increased cost, and restriction of freedom and flexibility."

Possible Opposition.

"That is certainly a very comprehensive resolution," I commented, as I handed her back the paper on which it was written.

"Yes, I think it is," Lady Askwith smiled. "And if we pass it we shall take the matter up with the Government, and have questions asked in the House."

"What first made you take an interest in all this, Lady Askwith?" I ventured.

"Lady Navarre drew my attention to the Broadcasting Committee's report some little time ago, and I felt at once that the proposed innovations were not in the interests of the public."

I thanked Lady Askwith for her courtesy in seeing me, and made my way out into the snow, or whatever it was that was falling at the moment, reflecting that it was interesting to meet a woman who has the courage of her opinions and expresses them in such a lucid and straightforward manner.

Any drastic re-arrangement of a national institution such as broadcasting will, of course, call forth considerable criticism both constructive and destructive. But with such able and impartial critics as Lady Askwith to watch every step taken "in Parliament or otherwise," listeners can rest assured that their interests will remain guarded through every stage of legislation directly or indirectly concerning the constitution of the controlling body of the new B.B.C.



The studio of the W.P.G. broadcasting station at Atlantic City, N.J.



CRYSTAL CHATS

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

(Staff Consultant.)

No. 12. GALENA

IN this article, the last of my series of little talks on crystal topics, I wish to deal with what is undoubtedly the most popular of all crystalline rectifying minerals—to wit, the ever-present galena.

The rectifying action of galena contacts have been known from the earliest beginnings of crystal reception, the unilateral-conducting properties of the mineral being known to the famous physicist and mineral-

additions of other materials may be added to the fused galena in order to increase its sensitivity, or to render the finished product more stable in the detector. Thus, in artificial galenas of well-known proprietary brands we have a rectifying material the sensitive properties of which have been enhanced as much as possible, as well as being kept under definite control.

Advantages of Galena.

Galena, as even the most recent newcomer to the ranks of crystal users knows, is mainly employed in crystal detectors in conjunction with a metallic contact consisting of a very fine spring or spiral of wire which is allowed to make light contact with the surface of the crystal. Under these circumstances galena gives its most consistent results. If a small piece of graphite is substituted for the cat's-whisker, the contact becomes more sensitive, as we saw in our latter talk on the subject of graphite; but, at the same time, the graphite-galena combination is very unstable and is easily upset by any extraneous disturbances.

A galena-galena contact affords quite good results, but in this case the two crystals of galena should be of slightly different nature. One should be softer than the other, and the softer galena crystal should be placed in the adjustable cup of the detector. Galena will give interesting results when used with zincite, molybdenite, silicon, etc.

Briefly, the advantages accruing to the use of galena, are the following:

1. *Very high distance-sensitivity*, a well-branded crystal of galena easily affording reception at ranges of 15 miles or over

when employed in a set of efficient design and construction.

2. The manner in which the mineral is able to give loud signals from aerial currents of small intensity.

3. The all-round efficient manner in which the mineral functions in all types of crystal sets and under many widely differing conditions.

On the other hand, galena possesses the disadvantages of contact-instability, and very often poor sensitivity-retaining properties. So, therefore, the mineral cannot be considered to be the last word in crystal rectifying materials.

Commercial Compromise.

Galena varies very much in the crystalline structure, or "grain," which it exhibits. Some galena crystals are almost cubical in shape. These very often make sensitive rectifiers, but their sensitivity is not well retained. From the cubical types of galena it is possible to pass through the coarsely grained varieties of the mineral down to the extremely fine-grained specimens. Most of the synthetic galenas are finely grained; they consist of an infinite number of microscopic crystals fused into a single mass.



An example of fine-grained Galena.

ogist, Ferdinand Braun, as far back as the year 1874. However, it is only since the introduction of broadcasting that galena has attained its present popularity, and the place which it now holds in the esteem of the average crystal user is almost entirely due to the many excellent proprietary brands of the natural or artificial material which are now on the market.

Most of the proprietary crystals which are to be had in so great abundance consist of galena. Some of these articles consist purely and simply of the natural mineral which has been cleaned, dressed, and carefully tested for sensitivity; others synthetically manufactured.

Artificial Preparation.

Galena, no matter what its form or origin may be, consists for the most part of lead sulphide. The natural mineral often contains slight traces of silver compounds, in which instance it is known as *argentiferous galena*. It also contains impurities, such as lead sulphate and carbonate, silica and limestone, all of which have to be carefully eliminated from the material before it can be placed on the radio market.

Galena can be made artificially by fusing up quantities of lead sulphide and then allowing the fused mass to cool slowly. Also, lead sulphide may be heated very strongly in closed vessels. Under these conditions the molten galena *sublimes*, or passes off in the form of a vapour which is condensed on the cooler parts of the vessel in the form of small but brilliant crystals. Further still, various small



Three Natural Galena Crystals.

In general, the coarse-grained crystals are the most sensitive, but their sensitivity quickly diminishes and their delicacy of adjustment in the detector is very great. Fine-grained crystals of galena, on the other hand, are not quite so sensitive, but they are much more stable in actual use. Makers of synthetic brands of galena, therefore, usually endeavour to produce a medium-grained material which in use will effect a compromise between the extremely sensitive coarse-grained crystals and the stable fine-grained varieties of the mineral.

Powdered crystalline galena can be mixed with various conducting adhesives, and then smeared over all sorts of metallic surfaces, in which state it will continue to exercise its rectifying action. Also, it has been found that powdered lead sulphide, when packed into tubes and compressed under the influence of moderate heat, acquires sensitive properties, and in this way it can be moulded into convenient shapes for fitting into the cups of crystal detectors.

GALENA.

COMPOSITION.—Lead Sulphide. PbS.

APPEARANCE.—Metallic-looking crystals with brilliant blue lustre. Is to be found in cubical, coarse, and finely grained varieties.

CHARACTERISTICS.—Fairly soft and brittle. Tarnishes on exposure to impure atmospheres. Sensitive to handling and to extreme degrees of temperature.

Possesses a high distance-sensitivity, and for general all-round use is very efficient in rectifying properties.

SOURCE OF MINERAL.—Mines in various localities in England, Southern France, Spain, U.S.A., etc.

BEST CONTACTS FOR USE.—Fine metallic wires, or cat's-whiskers. Galena-graphite contacts are highly sensitive. Galena-graphite combinations can also be used with success.

CURRENT PRICE.—(In sensitive condition) 2s. 3d. per ounce. (Non-proprietary brand.)



This coarse-grained "Crystal" is not very stable.



MISLEADING RADIO TERMS

A PRACTICAL ARTICLE FOR PRACTICAL AMATEURS.

By E. H. BANNER, M.Sc., A.M.I.R.E.,
A.Inst.P.

THE nomenclature at present in use in radio engineering is sometimes incorrect. Several terms are used which mean something totally different, and although no trouble may be caused amongst radio amateurs who are not electrical engineers, yet there may be considerable confusion due to a term having been used in the correct sense in electrical work and incorrectly in radio.

One of the worst examples of this is in the phenomenon of regeneration, retroaction or reaction. These are three names for the same thing, and apply definitely in radio to the coupling of the grid and anode circuits of a triode. There is no term like any of the above in other branches of electrical engineering.

In wireless it is not always easy to see the difference between induction and inductance. Both refer to the same phenomenon and the difference is literary rather than electrical. Probably on this account many contributions in the radio journals conclude that reaction is the same as reactance. There is no connection whatever between the two, although a reaction coil is a reactance, but that will be shown later.

Reaction and Reactance.

In alternating-current work resistance is not the only constant of a circuit, as in direct-current work. Two other components are present, inductance and capacity. The resultant of these two latter terms is reactance, although if one is negligible "reactance" still applies to the term. Sometimes "reactance" only applies to inductive reactance, and "capacitance" denotes capacity resistance, but in general the term "reactance" means the component of impedance due to inductance and capacity.

Impedance is the resultant of resistance and reactance. Resistance is denoted by "R," and is constant at any given temperature. Reactance, both inductive and capacitive, varies with the frequency. For the former case, if L is the coefficient of self-induction of the circuit, $2\pi fL$ is the reactance, where "f" is frequency in cycles per second. For capacitive reactance or capacitance an increase of capacity decreases the reactance, this is the inverse of the above, and is denoted by

$$\frac{1}{2\pi fC}$$

In an inductance with no resistance the current always lags by 90° behind the impressed voltage. Through a condenser

the current leads by 90° . The two are thus opposite, which accounts for the negative sign in the expression for total reactance, which is

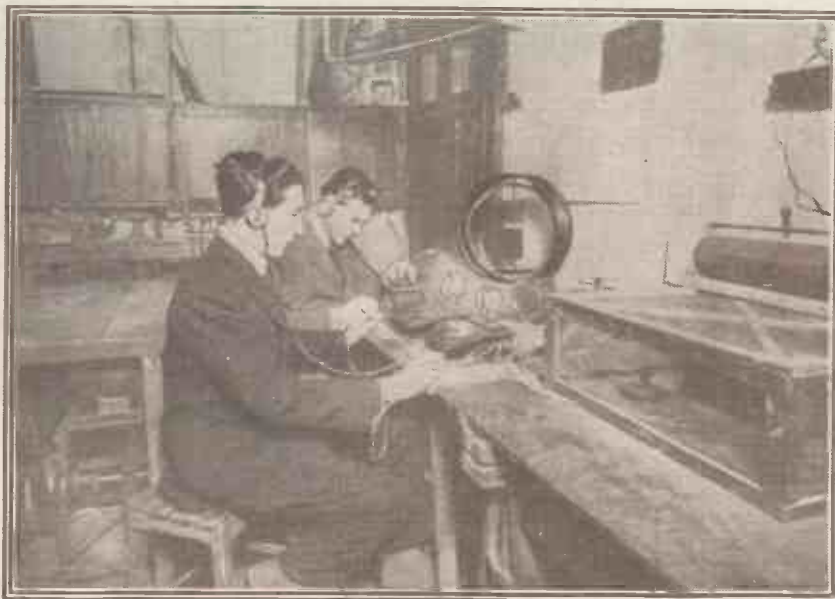
$$2\pi fL - \frac{1}{2\pi fC}$$

This is one component of impedance, and is measured in ohms. As these two effects consist of volts and amps. in quadrature, or 90° out of phase; the product of the terms volts and amps. in phase is zero,

coupled to input. The terms regeneration and retroaction are more expressive, but reaction is shorter, and so it is changed by people who are not engineers to the word "reactance."

"Vernier" Condensers.

Another common mistake is that of calling a small variable condenser a "vernier." A vernier is a method of measuring to greater accuracy than can be obtained



Students receiving an American station on a four-valve set at the Milan wireless school.

or, in other words, no power is absorbed in the circuit. This is true for a perfect inductance or condenser, but such cannot in practice be obtained, although close approximations are common.

Voltage overcoming resistance is energy voltage, therefore the current in the resistance may be considered as in quadrature with the current in the reactance. To obtain the resultant the parallelogram of forces is used. The sum of the squares of each term gives the square of the resultant, which then becomes impedance $Z =$

$$\sqrt{(2\pi fL - \frac{1}{2\pi fC})^2 + R^2}$$

Reaction as used in radio is purely physical; it denotes the reactions of the anode circuit on the grid circuit, or output

with a single scale, and a small condenser in parallel with a larger one is used only for fine tuning, there being no vernier scale whatever. A fine tuning condenser is sometimes called a micrometer condenser; this is better, but still of doubtful accuracy. Until a new term for a fine tuning condenser is evolved, "vernier" apparently will continue to be used for want of a simpler term, although its correctness of designation is nil.

