

THE NEW LOFTIN-WHITE CIRCUIT. (See Page 249.)

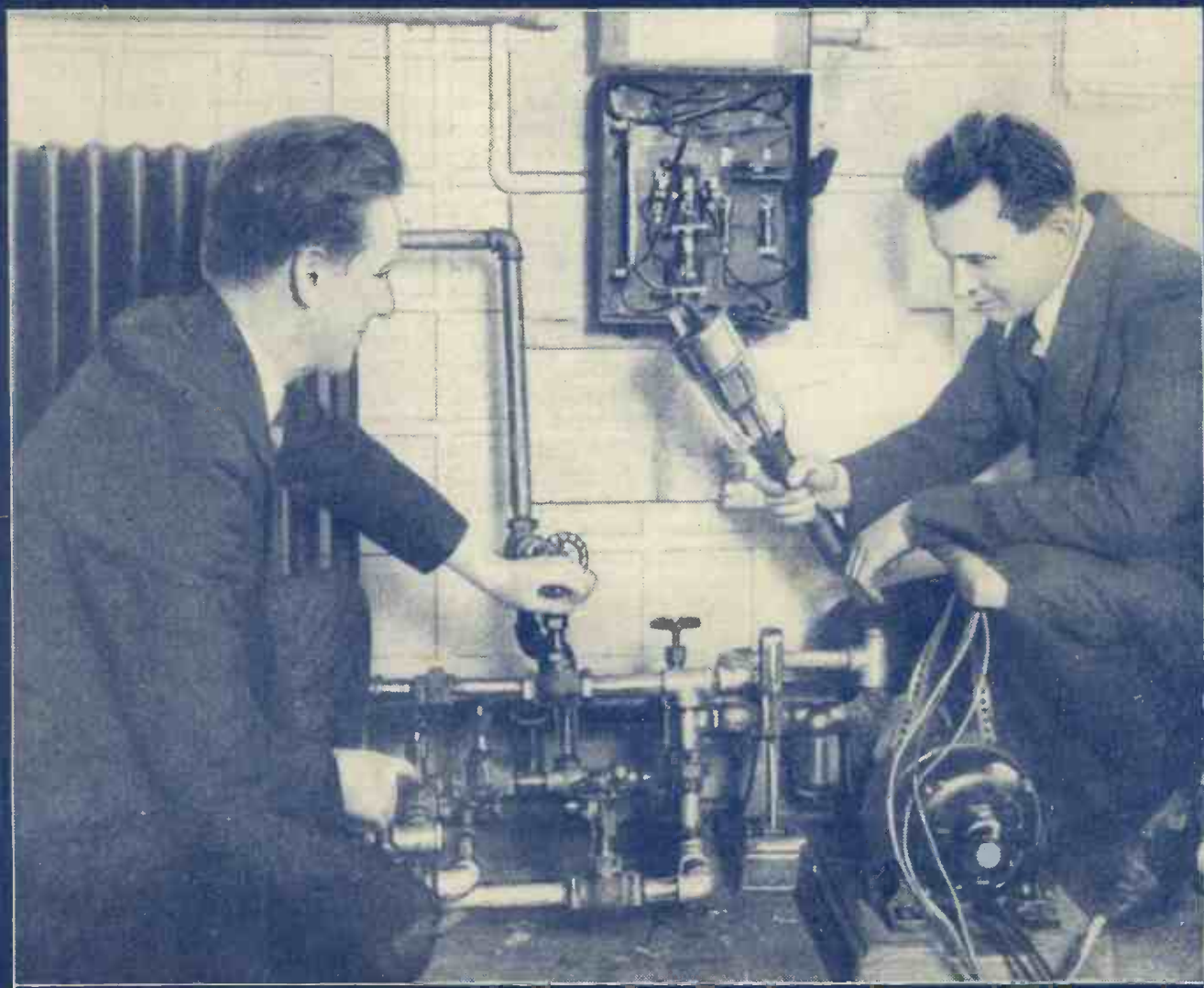
# Popular Wireless

Every Thursday  
PRICE  
3d.