Another point of difference between commercial alternating currents and radio-frequency currents is in the different standards of comparison. Supply frequencies are almost entirely between 15 and 100 cycles per second. Wave-length is not mentioned, although it is a constant and depends directly on frequency.

(Continued on next page.)

MISLEADING RADIO TERMS.

(Continued from previous page.)

Frequency is the term that is required for design purposes, primarily from the fact that in alternator design $f=np$ or frequency = revolutions per second multiplied by pairs of poles.

An International Question.

In radio engineering the wave form of the current is still the same—that is, approximately sinusoidal—but the wave-length is referred to as the constant, whilst frequency is ignored. There is room for discussion on the subject of bringing radio practice into electrical agreement by using terms of frequency only. The question is an international one, and cannot be settled here, but the problem is worth consideration.

appears differently. For instance, the outlet terminal of a generator is the positive, whilst that of a consumer is the negative, all based on the usual convention, not the electron theory. This apparent difference is caused by the fact that there must be a complete circuit for a current to flow. A generator with perfect insulation will be generating an electro-motive force (E.M.F.), but there will be no current flow as there is no circuit.

When a circuit is established, a current will flow, and the polarity of the terminals is then of interest. The circuit is from positive (+) to negative (-) through the external circuit or consumer, and from - to + on the return through the generator.

Plus and Minus.

A secondary cell whilst discharging is a "generator," and the positive terminal is the terminal which is connected to the positive terminal of a consumer (where polarity is of any consequence).

Whilst being charged the conditions are

distinct. The electro-motive force of any form of generator is a value which is a constant of the machine or battery, under given conditions. It is quite independent of the external circuit (if any).

For example, a Leclanché cell has an E.M.F. of about 1.47 volts when freshly set up.

A Battery's Internal Resistance.

Slight variations occur with the state of the chemicals and elements used in its construction, but, apart from this, when made up the cell's E.M.F. is 1.47 volts.

Now suppose the cell is put on load. A voltmeter connected across the cell now reads less (say, 1.37). The E.M.F., however, has not changed. The P.D. is being measured, and is 1.37 volts. Now to account for the other .10 volt. The cell must have some resistance, and therefore the passage of current will cause a volt-drop across it. This is the missing .10 volt, so that the battery E.M.F. is still shown to be as it was on open circuit, or 1.47 volts.

The E.M.F., then, is equal to the P.D. across the load plus the P.D. across the cell itself, all drop across leads, etc., being measured with the drop across the load.

If the battery had no internal resistance the E.M.F. would be numerically equal to the P.D. on load, although if the drop across any part of the circuit is measured it is not an E.M.F. that is measured, as this term only applies to a source of electrical pressure.

Open Circuit Readings.

Actually, the E.M.F. of any generator can only be measured by an electro-static voltmeter, but practically any high-resistance voltmeter will do satisfactorily (unless the resistance of the coil is of the same order, for battery work).

Suppose a wireless anode battery of 50 volts is to be tested. Its open circuit voltage cannot be measured with any ordinary voltmeter, as they consume far more current than the load (a receiving set, for instance). If the battery is quite new it may read on a voltmeter its true E.M.F., but this is unlikely, especially if a low-resistance voltmeter is used.

This explains why a battery reads differently when connected across different types of voltmeter, although the two instruments may both be correct.



Students in the vacuum laboratory of the Milan wireless school preparing elementary types of radio valves.

It is now generally believed in science that the atom of matter consists of two opposite kinds of electricity, positive and negative, the units of these being called the proton and electron respectively. It is also recognised that the flow of current from a heated filament is towards a positive charge. This means that the convention as usually observed of positive and negative is reversed.

However, the old terms are still retained; for instance, the carbon plate of a battery is still called the positive terminal.

The general convention being adhered to, there is still a little confusion in the terms positive and negative.

In general all electrical apparatus can be divided into two groups, generators and consumers. The first class includes all electro-dynamic machines, batteries, thermo-junctions, etc., and the latter all forms consuming devices—e.g. motors, lamps, heaters, etc.

Polarity applied to these two classes

reversed; the battery is the consumer with its + to the + of the generator, and the current flow is then opposite to that on discharge.

In the case of a three-wire direct-current system the mains are called positive, neutral (\pm), and negative. This does not introduce a new term, as at first appears. The neutral conductor is so called because it is intermediate in polarity between the others. Relative to the + main the \pm is negative, but as it is intermediate it must be + to the negative.

If, then, two wires are used, one of them is + and one - and there is no other term, and the system is just two two-wire systems with one line common to each.

E.M.F. and P.D.

Many wireless text books and journals confuse the two terms electro-motive force (E.M.F.) and potential difference (P.D.).

They are generally treated as if they were the same, but in general they are quite

FILAMENT RHEOSTATS.

"VERNIER" filament adjustment cannot be obtained with a filament rheostat having a large maximum resistance. A 30-ohm resistance is unable to provide the fine control of a 6-ohm resistance, for the simple reason that similar movements of its contact will give correspondingly greater "jumps." It is obvious that, whereas a 45° movement of the 30-ohm instrument gives a resistance variation of about 4 ohms, the same variation is spread out over two-thirds of the whole circular range of the lower resistance component. If a large resistance is required (say, to operate '06's on an accumulator), it is better to use a fixed resistance in series with a low-resistance filament rheostat.



We publish below the last of a series of exclusive articles by the Manager of the International Radiophone Bureau.

IF, in the autumn, when the nights commence to lengthen once again, it is found that order has been obtained in the 200-600 metre wave-band of the European ether, then the European broadcasting organisations will have reason for some pride in their achievement. They will have solved a problem of no mean magnitude, and will have set a fine example of what can be done in the profitable field of international co-operation. But they will not have reached the broadcasting millenium.

The placing of the European short-wave stations in positions where, according to all the laws of the game, no one will hinder or be hindered by the activities of another, must be regarded as nothing more than a starting-point in the development of the broadcasting art—something akin to the serving of cards or dominoes before the commencement of the game.

The High Power Stations.

Unfortunately, one will not be able to point to a complete solution of the wave-length problem, but only to that portion of the problem which affects the average run of stations. The high-power stations employing long wave-lengths are now calling for help.

The problem of the big brother amongst broadcasting transmitters is every bit as serious a one as that of the big brother in every-day life. He has got to be taken in hand or trouble will follow, and each delay in getting to business means only more drastic treatment in the end.

As "big brother" requires more room beneath the table for his legs and, furthermore, appears everlastingly to be in difficulties with his boots, so the high-power broadcasting station working on wave-lengths of 1,000 metres upwards, requires a greater proportionate share of the ether than the smaller members of the family.

Room for Ten Only.

Each high-power station needs a separation of something approaching 20 kilocycles if he is not to prove himself a nuisance to his neighbours and to those unfortunate listeners who, possessing average and not specially selective sets, are situated in point of geographic position midway between the two.

Now, whilst 20 kilocycles may only mean a wave-length difference of 2.7 metres when considered in relation to wave-lengths in the neighbourhood of 200 metres, or a difference of 25 metres in the neighbourhood

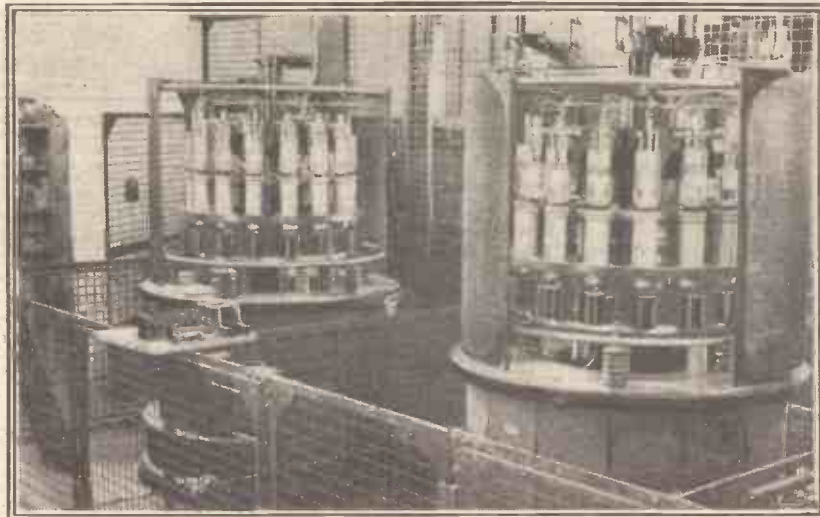
of 600 metres, a very different state of affairs presents itself when we get to 1,000 metres. Here a difference of 20 kilocycles means a separation of 71 metres; at 2,500 metres a 20-kilocycle difference becomes one of 500 metres! If one takes the pains to plot out positions between 1,000 and 2,000 metres, giving to each station 20 kilocycles separation, then we arrive at the startling result that there is only room for ten stations in this wave-band. A survey of recent wireless literature will show that there either already exists or are projected for the near future more than ten European high-power stations for long-wave working.

more fortunate than Daventry generally speaking, comes in for occasional bursts of Morse by some station more concerned with to-morrow's weather than to-day's French art.

There is also an uneasy feeling abroad that the telegraphic services are plotting an even greater incursion on those wave-lengths which broadcasters had hoped would be available for high-power transmission.

"Commune" Wave-lengths.

What the solution will be one cannot even predict at this moment. Washington may play a part in this particular problem,



Two of the power amplifiers—containing 15 valves in each—used at the Rugby station.

The placing of ten high-power stations in the 2,000 metres between 1,000 and 3,000 metres is based on the assumption that these broadcasting stations would have that section of the ether entirely to themselves. Anyone who has studied the wave-chart of Europe will see how hopeless is such an assumption. In almost every part of Europe, even on the high seas, are to be found telegraphic stations conducting commercial and other services within this wave-band.

5 X X Badly Jammed.

Even Daventry is jammed almost out of recognition in southern Europe by Spanish spark stations working exactly on 1,600 metres, whilst Radio-Paris, which is

for the Conference to be held there next year will certainly make a survey of the situation in those wave-bands which have been used in the past for telegraphic purposes.

The idea of one or more "commune" wave-lengths, as applied to the small power stations in the 200-600 metres wave-band, is hardly likely to prove applicable to the longer waves, as the stations under consideration are mostly of high-power and considerable radiating ability. It would appear as though advantage will have to be taken of the differences of time in eastern and western Europe, and the high-power stations of the East be made to duplicate the wave-length of the high-power stations

(Continued on next page.)

**EUROPEAN
BROADCASTING**
(Continued from previous page.)

of the West, each limiting themselves to two and a half hours transmission nightly.

The eastern European stations, by commencing at 8 p.m. their time, could finish their nightly transmission by 8.30 British or French winter time, thus leaving the western stations 2½ hours between 8.30 and 11 p.m. Greenwich mean time. Another alternative would be to abandon the long wave-lengths, and to put the high-power stations among those of lower power on the short wave-lengths. Germany, in fact, already has a broadcasting station under construction for use between 300 and 600 metres, which will be capable of applying 10 kilowatts to the antennæ.

Not to be "Scrapped."

I trust that no one will jump to the conclusion that Daventry and Radio-Paris, and perhaps Königswusterhausen also, are



The foot of one of the masts of the new American 50 kw. broadcasting station which operates on 455 metres.

about to be scrapped. This is not the case; neither is any Government likely to be so inconsiderate in their treatment of established stations.

It will be seen, therefore, that there is still much work for a Technical Commission even on the wave-length side of broadcasting. There are also other equally important and urgent matters to be dealt with.

International Broadcasts.

The provision of means for maintaining a common wave-length standard amongst all stations, and of securing stability in wave-length during transmission, are matters forming part of the wave-length problem. They are already "in hand." Perhaps the next most urgent thing for the engineers is that of arriving at a common agreement with the telephone engineers of Europe as to the needs of broadcasting in the matter of specially prepared long-distance lines for relay purposes.

Britain recently had a splendid example (judging by the reports I continue to receive) of the extraordinary possibilities surrounding the relay of distant events of considerable magnitudes, such as the Assemblies of the League of Nations at Geneva. Why, for instance, should the first night of a great new opera at the Scala, Milan, any longer be confined to those relatively few enthusiasts of all nationalities who are able to incur the expense of travelling to Milan for the purpose of being present? If international broadcasting of such an event could be arranged, the enthusiasts would fill the Opera House just as before; but the new opera and Milan would be the "talking point" of Europe next morning.

Land-line Difficulties.

Relaying by land line appears likely to be an extensive practice in the future. Unfortunately, few European lines are fitted at the moment for the purpose. In some countries, too, a movement is already well in hand to put underground in cables lines which hitherto passed across country overhead, and, unhappily, except for the risk of breakage by storm or falling boughs, the overhead lines are usually better suited for the long-distance transmission of music than are the cables.

Fortunately, there has recently been formed in Paris an International Consultative Committee of Government telephone

engineers for the consideration of the future needs of Europe in the matter of long-distance telephonic communication, and the Union Internationale de Radiophonie has courteously been given the opportunity of placing before that committee its views on the special technical requirements of the broadcasting engineer.

Future Possibilities.

The character of thousands of miles of telephone line cannot be changed in a month or even a year; nevertheless, I confidently look forward to the day when a play written around some Eastern theme and performed in a London studio may actually have for its background the actual sounds of an Oriental bazaar. I even believe the day will come when monarchs and statesmen of the East and of the West, speaking in one of the freely understood languages, will explain to the world at large on suitable occasions the real aims and ambitions of their peoples, and the particular direction in which they hope to contribute to amity and international prosperity.

There would be nothing undignified in such a procedure; on the contrary, the monarchs of recent times most beloved throughout the world have been those who have spared no pains to make clear in foreign countries how numerous can be the bonds of friendship, built on those touches of humanity which make the whole world kin.

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.

AN ALL-STATIONS RECEIVER.

The Editor, POPULAR WIRELESS.
Dear Sir,—I constructed a Det. and L.F. set much after that described by Mr. J. Allan Cash in "P.W." April, 1925, Vol. VII, No. 149.
I rearranged the components a little by fitting the two valves to the outside of front panel, and the three-way coil holder to the hinged top of the case with a special switch arrangement which did away with flexible leads.

The H.T. and L.T. terminals are fitted to an ebonite bridge piece, mounted on pillars secured to the base board. H.T. batteries are housed inside, L.T. outside. With three basket coils each having wound on them 56 ft., 110 ft., 68 ft., for reactionary, secondary and primary, No. 28 or 28 D.C.C. wire. 2 L.O. and 5 X X come in, one at the bottom of the scales and the other coming in about the top of the scales.

For over eleven months I have been able to jump from 2 L.O. up to 5 X X with half turn on the dials; of course, other stations are picked up between.

As for strength, on one valve both these stations come in equal, and too loud to be comfortable on two pairs of Siemens 4,000 ohm 'phones.

Valves used: D.E.3.B, D.E.R., B.5, Radio Micro.
Yours faithfully,

GEORGE S. BAIRD.

1, Hurst Road, Erith, Kent.

THE ROME BROADCASTING STATION.

The Editor, POPULAR WIRELESS.
Dear Sir,—Having read of the results of some of your readers regarding the reception of "Radiofonica Italiana-Rome," I should like to state that I have received this station on consecutive Sundays throughout the winter on a two-valve receiver, H.F. and Det. tuned anode with reaction on anode coil, and that when Rome was on lower power than at present. Reception was about R.5 strength and was free from fading, though tuning was rather critical, and especially the plate voltage.

The circuit is practically the same as your "P.W." Blueprint H.F. and Det., and is the best two-valve receiver for purity and D.X. work I have either built or heard. Here are some of the results I have had.

On indoor aerial (70 ft. "Superial" from ground floor to top of house, nailed anywhere) on 'phones: Daventry (very loud), Radio-Paris (fairly loud), Hilversum (loud), Königswusterhausen (loud), Hamburg (loud), London (fairly loud), Hull (fairly loud).

On outdoor aerial: Radio-Paris, Daventry, Königswusterhausen, Hilversum, Aberdeen, Birmingham, Rome, Glasgow, Newcastle, Hamburg, Bournemouth, Oslo, Manchester, London, Leeds, Hull, Nottingham, Radio-Belgique, Radio-Berne, Madrid, Breslau, and others which I have been unable to identify. My longest DX station was W G Y last winter, being unsuccessful at my one trial this winter. The set is very selective, two or three stations being tuned in on the 'phones only. I have been a regular reader of "P.W." for the last two years, and being in the trade, I am able to glean much useful advice, and keep *au fait* with all the latest in wireless, and thus to the benefit of my customers.

Wishing your paper the continued success which puts it right to the front in wireless literature.
Yours truly,

Market Place, Alford, Lincs. C. T. PINNEY.

RESISTANCE AMPLIFIERS.

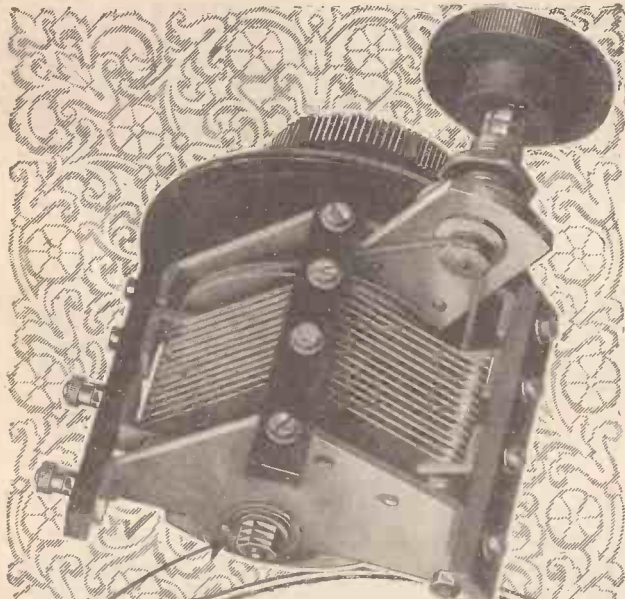
The Editor, POPULAR WIRELESS.
Dear Sir,—Mr. Turner's letter is extremely interesting to me, as I worked on the same problem for a considerable time, the difference being that Mr. Turner has the necessary skill, experience and facilities for the manufacture of special valves. There are certain matters in his letter which call for comment.

1. Anode resistances. There is very little to be gained by increasing the anode resistance, over a value of 1 megohm. A point which has not previously been brought out is that the valve impedance increases rapidly with the increase of anode resistance, and whilst the curved portion of the valve characteristic is straightened out considerably, there is still a curvature, as it is obvious that the curve cannot cut the base line at a finite angle.

It is therefore incorrect to write the voltage amplification obtainable as $\frac{R_o}{R_o + R_a}$ if by R_a is meant the anode impedance at some point on the straight portion of the static characteristic curve. The differential anode impedance corresponding to position on the curve at which the valve is being operated should be the value given to R_a in the above formula.

2. Grid leak. Very little can be gained by using grid leaks of higher than 5 megohms, as the reactance of the grid-flament capacity at the higher audible frequencies may be of comparable value. Unless some very special precautions are taken to reduce this inter-electrode capacity—a difficult matter, indeed—higher values of leaks are undesirable. Mr. Turner quite rightly mentions that care must be

(Continued on page 500.)



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NO
BACK LASH

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SQUARE LAW
SLOW MOTION**

THE "Cosmos" Condenser is a slow motion condenser with absolutely no back lash, either when new or after use. This desirable feature is accomplished by the use of a spring belt held in tension, which permits coarse tuning with the large knob, and a 10-1 slow motion with the small knob.

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The condenser for fine tuning.

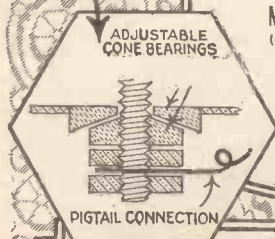
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R
P39

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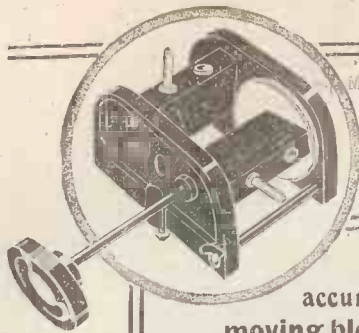
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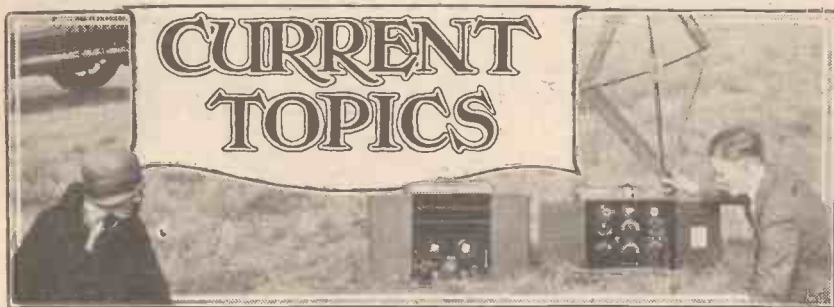
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4. CRYSTAL DETECTOR WITH L.F. AMPLIFIER.
5. H.F. (Tuned Anode) AND CRYSTAL, WITH REACTION.
6. H.F. AND CRYSTAL. (Transformer Coupled, Without Reaction).
7. 1-VALVE REFLEX WITH CRYSTAL DETECTOR (Tuned Anode).
8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing 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).

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By THE EDITOR.

A CORRESPONDENT to the "Spectator" makes an interesting suggestion which we think is worth bringing to the notice of our readers. He believes that the Prime Minister, as the head of His Majesty's Government, is the elective head and mouthpiece of the nation, and should be treated as such, and he would like to see this developed in a marked and wonderful degree, as it might be, by the use of wireless. From time to time, especially in periods of national stress, such as we experienced during the General Strike, it appears to be the general impression that the Prime Minister should address the nation through the agency of the broadcasting system of the B.B.C. To quote the "Spectator's" correspondent:

A Great Opportunity.

"Surely a great opportunity is lost when such a straight and friendly soul as Mr. Baldwin is only permitted to act as a mediator between the men's leaders. Here is an idea—an idea which I venture to class as a great idea—the revival of the personal and paternal touch in high politics, and a most important development in the organization of the central control for the nation. Wireless has placed this opportunity in the hands of those whom we elect to be our popular leaders."

This suggestion is an interesting one, and we ourselves can only hope that there will be many more opportunities of hearing Mr. Baldwin broadcast. His voice is peculiarly suited to the microphone, and despite a touch of the House of Commons intonation, which we suppose is inevitable, the clarity of his voice, the deliberate and finished quality of it, makes him an ideal broadcaster.

In writing of Mr. Baldwin's broadcast speech, we are reminded that several people have remarked on the similarity between his voice and that of Mr. J. C. W. Reith, the Managing-Director of the B.B.C. We have heard many comments indicative of the belief that Mr. Baldwin broadcast more than once, and this belief, due to the similarity of Mr. Reith's voice, in the opinion of many people has, no doubt, created this rumour. But, as a matter of fact, we have it on the best authority that during the strike Mr. Baldwin broadcast only once, although on more than one occasion Mr. Reith read out a special message from Mr. Baldwin.

We remarked in our last issue that there was every indication that the strike had created a wireless boom, and now we find this more than confirmed, not only from our own observations of the state of the trade,

but from Mr. W. W. Burnham, the Chairman of the Radio Manufacturers' Union, who has stated that, despite transport difficulties, the sales of one of the largest manufacturers in London for the first week of the strike were 435 per cent. higher than those for the corresponding week last year, and it is expected that the sales for the second week will show a percentage only slightly lower.