No. 253. Vol. XI.

INCORPORATING "WIRELESS"

April 9th, 1927.



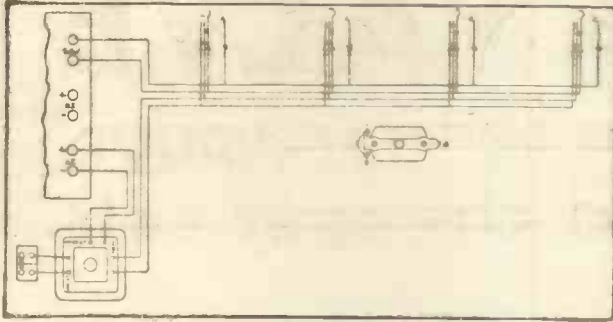
### SPECIAL FEATURES IN THIS ISSUE

**TELEPATHY AND RADIO.** By Sir Oliver Lodge, F.R.S.  
**HINTS AND HOOKUPS. MINUTE DEFECTS OF CONTACT.**  
**HOW TO BUILD THE "R.7" CRYSTAL SET.**  
**LANGENBERG**—An exclusive and well-illustrated article on "Germany's 5 X X."

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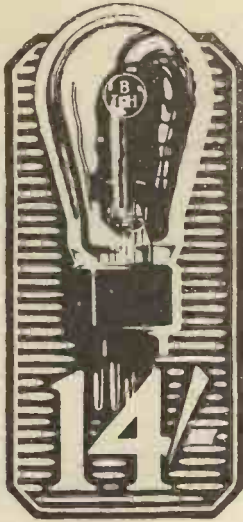
that can be so fitted in different rooms. All the rooms can listen in simultaneously and it is not possible for one room to interfere with another. The last plug to be withdrawn breaks the Filament Circuit and cuts off the Set. The Receiving Set is actually controlled from any point where a Wall Jack is wired up and by inserting or withdrawing the Plug. This Remote Control makes it entirely unnecessary to go to the Set to switch it on or off.

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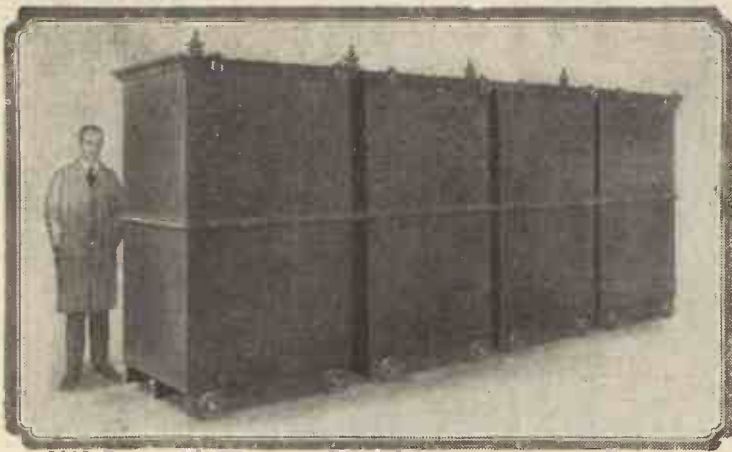
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Editor: NORMAN EDWARDS, M.Inst.R.E., M.R.S.L., F.R.G.S.

## RADIO NOTES AND NEWS.

### Easter Greetings—Why this Modesty?—The Experiments will Extend—Russia to Go "All Out"—Who Pays?—Twelve Stations for Ivan—When is an Aerial Not?

#### Easter Greetings.

**E**XTRA warm ones from all of us to all of you, in case it should snow. By this time next week we shall be in the middle of the Easter holidays. Already the office boy is showing signs of fancy vests, and the technical staff are competing for the loan of our tin-lizzie two-seater—"to try out a new circuit." I think not. Well, let us hope the weather will not be Easter-ly.