It is Mr. Burnham's view that the increased sales in the radio industry will continue. "A wireless set, once regarded as a plaything," he said, "is now regarded as a necessary investment, and in times such as we have now passed through, a more urgent necessity than the telephone."

Talking of broadcasting through the strike, we have had brought to our notice a very interesting point of etiquette in connection with loud speakers.



A firm in Vienna provides loudspeaker entertainment while customers "try on" boots and shoes.

At a West End club during the strike, on the night of the King's broadcast message to the nation, there was a crowd of members in front of the loudspeaker fitted up in the club smoking-room, and when the King's speech was announced by Mr. Reith, one middle-aged and rather pompous member rose from his armchair and stood sternly at attention.

An Apt Reply.

One by one other embarrassed members of the club followed his example; all except one young man, who remained safely ensconced in his armchair. At the conclusion of the King's message, the middle-aged and pompous member of the club took it upon himself to read the young member a severe lecture on loyalty and etiquette (possibly being ignorant of the fact that he could, if he liked, display several wound stripes). This started an argument, and opinion would seem to have

been against the pompous member, more particularly when the young man said: "The message came, I believe, from 2 L O. Do you, sir, when you read a message from His Majesty in your morning paper, stand up at your breakfast-table?" We can imagine the pompous member collapsing somewhat in the manner of a pricked balloon.

The Aurora Borealis.

American wireless papers are taking up the question as to whether the aurora borealis has any effect on radio reception. It would appear, however, that observations indicate that the northern lights are not a disturbing factor as far as wireless is concerned, although the effect upon very short waves, according to "The Scientific American," has not yet been ascertained. The aurora borealis undoubtedly interfered with telegraphic traffic during this year's international broadcasting tests and the aerial current often reached a potential as high as 150 volts. In particular the disturbance was chiefly noticeable on grounded circuits, but the metallic long distance telegraphic and telephone lines, which had no connection with the earth, did not pick up this current.

The aurora borealis has, apparently, a peculiar effect on waves less than 100 metres in length, but not upon higher waves. During the January aurora borealis display, commercial short-wave stations found communications across the Atlantic interfered with, and low-wave receiving sets in this country failed to detect the 41

metre signals from W G Y. British transmitters, however, did not notice anything particular as regards the effect of the aurora on the regular broadcasting wave-lengths from 200 to 500 metres.

The statement that the phenomenon of the aurora borealis acts like a "blotter on the air" is contrary to conclusions reached by experts who have made a study of this matter, and its effect upon radio waves. Dr. MacMillan, who

has made a study of this in the far north, has stated that "the aurora borealis has, apparently, no effect upon radio transmission or reception." He has noticed, when passing right through the aurora belt, that it did not trouble the radio waves in the least, while reports from operators on ship and shore stations bear out Dr. MacMillan's contentions. Although spectacular displays of the aurora borealis in 1924 interfered with telegraphic lines, operators on ships and at shore stations have reported that no bad effects were noticed.

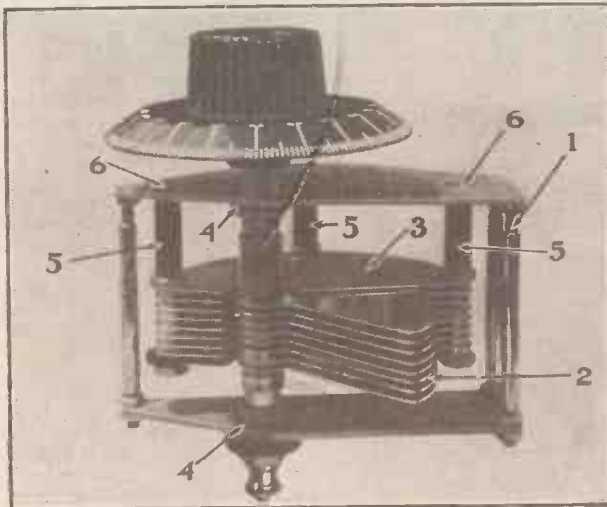
We regret that owing to conditions created by the strike, several advertisements were unavoidably held over. We feel sure our advertisers and our readers will accept our apologies and regrets that these unavoidable circumstances prevented us from publishing an issue of normal size.

CONCERNING LOW-LOSS CONDENSERS.

FROM A CORRESPONDENT.

MOST of the variable condensers now offered to the experimenter are sold as "low-loss." These condensers vary very much in design, and it may be profitable to consider what features point to utmost efficiency. We will then be better able to make a good choice from the various models at their various prices. Losses in a condenser may roughly be divided into those due to leakage from one set of vanes to the other, and to dielectric absorption.

The first cause of loss, it is generally admitted, can be effectively dealt with, but the damping of the oscillations due to dielectric absorption is not so easily contended with. Air, paper, mica, glass, rubber, ebonite, and other practical dielectric or insulating mediums have in themselves inherent properties of absorbing oscillating energy. Air is the best dielectric, and in the case of an appreciable air gap the energy lost by absorption is negligible.



A low-loss variable condenser designed and made by our correspondent. The numbers are referred to in the text.

It is, however, impossible to make a condenser with a dielectric entirely of air. There must in addition be some form of solid dielectric to support rigidly the two sets of vanes. It is here that dielectric losses are likely to occur, and even leakage. Absorption losses are found to be directly proportional to the intensity of the dielectric strain and to the cross-sectional area of the dielectric. These losses are inversely proportional to the length of the dielectric. It being impossible to abolish solid dielectric entirely, that which is likely to be responsible for the least possible damping by loss due to absorption is a long thin dielectric, situated away from the area where oscillations are straining the main dielectric (air). The maximum strain is likely to occur where the vanes are interposed. It follows, therefore, that any solid dielectric supporting

the spindle of the moving vanes is likely to be always in the field of strain.

In the popular type of condenser, which has the moving vanes electrically connected to the frame and the dielectrics removed to the "outside," there may still be a field of strain at the outside position if the thickness of the solid dielectrics there is not somewhat greater than the thickness of the air dielectric at the "business" part of the condenser. It all comes back to our ideal, solid dielectrics that are long and with slight cross-sectional areas. Naturally there should also be as few as possible of these points of solid dielectric.

Not a Commercial Product.

The condenser illustrated was designed and made by the writer for a set to heterodyne short waves to a more "fool-proof" frequency. The condenser is not on the market, so if we consider its points we shall be neither favouring nor depreciating any commercial product.

The condenser consists of three main parts—frame, 1; moving vanes, 2; fixed vanes, 3—all three insulated from each other.

The spindle of the moving vanes is insulated from the frame by means of ebonite bushes, 4. The fixed vanes are rigidly fastened to and insulated from the frame at three points only by lengths of Bakelite tube, 5. These tubes are threaded internally. In the model shown they are $\frac{3}{4}$ in. long, and attached to the frame of the condenser by three $\frac{1}{4}$ -in. countersunk screws, 6.

The three pillars clamping the three fixed vanes of the condenser screw into the opposite ends of the tubes $\frac{1}{8}$ ths of an inch.

The frame plate of the condenser being $\frac{1}{8}$ of an inch thick, there is therefore an air gap between the ends of the screw, 6, and the ends of the pillars of $\frac{3}{8}$ in. This air gap is very much greater than the thickness of the air dielectric of the condenser, and there is therefore unlikely to be any appreciable strain at this point.

Reduction of Solid Dielectric.

The cross-sectional area of the solid dielectrics—i.e. the Bakelite tubes, is of a minimum for the strength given, for there is nothing mechanically stronger than a tube for a given cross-sectional area.

It will also be noticed that there are only
(Continued at foot of next column.)

A CONDENSER DIAL STABILISER.

By J. F. C.

ACCURATELY geared slow motion variable condensers are a refinement to any set. And, like most of the refinements of this world, they are not inexpensive. For many super circuits they are, of course, essential if the best results are to be obtained, but for ordinary use such condenser attachments may be substituted by the device described below, and with equally good results.

An ordinary typewriting rubber or eraser costs, at the most, the sum of threepence,

and it may be obtained from any firm of typewriting people or office suppliers. Such an article forms the basis of our present slow motion condenser attachment.

As will be seen from the illustration, the circular typewriter eraser is attached to the panel by means of a small screw fitted with a lock nut on its under side. The eraser is so fixed that it makes frictional contact with the condenser dial, the degree of contact, of course, being varied to suit the needs of the individual amateur by means of the central screw.



Showing how the attachment is fixed.

tached to the panel by means of a small screw fitted with a lock nut on its under side. The eraser is so fixed that it makes frictional contact with the condenser dial, the degree of contact, of course, being varied to suit the needs of the individual amateur by means of the central screw.

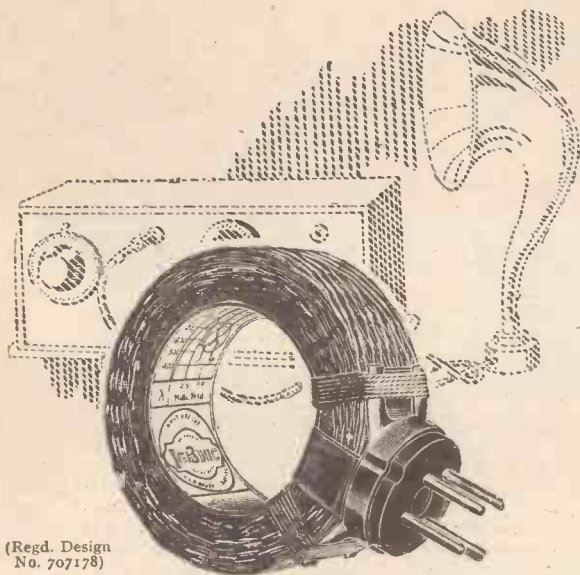
Serving Two Purposes.

In the first place, it may be used merely as a condenser dial stabiliser for preventing the dial from revolving away from an accurate setting. Thus, by revolving the condenser dial to any particular setting, the mere contact of the rubber disc is sufficient to prevent it from sliding away.

Again, the gadget may be used to impart a very slow and accurate motion to the condenser dial. In this case a fairly firm contact of the rubber with the condenser dial is required. The dial itself is roughly set at its approximate position, after which slow motion is imparted to it by slowly revolving the circular rubber disc by means of the fingers.

three points of solid dielectric in this condenser, whereas the popular type of condenser already referred to has six.

The bushes insulating the spindle from the frame are "in series" with the tube dielectrics, so that these add to the effective length of the solid dielectric, the frame of the condenser being insulated from both sets of vanes, an effective means is provided of shielding the condenser. Actually in practice the condenser is used with a geared vernier knob.



(Regd. Design No. 707178)

The Igranic Honeycomb High-Frequency Transformer.
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Conducted by our Staff Consultant, J. H. T. ROBERTS, D.Sc., F.Inst.P.

THERE appears to be a certain amount of confusion in the minds of many amateurs as to the exact meaning of the designation "straight-line" with reference to variable condensers. In this country it is customary to describe such condensers as "square law," and it is here that the ambiguity seems to arise. I have frequently received enquiries from readers as to whether a "square-law" condenser is a straight-line-wave-length or a straight-line-frequency.

The fact is that the term "square law" is used by different manufacturers somewhat loosely. In this country, however, it may be taken to mean either straight-line-capacity or straight-line-wave-length, and almost invariably the latter. In the United States, as most British amateurs now know, the straight-line-frequency condenser has lately gained considerable popularity.

There is a certain fundamental reason for the popularity of the straight-line-frequency condenser in the United States and the popularity, on the other hand, of the straight-line-wave-length condenser in this country. The reason is connected with the different methods adopted in the two countries for separating different transmitting stations. In the United States the stations are separated according to their frequency, the estimate for the minimum frequency-separation in order to avoid interference being somewhere about 10 kilocycles. In this country, however, the separation is arranged (at any rate at present) by wave-length, and consequently, a straight-line-wave-length condenser is more useful.

It is well known that, in order to secure the straight-line-wave-length or straight-line-frequency feature, the vanes of the condenser have to be shaped with a special contour, and different manufacturers have patented different types of vanes for this purpose. The straight-line-frequency condenser usually has vanes of a peculiar elongated shape and consequently is apt to take up more space behind the panel.

Die-cast Condensers.

Whilst on the subject of condensers it is interesting to note that the die-cast condenser, which was introduced some time ago in the United States, is now making its way on to the British market. In this condenser the stator and rotor are each cast in a single piece, so that there is no possibility of any bad contacts or high-frequency-resistance losses due to the vanes not being properly connected together. Another advantage of

the die-casting process is that, since the stators and rotors are turned out of a mould, they are automatically matched, and different condensers can consequently be relied upon to have matched characteristics to within a considerable degree of accuracy. In the making of die-cast condensers, it is very important that the metal or alloy which is used should be proof against warping and corrosion.

New Power Valves.

I notice that a number of new power valves are appearing on the market and one



An interesting comparison. (Left) Mr. Marconi's first valve, made in 1895; and (right) one of the latest types of Marconi dull emitters. The coin is a halfpenny.

of these is of a somewhat novel design in that it has two anodes, two grids and two filaments, the latter being in parallel. It thus has, in effect, two separate sets of electrodes and is equivalent to two valves in parallel. At first one would be inclined to say that the experiment of running two valves in parallel was known to be not always a success, owing to the two valves not being properly matched. But, according to the tests which I have myself made on some preliminary samples of the valve referred to, it appears that the new valve is eminently successful, and this is due partly to the electrodes being matched in manufacture, and no doubt largely to the fact that they are contained in the same vacuum. This is a point which, of course, can never be achieved when using two separate valves.

Whilst on the subject of novel valves, I see from one of the German papers that a new valve has lately been put on the German and the United States markets which, in effect, combines three valves in one—detector and two low-frequency amplifiers. All the wiring is inside the valve except that, of course, which is concerned with the coils and transformers. The valve is considerably larger than the ordinary receiving valve and is provided with six pins at the base which fit into a special holder. I have not yet had an opportunity of examining one of these valves, but according to the reports, it gives excellent results. There is only one filament for all the three parts of the valve, and there are three grids (each grid being double) and three anodes.

Recent Developments.

Another valve made by the same manufacturer has one filament, two grids and two anodes, and provides for two stages of resistance-coupled high-frequency amplification. There seems to be a considerable future for these multiple valves, although, naturally, they are much more expensive than the ordinary receiving valves and there is the danger, in case the filament is burnt out, of the whole appliance being rendered useless.

A few years ago it was discovered by Messrs. Johnsen and Rahbek that if a partially conducting substance, such as agate, were placed in contact with a metal surface, an unusually strong electrostatic attraction was set up, and some ingenious uses of this phenomenon were made. It has now been found that a similar combination has the property of rectifying alternating currents; and may be used as a wireless detector in the same manner as a crystal detector. Iron and agate have been experimented with to some considerable extent, and characteristic curves have been obtained similar, in a general way, to those which are now familiar in relation to crystal detectors. One of the peculiarities of the combination is that it is not necessary to have a point-contact: the two surfaces must, in fact, be brought into surface-contact as well as possible, and the agate surface must be silvered to improve its electrical conductivity.

These discoveries were made by W. Kramer, and it is expected that much new information of importance in wireless reception will be forthcoming from the continuation of the experiments.

PHOTOGRAPHS.

Readers are invited to submit photographs of wireless interest for publication in "Popular Wireless." Every photograph accepted and published will be paid for at the rate of 10/6 per copy.

This time next month!!



The "Permatecor" is heavily nickelled and costs only **3/-**. From dealers or direct.

The "Permatecor" definitely provides trouble-free crystal detection. It 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.

Fit a Brownie Wireless "Permatecor"

• to-day

and that's the end of your crystal detection troubles. Set it to give the loudest signals

and in a month's time

it will still be giving the same voluminous reproduction. Extraordinarily stable, is the Permatecor. Test it for yourself in this way—shake the receiver vigorously while you are listening and you will find that reception is entirely unaffected. The secret lies in the unique spring construction and the use of two super-sensitive crystals. So sure are we that each instrument will give perfect results that every "Permatecor" carries—

The Brownie Wireless Guarantee "the guarantee that counts"

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 Gt. Britain) Ltd.

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

310a-312a, Euston Road, London, N.W.1

Phone: Museum 3747.



Get Rid of Valve Trouble

Get rid of these disturbing microphonic noises—prevent the danger of breakage from shock. Ask your dealer for the new improved Lotus Buoyancy Valve Holder, which absorbs shock and protects your valves.

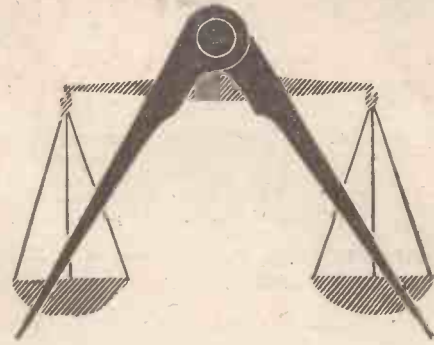
Valve sockets and springs are locked together by a mechanical process, making a definite and permanent connection. Bakelite mouldings, nickel silver springs and phosphor bronze valve sockets, nickel-plated.

Without Terminals **2/3**

With Terminals **2/6**

LOTUS
BUOYANCY
VALVE HOLDER
ANTI-MICROPHONIC

Garnett, Whiteley & Co., Ltd.,
Lotus Works, Broadgreen Road, Liverpool.
Makers of the famous Lotus Vernier Coil Holder.



MATHEMATICAL ACCURACY

IF YOU could see some of the instruments in the PYE laboratories you would understand that at this House radio is treated as a science.

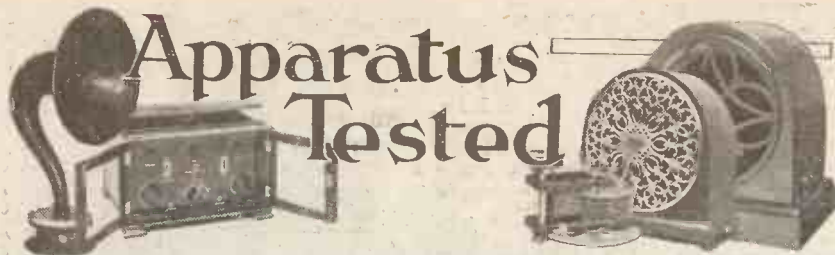
By means of these instruments the efficiency of every PYE component is tested with micrometric exactitude. Not so much as a single terminal can escape on to the market unchecked.

But the most exacting test of all comes last, when the components have been assembled. It is in no small measure due to our error-proof methods of final examination that PYE products have come to be recognized by all serious radio experimenters as the components that 'bring reception to perfection.'

W. G. Pye and Co., Granta Works,
Montague Road, Cambridge

Manufacturers of Scientific Instruments and Radio Apparatus





Apparatus Tested

Traders and manufacturers are invited to submit wireless sets and components 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.

THE PHILIPS SAFETY FUSE.

MESSRS. PHILIPS LAMPS, LTD., of 145, Charing Cross Road, London, W.C.2, recently sent us some samples of their new Philips Safety Fuse. In appearance the device is somewhat similar to a small grid leak and is provided with mounting clips and nuts. It consists of a very fine wire, positioned in a glass tube, which is designed to fuse at a current below that which could burn out even a "point-0-six" dull emitter. Connected in series with the H.T. battery, it offers such a low resistance (merely some 30 ohms) that it does not affect in any way the operation of a receiver. We had the temerity to test the fuse in a practical manner and were satisfied that it does its job by a failure to cause damage to 3 D.E.'s with 120 volts H.T. — and a Philips fuse. The retail price is 2s. 6d. for two fuses and the necessary nickel fittings, spare fuses being obtainable

at 1s. each. Such a certain safeguard should figure behind the panel of every "household" receiver.

THE "EKCO" HIGH-TENSION UNIT.

We recently received an "Ekco" H.T. Unit for test from Mr. E. K. Cole, 505, London Road, Westcliff-on-Sea. It is a device for breaking down and smoothing the current from D.C. mains so that they can be used for H.T. purposes instead of the ubiquitous dry battery of high voltage. The Unit is built into a small, polished oak cabinet and is provided with an adaptor attached to a long flexible lead. Two terminals are provided for breaking the earth connection; that is, to one terminal is connected the earth-lead, and to the other a lead from the earth terminal on the receiver. This brings into series with the earth a large fixed condenser which,

although it does not affect the operation of the set, eliminates any danger of earthing the mains.

The particular "Ekco" Unit sent us was designed for 150-volt mains, and to provide two voltage tappings of 120 and 60 volts. A number of other types are available, ranging from Model 1 at 35/-, having but one tapping, to Model V2, which provides two infinitely variable voltages from 0-100 and three fixed voltages of 60, 120 and 200 on 200-250 volt mains, at £8 17s. 6d. That one tested by us is Model 2A and, complete with adaptor and six yards of flex, retails at 55/-.

Three sockets figure on the small front panel, one being H.T. minus and the other plus. These sockets will take ordinary standard wander plugs.

We had the "Ekco" Unit in use for some time, using it with a straight three-valver having two stages of transformer coupled L.F. In the last stage a power valve was employed, and for this the 120-volt tapping was used, the 60-volt point serving the detector and first L.F. Very satisfactory results indeed were obtained, and the "hum" usually associated with such devices was so faint as to be unnoticeable on a loud speaker. A voltmeter test showed that the marked voltages were substantially accurate and the consumption of current as indicated by a milliammeter was but 7 milliamperes.



The "Ekco" H.T. Unit.

(Continued on page 496.)

EDISON BELL RADIO

THE EDISON BELL MUSICALLY PERFECT SPEAKER

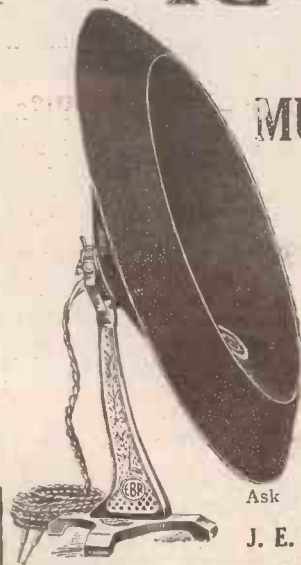
FACTS WORTHY OF YOUR NOTICE

IT IS

NOT THE LOUDEST—but the most natural
 NOT THE SOFTEST—but the most musical
 NOT THE MOST CONSPICUOUS—but the most artistic
 NOT THE MOST EXPENSIVE—but the BEST

Price 42/-

(OF ALL HIGH CLASS DEALERS).



TESTED 500 VOLTS FLAT TYPE



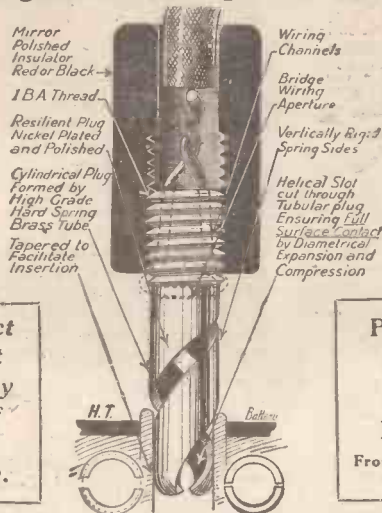
TESTED 500 VOLTS UPRIGHT TYPE

Ask your dealer for illustrated catalogues.
 If unable to obtain write direct —
J. E. HOUGH, Ltd., Edison Bell Works LONDON, S.E.15
 and at HUNTINGDON.