#### Why this Modesty?

**T**HE Post Office has informed the German Minister of Posts that the London-New York wireless telephony service is still in an experimental stage. Dear me! And are the fees experimental, too? One hopes so. Anyhow, this candour is refreshing, but it's unusual to charge the public £5 a minute for the privilege of helping Post Office research.

#### The Experiments will Extend.

**I**N this connection, it is interesting to learn, as I have, that when the long-distance telephone line from Mexico City (where they live on aguardiente and plots) to the American border is completed,

in September, it is hoped, the telephone service from England will be extended to Mexico. Till they steal the wire, of course.

#### Russia to Go "All Out."

**S**OME time ago Europe was gladdened or saddened—some of each—by the news that Russia was to build a 1,000 kw. broadcasting station so that every workman and/or peasant in that happy land could receive on a crystal set. Wages there do not run to valves. It was all too obvious that the waves bearing the light and joyous programmes, such as the one I published last week, could not be confined to the borders of Russia, and therefore a good deal of propaganda could be put over.

#### Who Pays?

**N**OW we are gladdened or saddened—according to how we think—at the news that the scheme has been dropped for the present, as unpracticable. Instead, an ambitious programme of regional broadcasting is planned, still with a view to leaving no one Russian out of reach of all the glad tidings to be poured forth by his rulers. Whether receiving sets will be obligatory I do not know. But can there be any doubt as to who will pay for the stations detailed below?

#### Twelve Stations for Ivan.

**T**HE erection programme is said to be as follows: Moscow, Leningrad, Khar-koff, Tiflis, Saratoff and Ekaterinburg (now Sverdlovsk), 25 kw.; Minsk, Kieff, Odessa, Kazan, Rostoff-on-Don and Taschkent (Turkestan), 10 kw. Siberia is a nut to crack later; all *versis* and no people. Yes, Ivan has got to pay, as well as sing "vulgar" boat songs, I fear.

#### When is an Aerial Not?

**I** SHALL expect to hear news from valve Barts of W R N Y (New York City).  
 (Continued on next page.)



How the arrangements were made to broadcast the Boat Race. (In circle) The microphone; (left) the radio-equipped launch, and (right) the special short-wave transmitter.

## NOTES AND NEWS.

*(Continued from previous page.)*

as it is going to broadcast below 50 metres in addition to its usual work on 375 metres. Moreover, it is to use a buried "aerial," which will be six feet underground and run in terra-cotta pipes.

## The Burial.

**WHAT** a "come-down!" This will be the first station in America, it is claimed, to broadcast from a buried aerial. So far as I know, it can have the world rights, too. But it will be a most interesting experiment, both for the transmitting engineers and the public. I suggest the wire should be called a "burial," not an aerial.

## Now a Resurrection.

**BY** way of contrast, I am glad to report that the Huddersfield Radio Society, which was dead, is alive again. Yorkshire tykes never really die, they only fade away—retaining one eye open to see the clouds roll by.

## Our New War.

**SO** there is to be a war on the B.B.C. monopoly of broadcasting, and the cudgels have been taken up by the music-hall managers mainly because some amateur statistician says that the "halls" lost £10,000 on the night the performance at the Victoria Palace was broadcast. I will go so far as to prophesy that the B.B.C. will win without firing a shot, and to assert my belief that as a result of the afore-mentioned broadcast the "halls" have won many new patrons—just as the theatres did when excerpts of their shows were broadcast.

## Never Say Die.

**OR** even say "marry." Here is Miss Texanna Loomis—what a name for an advertisement—running a wireless school in Washington. She has been artist, musician, singer and Red Cross nurse, and now teaches young America watts watt. Some day she will probably radiate something which will be received and answered in the oldest code of the world.—(Look here! Stick to wireless.—Ed. "P.W.")