INSIST ON EDISON BELL CONDENSERS

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

THE ONLY WAY—
Scrap your old junk and fit—



A perfect fit for every type of H.T. Battery.

PRICE :
2^{D.}
EACH
From all traders or direct.

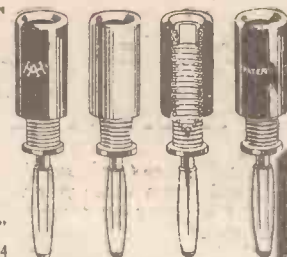
CLIX
REGD TRADE MARK.
WANDER-PLUGS
(NON-MICROPHONIC)

90% of the efficiency of a soldered joint.
For all other connections use CLIX plugsockets and adaptors.

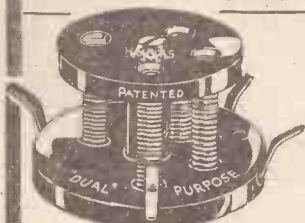
From all traders or direct from:
AUTOVEYORS LTD., 84 VICTORIA STREET, LONDON, S.W.1

"YOU'LL CONVERT YOUR RIGID HOLDERS NOW"

Fig. 975. Code Word
JUST PLUG "WOBBLERS" THEM IN! Per 1/6 Set of 4 (3 black, 1 red).



Full Size Illustration.



Full Size Illustration.

Code **"DUAL"** Word.
PURPOSE

DOUBLE ENDED. Price 1/9 each. **THE FOOL-PROOF HOLDER FOR BASE OR PANEL FITTING OR IN ANY OTHER POSITION.** The smallest and neatest combined holder on the market. No joints because the soldering tag is the same piece of wire as the spring. Show cards and display cards free.

Fig. 974. Code **"WOBBLY"** Word.
PRICE .. 2/3 each.

THE IDEAL EXPERIMENTER'S HOLDER TOO SIMPLE TO IMPROVE

For the genuine experimenter who must have a holder without capacity, and perfectly sprung, Hunt's "WOBBLY" is ideal. It is impossible to have fewer parts, or to better insulate, separate or spring them. Separately sprung legs are far more effective than a closed-in solid spring top.



Full Size Illustration.

Made under Patent 242057/24, Pror. Pats. 30670/25 and 40/26, by:—
A. H. HUNT, Ltd. (Dept. 12), Croydon, Surrey.

The NEW "BEST WAY" Guide for Wireless Constructors



Details of the three splendid sets described in this "Best Way" Wireless Guide are given below. The book is amply illustrated with photographs and diagrams, and constructors will find the wiring directions most lucid and straightforward.

The All-Station Loudspeaker Portable

A remarkably compact six valve SUPER-HET. Aerial, batteries and loudspeaker all completely enclosed and permanently connected. This receiver will appeal strongly to motorists, Caravanners, River Parties, and seaside Bungalow inhabitants.

A Three-Valve Portable

Several stations on the loudspeaker and many on Telephone receivers can be obtained with this receiver. It employs a frame aerial which is built into the lid of its neat carrying case. It will prove popular among Motor Cyclists and other Road and River Tourists.

The Baby Portable

A two valve receiver contained in a very small attache case. Batteries and telephone receivers are enclosed and a reel of wire and earth pin for erecting temporary aeriels are provided. This is the set for the Cyclist Holiday Tourer.

Now on Sale Everywhere. Buy a Copy To-day 6d.

APPARATUS TESTED.

(Continued from page 494.)

Thus the cost of running the Unit constantly for a whole year would amount to but a penny or two, and even dull emitters could not be burnt out were H.T. and L.T. connections deliberately reversed. The "Ekco" is the most satisfactory H.T. unit we have yet had brought to our notice, and can be fully recommended to the attention of all readers who contemplate switching over from batteries to mains.

AN ANTI-MICROPHONIC VALVE HOLDER.

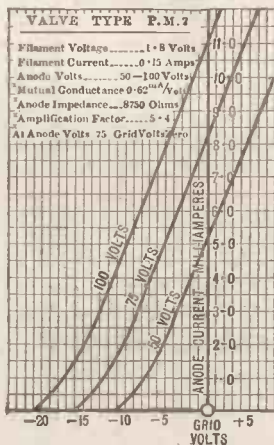
A new "Anti-Vibro" valve holder of interesting design was recently submitted to us for examination by Messrs. Mandaw, of 9-15, Whitecross Street, London, E.C.1. Known as the Etherplus, it retails at 2s. 6d. It consists of a strong insulated base, designed for baseboard mounting, and the four sockets are mounted on a rubber platform, which, in its turn, is suspended on four metal springs. Thus, each socket is movable independently and the whole four together. Four terminals are provided, on each of which is also a soldering tag. Tested with a very microphonic valve, the Etherplus proved to be perfectly efficient. It is well made and nicely finished and should command a ready sale at the above-mentioned price.

A NEW MULLARD VALVE.

Another addition has been made to the famous "P.M." range of dull emitters by Messrs. Mullard. This time it is the P.M. 2, a 1.4 to 1.8 volts power valve which is in many respects quite unique. For instance, it is provided with a filament which runs at such a low temperature that it is practically invisible, and it is claimed that it can be tied in knots after running 1,000 hours—a remarkable proof of retention of ductility and toughness. Again, the P.M. 2 consumes but 15 amps., which is, as will be agreed, remarkable for a power valve of the "two volt" type.

It is provided with a very long filament of "V" shape, and this provides a very large emission area. The valve is primarily intended as an L.F. amplifier, having an impedance of 8,750 ohms, but it functions very well in detector and H.F. positions as well.

Used in the last stage of a "det. 2.L.F." with 100 volts H.T. and 9 volts



Characteristic curves of the P.M. 2.

grid bias reproduction in a loud speaker was full and distortionless. There was a "punch" rivalling a "six volter" and a purity of tone which proved that negligible wave distortion was caused. No microphonic noises were present even when the panel of the receiver was struck sharply, although ordinary valve holders were in use.

Employed as a detector, the grid being connected through the leak to L.T. plus as advised by the makers and 60 volts H.T. being used, excellent results were obtained. In an H.F. stage with some 50 volts H.T. the P.M. 2 functioned with a high order of efficiency and was reasonably stable.

We were much impressed by the general excellence of construction of the little P.M. 2. A mechanical dissection, although painful in that it meant the destruction of a splendid valve, was very interesting. It revealed an example of craftsmanship of a very high order.

The electrodes were found to be made and assembled with absolute precision, and there was not one point that could be criticised. We discovered that the metal base is provided with internal serrations which have the effect of preventing any movement of the glass bulb. In itself this is, perhaps, a small point and the sort of thing one should take for granted in the case of a Mullard valve, but it is characteristic of the component throughout.

It is claimed by Messrs. Mullard that this new valve is the most economical and efficient two-volt power valve ever produced. In our opinion their claims have ample justification. The P.M. 2 at 18/6 should "line up" with the other P.M.'s in popularity.

Thousands have been amazed with the results they get from the 2-Valve "P.W." Continental



ONE of the most popular sets ever designed and described in "Popular Wireless" was the famous "P.W." Continental. Originally designed by Mr. Rogers of the "P.W." staff, this Set has given unbounded satisfaction to thousands upon thousands of "Popular Wireless" readers. And the most amazing thing about this 2-Valve Set is the fact that all the parts, including the cabinet, cost only 66/3. To this, of course, must be added

the Marconi Royalty of 2s/- if the complete kit is purchased. This Receiver is only one of the many described and illustrated in the Pilot Manual. Why not send 6d. for a copy to-day and learn how much you will save if you build sets the Pilot way—the safe way and the economical way. One of our customers writes: "I built the 'P.W.' Continental before lunch time on Saturday, and have already received five English and four Continental stations, all loud."

66/3
buys all the parts

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

Also 62, High Holborn, London, W.C.1
Walthamstow: 23, Wood Street.
Plymouth: 4, Bank of England Place.
Liverpool: 4, Manchester Street.

PILOT SERVICE ENSURES SATISFACTION!

SCRAP HIGH-TENSION BATTERIES!



Derives H.T. from the mains (D.C.) by just attaching adaptor to electric light lamp-holder!

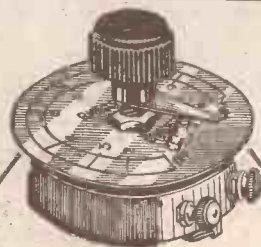
SAFE! SILENT! SOUND!

Model	Tappings	Set suitable for	Price.	Postage and Packing.
1	1	1 to 3 valves without power valves	35/-	1/6
1a	2	1 to 3 valves with power valves	42/6	
2	2	1 to 3 valves without power valves	47/6	
2a	2	3 to 6 valves with or without power valves	55/-	
3	3	3 to 6 valves with or without power valves	67/6	
V1	1 Variable and 3 Fixed	3 to 8 valves with or without power valves	£8/17/6	
V2	2 Variable and 3 Fixed	3 to 8 valves with or without power valves	£8/17/6	

Illustrated Catalogue Sent Free! Satisfaction or Cash Returned!

E. K. COLE (Dept. A), 505, London Road, WESTCLIFF-ON-SEA.

C.E. PRECISION RHEOSTATS 7 & 15 ohms 2/9, 30 ohms 3/-.
C.E. PRECISION POTENTIOMETERS, essential for efficient H.F. control, 5/9.



Used in such famous Circuits as: The 1926 Unidyne 2-Valver; The Marcuse Short-Wave Receiver; The Household 3-Valver; The Trindadyne 1-Valver, &c.

WHY PAY MORE?

You may pay more, but you certainly will never require a better Rheostat than the C.E. Precision. They are perfectly finished, and the neat silvered dial which mounts flush with the panel, lends an air of distinction to any set. Call in and see one; you will buy it.

C. EDE & CO., High Road, Blyleet, Surrey.
ALL Enquiries to London Electric Stores, Ltd., 9, St. Martin's St., Leicester Sq., W.C.2.



4-Valve Family Receiver
Including set of coils, 4 .06 B.5 B.T.H. valves, 90-volt H.T. battery, 4-volt 20 actual Oldham accumulator, ultra S22 loud speaker. 10/- with order and 13 monthly payments of 31/-. All royalties paid.

FREE Send for 56-page fully illustrated Radio Book giving particulars of many more excellent sets purchasable under this easy system.

10/-down buys any of these Sets

Complete with Loud Speaker, Valves, H.T. and Accumulator. You buy your House by deferred payments. You purchase your furniture out of income, and perhaps even your motor-car by the same up-to-date methods. Then why not choose a really good Wireless Set and pay for it as you use it. How much more satisfactory to buy out of income a really worth-while Set, capable of giving the very best possible results, in preference to something considerably cheaper and less satisfactory. Each of the instruments listed here is fully tested and guaranteed, and the prices include tuning coils, Marconi Royalties and handsome polished mahogany cabinet. Now read particulars, and see how easily any one may be yours.

The All Concert de Luxe

A splendid all-round Three-valve Receiver of remarkable power and sensitivity. Complete with set of coils, three .06 B.T.H. valves, 90-volt H.T. battery, 4-volt 20-amp. hour actual Oldham accumulator. Ultra S22 loud speaker. 10/- with order and 12 monthly payments of 30/-.

The Two-Valve Reflex

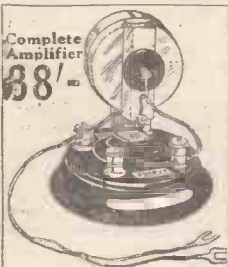
The best Two-valve Set on the market. Wonderful volume. Almost the equivalent of four valves with the maintenance cost of two. Complete with set of coils, two .06 B.T.H. valves, 90-volt H.T. battery, 4-volt 10-amp. hour actual Oldham accumulator, loud speaker. 10/- with order and 10 monthly payments of 20/-.

The Two-Valve Amplifier

Designed specially for use with any type of crystal set. Excellent loud speaker strength guaranteed. Either one or two valves can be used as required. Complete with two .06 B.T.H. valves, 90-volt H.T. battery, 4-volt 10-amp. hour actual Oldham accumulator and loud speaker. 10/- with order and 9 monthly payments of 20/-.

NEW TIMES SALES CO., 56, Ludgate Hill, E.C.4.

"PHUT"—There goes another Valve



Think of the cost and the trouble of constant valve renewals. You eliminate all this if you add a **MAGNETIC MICROPHONE BAR AMPLIFIER** to your Crystal set and you get **LOUD SPEAKER** results from crystal reception of average strength. Weak reception made loud and clear.

NO VALVES ACCUMULATORS H. T. BATTERIES

Equally efficient on Valve sets. Also supplied in separate parts. Fully illustrated particulars i/d. stamp. Don't hesitate, send now, and begin to really enjoy broadcasting. Order from your dealer, or direct from Sole Manufacturers and Patentees.

NEW WILSON ELECTRICAL MANUFACTURING CO., LTD.
18, Fitzroy St., Euston Road, London, W.1. 'Phone: Museum 2703.

Convincing Proof in Black & White!

Manchester, 17-1-26
"Your receiver fully tears out all you claim for it, and am able to receive most of the British and continental stations." H. B.

Princeton Mass., Princeton St., Holborn, W.C.
Dear Sir,
I have had your circuit on 3 valves now working for 3 weeks and am delighted with same. Located here in Holborn, I can cut 2 L.O. out dead, and receive other stations even on a short indoor aerial located in the basement. I have received Radio Paris. I think this speaks wonders for a circuit that is really selective and of easy operation with a minimum of interchangeable coils, providing the "Ormsby Reaction Unit" is used.
Yours truly,
(Signed) G. Gilbert.

The ORMSBY CONSTRUCTIONAL MODEL of the remarkable Ormsby Long Range Selective 4-Valve Receiver has met with an overwhelming success. This receiver has been much improved, and many glowing tributes we have received from delighted users prove that this Model of an already famous receiver has come to stay. There are no complex charts! You have a full-size model—an exact replica of the actual set showing all connections and components clearly. Nothing to do but copy the model. Success is assured, and building this extraordinary receiver is simplicity itself. Read the two unolicited testimonials, and send for this model TO-DAY!

CUT OUT LOCAL STATION

This receiver will cut out your local station and enable you to tune in most European ones on the Loud Speaker. Choose your programmes from the world's best.

The ORMSBY CONSTRUCTIONAL MODEL is sturdily made of stout cardboard. It is full size, simple to copy, and comes to you complete in box, with full instructions and charts.

Price **4/9** Post 3d.



Demonstrations every Wednesday Evening.

ORMSBY & CO., Ltd. (Model Dept.)
10 NEW OXFORD ST., LONDON, W.C.1.
'Phone: Holborn 4897.

PERFECT Grid-Leak SERVICE



Don't simply ask your Local Wireless Dealer for a Grid-Leak; ask for the "BRETWOOD," and both he and it will render you perfect service.

"Bretwood" Products carry a Three Years' Guarantee. Write for Complete List.

PRICE of GRID-LEAK or ANODE RESISTANCE 3/- (With Condenser as illustrated, 4/-) EACH Postage on either, 3d.

BRETWOOD LTD., 12-18, London Mews, Maple St., London, W.1

Parr's Ad.

"POPULAR WIRELESS" ADVERTISEMENT RATES

WHOLE PAGE £40:0:0 QUARTER PAGE £10:0:0
HALF PAGE £20:0:0 EIGHTH PAGE £5:0:0

Narrow Column Advs. (3 cols. to page) per inch 30/-
Minimum Space accepted half inch 15/-
Cover pages close for press 11 days prior to day of issue.
Inside pages close for press 9 days prior to day of issue.

COPY AND BLOCKS MUST BE IN HAND AT LEAST 3 DAYS EARLIER TO ENSURE PROOFS.

ALL communications respecting advertising must be made to the

SOLE ADVERTISEMENT AGENTS—

JOHN H. LILE LTD.

4, Ludgate Circus London, E.C.4.

'Phone No.: CITY 7261

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4, Ludgate Circus London, E.C.4.

'Phone No.: CITY 7261

RADIO TUTORIAL

All Editorial Communications to be addressed to The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

Stop that continued vibration of the filament!

USE the Clearer Tone Valve Holder and float your valves—secure from the ever-present, tone - destroying vibrations caused by street traffic, indoor footsteps and the hundred and one other microphonic disturbances. So thoroughly does this new holder cushion the valve that foreign noises are completely dissipated.

The springs, though delicately adjusted, are immensely strong and the tightest valve can be inserted without fear of damaging them. Each spring has one turn only. Bakelite construction of the body of the holder ensures high insulation, low capacity and sturdiness.

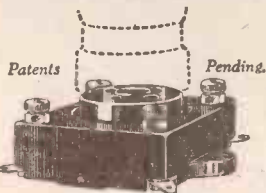
each **2/9**



There are terminal connections for the experimenter and soldering tags for the permanent set.

2/9
each.

The springs themselves form the valve pin sockets. No soldered joints—all one solid metal piece from tag to valve leg. No flexible wire connections. The spring supports are not affected by stiff bus-bar wiring. For good reception with Dull Emitter Valves, Benjamin Clearer Tone Anti-Microphonic Valve Holders are essential.



BRITISH **BENJAMIN** MADE
CLEARER TONE VALVE HOLDER
(ANTI-MICROPHONIC)

From your Dealer or Direct from
THE BENJAMIN ELECTRIC LTD.,
Brandwood Works, Tafford Road,
Tottenham, N.17.

The Benjamin Battery Switch gives perfect current control, 2/- each.

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

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."

Questions and Answers

DOUBLE VANICON CONDENSER.

A. E. T. (West Ealing).—I have tried to obtain a Double Vanicon Condenser of '0003 mfd., as stated in "P.W." of May 1st issue, for the construction of the six-valve set. I am informed that no '0003 mfd. condenser of this type is made, the nearest being the '00025 mfd. Will this do equally well?

Yes. The value of this condenser should have been stated as '00025 mfd.

ADDING L.F. TO CRYSTAL SET.

"AMPLIFIER" (Portslade, nr. Brighton, Sussex).—I have purchased a one-valve amplifier (low frequency) for use in conjunction with my crystal set. This latter gives very good results, but the addition of the amplifier does not increase signal strength to the extent that I had hoped. I have assumed that the "input" of the amplifier is merely connected to the 'phone terminals of the crystal set, and that the batteries are then joined up to their respective terminals. What is likely to be the trouble?

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 Sets, 1s. Three-Valve Sets, 1s. Three-Valve and Crystal Reflex, 1s. 6d. Four-Valve Sets, 1s. 6d. Multi-Valve Sets (straight circuits), 1s. 6d. Except SUPER-HETERODYNE 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 1s. 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.

The most likely cause of the inefficient amplification is the fact that apparently you have not earthed the amplifying unit. Try the effect of connecting a wire (externally) between the H.T. terminal on the amplifier and the earth terminal of the crystal set. This should effect a great improvement, but if amplification is still poor you are probably using a component or accessory that is faulty or unsuitable.

WIRELESS AND LIGHTNING.

R. A. F. (St. Helen's, Lancs).—I have only just taken up wireless and am rather nervous about the aerial, as I understand that it is dangerous during a thunderstorm. Is this a fact?

When it is properly installed a wireless aerial does not constitute a danger during thunderstorms. As a matter of fact, it is generally a safeguard, provided that some provision is made whereby the aerial can be directly connected to earth, outside the house.

H.F. AND REFLEX SET.

R. G. A. (Stamford Hill).—I have a very good three-valve reflex set, similar in principle to the one described by Captain Twelvetrees in POPULAR WIRELESS. As I wish to tune-in to the distant continental stations, I am thinking of adding one stage of high frequency to this receiver. Would it be likely to give a marked increase in the range of the set, as otherwise I would rather not go to the expense and trouble involved?

We certainly do not advise you to attempt to add further H.F. amplification to a three-valve reflex set, in which a crystal is employed as detector. A "straight" valve set employing the same number of valves would probably give results at least equal to the reflex set's, and it would be infinitely easier to handle.

(Continued on next page.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from previous page.)

OSCILLATION.

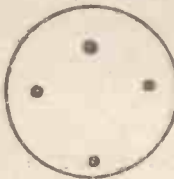
M. J. B. (Beccles, Suffolk).—What is the cause and cure of "oscillation"?

The following notes will probably be of assistance to many readers who are not very certain upon this important point.

Oscillation is caused by the mishandling, through ignorance or carelessness, of a valve receiver. A crystal set cannot cause howling in other people's receivers. With proper circuits, a good aerial, and intelligent handling, a single valve set should prove quite effective for headphone work up to 30 miles

For the Constructor

No. 1. VALVE TEMPLATES.



At the top is shown an ordinary 3-electrode (4-pin) valve. The exact drilling positions can be determined by cutting out the paper template, and carefully pasting it to the panel in the required position. A better plan, which does not entail cutting the page, is to pin a piece of paper underneath the template, and then prick through the centres of the dots with a pin.



The lower template shows a Unidyne valve (4-electrode, 5-pin) of the U.C.5 or K.4 type.

from a main station, five miles from a relay station, and from 100 to 150 miles from Daventry.

If good results are not being obtained at these distances, the aerial is inadequate or the circuit wrong. In the former case and where it is impossible to erect a more efficient aerial, the listener should try the effect of two valves. If the fault lies in the circuit, he should consult an expert. (Manufactured sets should never fail through the latter cause.)

Most valve sets have a tuning adjustment and a reaction adjustment. If a single-valve set is "tuned in" to a station (that is to say, adjusted so as to give the loudest signal), a howl of constant or variable note may be heard in the telephones. This howl may be caused by another person oscillating, or by the operator himself.

A simple test—i.e. moving the tuning adjustment of the receiver, will show whether the operator is at fault or if the howl comes from outside. If the note varies in pitch sympathetically with the alteration of the receiver's tuning adjustment, then the receiver is at fault and oscillation will cease if the reaction adjustment be moved in either direction until no howl can be heard which varies in pitch with the alteration of the controls on the receiver.

Some people tune in a broadcasting station by making the receiver howl at a high-pitched note and then, by altering the tuning adjustment, gradually reduce this note until it is so low as to be almost or quite inaudible and remain under the impression that they are not oscillating. As a matter of fact, oscillation is probably still occurring, though at such a low frequency that no howl can be heard. This will, however, still cause distortion in neighbouring receivers.

The test for this form of oscillation is to touch, or approach the hand to, the aerial terminal, when a howl will immediately become audible.

2-, 3- & 4-VALVE SETS AT SPECIAL CLEARANCE PRICES

Absolutely new and guaranteed. All are in dark mahogany cabinets with hinged lids.

PRICES 2-Valve Receiver £5-7-6
(Plus Marconi Royalties.) 3-Valve Receiver £8-2-6
4-Valve Receiver £10-15-0

RADIAX LTD., 10, ACCESSORY HOUSE,
Palmer's Place, Holloway, N.7



—the finest coil you ever saw

Three Eureka features

Low Loss

Hold a Eureka Coil up to the light. See the air spacings and you'll appreciate the reasons for its astounding efficiency. Silk covered copper wire—the highest grade obtainable—unvarnished, wound on a solid ebonite former. Connections are brought through the centre of the coil mount and soldered to the sockets. Electrical losses have been reduced to a minimum. Tests have proved the Eureka to give infinitely sharper tuning and to be, therefore, much more selective.