## Wireless Hypnotism.

**ALL** right! I will. So just to prove that what I was hinting at is possible, I will report that Lorenzo McCoy was hypnotised by radio. No. He was already married. The broadcaster at a Boston station told him by radio to lock his hands together and that he would be unable to separate them until so ordered. Lorenzo kindly complied, and found his auto-handshake to be well and truly permanent. All the king's horses, etc. The McCoy family exerted its combined strength to no avail, and papa continued to shake himself heartily by the hand till Boston let him loose by the word of command.

## Australian Progress.

**THE** number of licences issued is 187,228, or one to every 33 persons. In Sydney the ratio of licences to persons is one to 23, or about the same as in the United Kingdom.

## 2 LO's Young Brother.

**3 LO** (Melbourne) has sent me a budget of interesting news, *not* including any report of a pick-up of its signals by anyone over here. Just now they are having a round-up of all available jam for the Foundling Hospital. Pots are arriving with such speed and generosity that all ex-soldiers roundabout are being reminded of the Great (plum-and-apple) War. No mention of the Charleston or Frothblowers, but they are running a shorthand speed competition and building a new studio. Cheerio, diggers!

## The Australian Beam.

**THE** opportunity of telephoning by wireless to Australia is well within sight, as the preliminary work in connection with adapting the Beam to telephony is far advanced. I don't know what the fees are likely to be, but surely they should be less than those for America. It has already been done by Marconi from Poldhu, and I am assured that the effect on the imagination is uncanny. So I should think.

## Broadcasting in India.

**MR. ERIC DUNSTAN**, whose departure for India, where he is to manage the Indian Broadcasting Co. at Calcutta, was recently announced, has already got into his stride. Lecturing before the Rotary Club there, he congratulated the local amateurs on maintaining a broadcasting service so long in the face of great difficulties. The language question, which has puzzled so many people, in view of the vast number of dialects current, appears to present little difficulty, English and Hindustani being considered sufficient for broadcasting purposes.

## SHORT WAVES.

During the taking of a film, a bear attacked a well-known wireless artist. This only just shows how careful you have to be to keep a profession like this dark, even with animals.—"Sunday Pictorial."

We read that there are 10,700 more radio fans this year. It certainly looks as though we shall have a fairly cool summer.

Listeners Inn: The public-house with a loud-speaker.—"Star."

"Woman's Realm in Radio Talks. Even Spring Cleaning in 1927 Series!" runs headlines in the "Daily Chronicle." We have heard it said that this is generally a most uneven event.

From a broadcasting programme: 8.55. All Stations except Aberdeen. The Week's Good Cause.—(Sunday Paper).

What has the granite city done to serve these constant insinuations against its generosity?—"Punch."

An extract from a listener's letter to a daily newspaper: "We are not the cause of the interference because we have a private earth." Evidently a monopolistic landowner on a very large scale.—"Tit-Bits."

A reader writes to ask us which is the most advisable for good all-round use, dry or wet cells. Mr. Smith, ex-convict, writes in answer to this query that he prefers a dry one, every time.

Need Talking To.—A critic says that wireless is unsociable. Indeed, there's none so deaf as he who listens in.—"Sunday Pictorial."

Snaarl: "What will you give me for my radio and loud speaker?"

Coil (who lives downstairs): "Twenty-five dollars more than it cost you, sawed, split, and delivered."—"Science and Invention."

## Langenberg Station.

**A**MONGST recent newcomers in the ether, Langenberg has given rise to the most interest amongst long-distance listeners, and reports about its carrying powers vary greatly. The most reasonable suggestion in explanation of the apparent variations of its radiated energy seems to be that these are due to variations of the aerial input, and that the plant is the subject of study by the engineers.

## The Rhineland Relay.

**L**ANGENBERG is the first station to be erected in the Ruhr. It lies between Essen and Elberfeld and considerable difficulty was met in finding a site, in which task aeroplanes were used. It is only a relay station, having no studio but relaying Elberfeld chiefly, though listeners may sometimes catch it passing on the programmes of Cologne and Dusseldorf. Wavelength, 468.8 metres.

## More Amateur Transmitters.

**MR. A. C. NARRAWAY**, The School House, Darrington, near Shrewsbury, begs to announce that he transmits on 45 metres to 90-100 metres; call sign 2 A P W.

Mr. H. T. G. Freitas, R31 de Janeiro, 141, Funchal, Madeira, transmits on 45 metres with 10 watts; call sign P 3 G F. He uses a Hartley circuit. Here's a chance for a modest flip by a beginner.

## "Super-het." Results.

**I**HAVE just heard of a man who made a "superhet" from Geophone components, and with it can receive all B.B.C. main stations and many of the relay stations, besides forty Continentals, all a loud-speaker strength. He gets K D K A (63 metres) on the loud speaker, using a frame aerial of two turns two feet square, with only one L.F. stage.

## More Results.

**E. H.** (Edinburgh), who I mentioned on February 17th as a runner-up for valve honours, now tells me he has got K F K X (Hastings, Nebraska). Ed, I reckon you qualify, not only for that but because of the bouquet you flung at "P.W."

## Why Use Aerials?

**WHAT** attracts me in E. H.'s work is the results he gets on three valves with the merest hint of an aerial. For example, on an aerial 8 feet high in the same room as the set, he can get at night practically all the Continental stations at extra-loud-speaker strength, and on an aerial 3 feet high he has received several "Yank" stations—reception confirmed. Why don't you bury your aerial? Why do you bother with one?

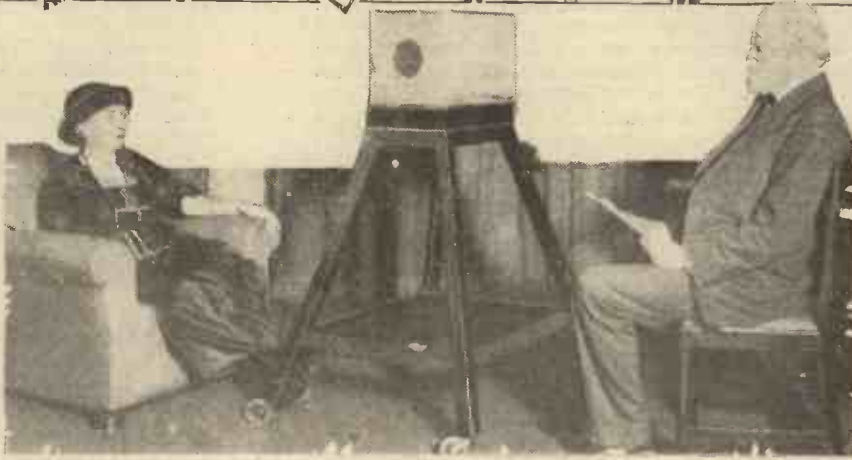
## A Correction.

**THE** photograph of "Some home-constructed receivers and components shown at a recent wireless exhibition, organised by a London Radio Society"—which appeared in "P.W." 246 (page 1492)—was not correctly described as above. Actually, this picture was taken at a radio show organised by the Tottenham and District Branch of the Wireless League.



# Telepathy and Radio

"... If that is true, then there is a close analogy between the telepathic process and radio telegraphy."



A special and exclusive article by  
**SIR OLIVER LODGE, F.R.S.**  
 ("P.W.'s" Scientific Adviser.)

THE recent telepathic experiment conducted by the Society for Psychical Research, with the permission of the B.B.C., and the aid of their splendid organisation, has excited some interest. The results have not yet been fully worked out or reported upon; nor is it expected that there will be much positive result of the obvious kind, though there may be side-issues of interest and perhaps importance. Meanwhile, it may be serviceable to take advantage of the interest aroused for making a few remarks on telepathy in general, and on the question whether it has any close analogy with radio transmission and reception.