Mechanical Strength

Most coils are flimsy and readily go out of shape through handling. The Eureka on the other hand is wound on a stout ebonite former and protected by an additional ebonite band. It is reinforced internally by an ebonite rib situated immediately above the plug. This rib takes all the strain when the coil is withdrawn from its socket. A Eureka coil should last for years—it is proof against mishandling.

And Handsome Appearance

A coil is one of the most conspicuous parts of your Set. A cheap-looking coil will make even the best Set look shoddy. You can be proud of your Set when you use Eureka Coils—their smart business-like appearance will reflect the wisdom of your choice and emphasize your good judgment.

Best of all is its reasonable price

You would expect to pay very much more for such a beautifully made coil as the Eureka. Ask your dealer to show you one. You will be amazed at its low price.

E20	40-150 metres	4/3
E25	55-250 metres	4/3
E35	80-375 metres	4/3
E50	120-560 metres	4/6
E75	185-760 metres	4/10
E100	285-1000 metres	6/3
E150	360-1500 metres	7/-
E200	470-1375 metres	8/-
E250	530-2725 metres	8/6

All the above wave-lengths are obtained with a 7000 mfd. variable condenser in parallel.

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Low Loss Plug-in Coils

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That our Summer Catalogue contains the finest Radio Bargains ever offered. 600 Illustrations of a wonderful selection of unique apparatus.

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Phones re-wound and remagnetised, 4/6 per pair. Remagnetised only. 2/- Loud Speakers and Transformers re-wound. Glass Jars for making up wet H.T. units, waxed, 1/3 doz., plain, 1/-. Post extra. The H.R.P. Co., 46, St. Mary's Road, Leyton, E.10.

H.T. Accumulators —

60 Volts **37/6**
3 Actual Amp-hour



SOLD ON APPROVAL SYSTEM
Obtainable only from:
ACCUMULATORS ELITE,
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or from Messrs. **Cecil Pohlman, Ltd.,**
77, Great Portland Street, London, W.1.
Trade Supplied Telephone 1504

Striking Advance in H.T. Supply.

Accumulator and charger in one unit, charging from A.C. or D.C. light supply or from 6-volt L.T. battery.
Price of set 1/- per volt. Battery only sevenpence. Patents applied for.
Particulars post free from **A. E. BAWTREE,** 20, Manor Park Road, Sutton, Surrey.

AT LAST! 60-volt H.T. batteries **21/-** that you charge yourself, no electricity needed, just acid. Battery practically everlasting. Lists Free. **GET ONE NOW,** guaranteed—Tennants Wireless (Dept. P), Hylton Road, SUNDERLAND.

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WIRELESS VALVES
THE ECONOMICAL COMBINATION
2v. '06 H.F. & L.F. each 9/-
2v. '34 P.V. 11/-
Obtainable from 'Lewis's' Ltd.,
Liverpool and Manchester and
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CHEAP GOVERNMENT WIRE !!
Saves for gardens, fencing, greenhouse, training peas, fruit. Waterproofed, flexible, lasting! Small lots quoted, or 19/6 mile. Samples free with list. 300 bargains. Postcard to-day.
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VALVES Repaired Quick

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RADION Reliable Repairs
RADIONS Ltd., Bollington, Nr. MACCLESFIELD, Ches.
Largest valve-repairing firm in the world. List Free.

MAP

SMALL PARTS TO THE TRADE.
MAP Co., 246, Gt. Lister St., Birmingham.

CORRESPONDENCE. (Continued from p. 486)

taken with mounting of components, as with inferior insulation the "stray" resistances may be less than the grid leak resistances.
Coupling Condensers. I have used values of .0005 mid. to 0.025 mid., and provided the leak is of high value, say 5 megohms, the condenser can be reduced to 0.01 or .005 mid. without any detectable difference in reproduction of the lower frequencies. It is quite easy to prove this by calculation, the main point being that the reactance of the coupling condenser must be small compared to the grid leak resistance at the lower audio-frequencies. The cost of coupling condensers—hitherto recommended from .05 to .25 mid. (mica insulated) is prohibitive, and this expense is unwarranted. For those who prefer to use the usual 100,000 ohm resistances with, say, 1/2 meg. grid leaks. It can be said that paper insulated condensers of established makes are perfectly satisfactory as these condensers are tested at 200 to 300 volts in the course of manufacture, and these voltages are not required in operation.

H.T. Voltages. The H.T. voltage required in any receiving set is not determined by the intermediate valves, but is fixed by the requirements of the last stage loud-speaker valve. Any set which has pretensions to be judged as giving satisfactory quality and volume should use a valve in the last stage capable of a grid volts swing of at least 90 volts without taking grid current, and with present day valves at least 120 volts H.T. is necessary to fulfil this condition. There is not the slightest necessity to exceed this voltage for the intermediate valves in a R.C. amplifier. The mistake most people make is to imagine that loud-speaker reproduction can be pure if the last valve is fed with a 60v. H.T. dry battery in an exhausted condition. Whether the I.F. amplifier is transformer or R.C. coupled, the last stage valve needs at least 120 v. H.T., and the valve should be of a type to handle a grid volts swing of 90 volts without distortion. . . . Prejudice against R.C. coupling will not be overcome easily; it is astonishing how difficult it is to convince even technical wireless engineers that high H.T. voltages are unnecessary. Mr. Turner's work will doubtless do a great deal to change the present attitude.
Yours faithfully,
W. SYMES.

"Irlismere," Flixton, nr. Manchester.

BROADCASTING AND THE STRIKE.

(Continued from page 474.)

What more could any neutral party do? It was no small feat to hold the balance fair, and check the spread of rumour. No hint of personal bias was put upon the air. It was all "We are informed by Reuters," or "We are instructed to announce," said without a trace of party feeling. Through it all, the speaker sounded as impersonal as the loud speaker.

I should have liked to have been able to tell you instead of magnificent moments—of fearful breakdowns, averted only by a miracle! Of thrilling brain-waves that saved the situation in a second! Of how, for instance, the liftman, firm as a rock, gained imperishable glory by repelling single-handed six armed assailants! But it wouldn't be true! Broadcasting during the strike wasn't a bit like that. The thrills were missing, the romance was absent, the excitement and glamour didn't exist.

Instead, there was just an awful lot of extra work to do, under difficult conditions. There was just a chance of putting shoulders to the wheel. Just an opportunity for public service. And the B.B.C. took it.

In a letter to the editor of "The Times," one correspondent expresses a hope which most listeners must have felt, if not uttered. He wrote:

"It is to be hoped that no time will be lost before someone whose voice counts expresses publicly the gratitude we all owe to the Directorate and Staff of the B.B.C., for their unwearied and incomparable service to the public during the period of the strike."
They deserve it, for what should we have done without the wireless bulletins?

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Inventions Advice Handbook & Consultations FREE.—B. T. KING, C.I.M.E., Regd. Patent Agent (G.B., U.S. & Canada), 146a, Queen Victoria Street, London, E.C.4.
40 years' references. Phone: Cent. 682.

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Headphones, Loud Speakers and Transformers re-wound and reconditioned
EQUAL TO NEW
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A customer writes: "—thanks to the excellent manner in which it was reconditioned, the results achieved have been astounding."
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2-VALVE AMPLIFIER, 30/-
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SPECIAL OFFER—500 PAIRS OF REVO 4000 OHMS. List Price 19/6. Maker's Guarantee. OUR PRICE, 13/6 each, Post Paid. Cash with order.
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HEADPHONES REPAIRED
Re-wound & re-magnetised 5/- per pair. Loud Speakers repaired 5/-, Transformers re-wound 5/- each. All work guaranteed and tested before delivery.
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6d., or 2 samples in box for 5d.. Obtainable from first-class dealers or direct, post free.

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H. W. HOLMES, 29, Foley Street, Great Portland Street, W.1. Phone: Museum 1414.

EASY PAYMENTS Finest 2-valve amplifier set, including loud speaker, 120 H.T., D.E. valves, £7 10s.; or 18/9 down and 11 instalments of 15/-.

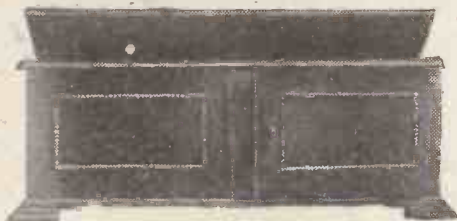
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L/speaker, hornless, £5 line for 55/-; Good Crystal Sets, 8/3 and 9/3; Amplifiers, 17/6 and 21/-; Phones, Teletunken type, 7/9; Dr. Nesper, 10/6; Fr. T. Houston, 11/6; H.S. Baldwin, 17/9; Philips Valves, bright, 3/2; D.E. 7/8; Radio Micro special, 5/8; or Power, 10/6; Good H.T. 60-v., 5/9, or 4/- (laboratory test) 4/- doz. Nice metal case, 3/6.
Accumulators with 12 months guarantee, 2/- 40; Ignition, 8/3; 4-v. 40, 15/-; 6-v. 60, 29/-; Polished Cabinets, Ebonite, Variometers, Transformers, Condensers, Coil Holders, and everything in Wireless reliable and cheap. Satisfaction or cash returned.

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•06 DE'S 10/6
Our Valves are admitted to be the best British made valves on the market. 3 Volt 06 L.F. or H.F. only 10/6 2 Volt 34 only 10/6 Power Valves from 1/2 Write at once for our FREE BOOK and get full particulars if your dealer is "tied" we supply direct. **RADIONS LTD.** Radion Works, 80, LILLY GTON, Macclesfield, England.

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Made for Sets "All Concert Receiver,"
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 "Any Valve Low Frequency Amplifier."
 Special Cabinets made to customer's measurements.
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Cash with Order. Fumed Oak ... £1 5 0
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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.

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Plug in a LEWCOS Coil — and listen!

Each LEWCOS Coil is tested in our laboratory. It is then boxed, sealed up and reaches you in perfect condition. Be sure the LEW seal is unbroken.



THAT'S the test. It makes *all* the difference when you tune in with a LEWCOS Coil. Listeners everywhere have been quick to realise the quality and advantages of this guaranteed coil. Ask your dealer for a demonstration.

No.	25	35	40	50	300	75	100	150	200	250	300
Price	4/6	4/6	4/6	5/-	5/6	5/6	6/9	7/6	8/6	9/-	10/-

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1. High electrical efficiency with great mechanical strength.
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Some of those components may be square pegs in round holes, not quite "in tune" with the rest of the circuit—transformers especially.

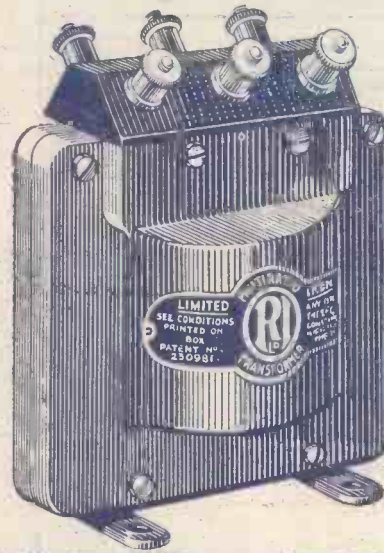
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Many conflicting statements have been made as to whether the impedance of a transformer should match that of the valve, but it is a fact that, whatever valve you may be using, one of the impedances available in the R.I. Multi-Ratio Transformer will be absolutely suitable.

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