The fact is that thought transmission, as ordinarily conducted by speech or writing, is a much more complicated business than is radio telegraphy. With wireless apparatus we know what we are doing. We are exciting electric oscillations, which emit continuous waves, and we are then modulating or modifying those waves so that they shall carry with them, at the speed of light, the tones of music or of human speech, not in the form of sound, but in the form of variously formed ether waves. We then at some distant place receive those waves, rectify them so that we shall get intermittent disturbances all of one sign, magnify them as much as necessary, convert them into electric currents which can affect a telephone, and trust to the human ear for the rest. Then begins a complication.

### Ordinary Thought Transmission.

The human ear is receptive mechanism for sound waves, and by remarkably ingenious processes stimulates the terminals of the auditory nerve. So far the process can be followed with fair completeness, though there are still outstanding puzzles about it; and we may well marvel at the discriminating power of what is called "a musical ear." The nerve takes up the tale, and carries it to the brain. The brain somehow transmits it to the mind, but in all that part we are completely in the region of mystery, to which we have only grown accustomed by long habit.

Ordinary thought transmission is effected by another mysterious operation at the sending end. A thought or idea in some unknown way actuates the brain: that somehow stimulates the nerves, and sets the muscles working. The result is voice

production, or it may be the movement of a hand holding a pen. All the rest is purely physical, until the result of the sending operation reaches either the ear or the eye in the form of either sound waves or light waves; when, again, the nerves are stimulated, and a remarkable physiological activity, ending in psychological activity, occurs.

### Direct Telepathy.

Now the question has arisen whether thought transmission is ever possible by some less roundabout and indirect process, whether mind can ever act on mind without all this intermediate mechanism. The question can only be answered by experiment, and we must be guided by

the telepathic process and radio telegraphy.

But is it true? Does a thought excite vibrations? Have vibrations anything to do with it? We simply do not know. We do not know enough about minds to dogmatise on the subject. It may be that they are inter-connected in some way, apart from their action on the brain; though under the ordinary conditions of life such direct thought transmission does not usually occur. Bergson thinks that the brain is an inhibiting organ, tending to prevent this direct communication; and causing us to be dependent on the physical methods of transmission to which we are accustomed; so that each individual is isolated, and independent, and screened from others, except in so far as he may wish to communicate with them. If the telepathic method is a reality, it seems to be spontaneous and involuntary. When an accident or an illness happens to one person, there is evidence that relatives, even at a distance, may in some cases become aware of the fact by what we call telepathy; but the agent or transmitter knows nothing about it, nor is he aware of having produced any effect; that is what I mean by its being spontaneous and involuntary.

There are cases, however, in which a simple idea has been transmitted to a person awaiting it, the transmission being purposive; and that is the sort of experiment that on a large scale has recently been tried. The evidence of the occasional success of this experimental or purposive process has hitherto been limited to people *en rapport* with each other, being either well known to each other, or in the same room, or something of that kind; and even that has not been accepted as a fact by the majority of scientific men. That there is anything like broadcast telepathy, so that strangers can be reached at a distance, is quite unlikely. It cannot be common, or business could hardly go on. Nevertheless, it was thought worth while to try.

### Is It Radio?

And even if it succeeded what would it prove? Well, it would open up a whole series of questions that would still need investigation. And we might not be any nearer answering the question that obtrudes itself from time to time, whether telepathy is a physical process at all, and whether it has any real analogy with radio telegraphy. That question remains, and probably will remain for some time, unanswered. Meanwhile enquiry must proceed.

## Another Interesting Article

BY

SIR OLIVER LODGE, F.R.S.,

WILL APPEAR IN  
 NEXT WEEK'S

"POPULAR WIRELESS."

the facts. It has been found that certain people have this faculty, the faculty of receiving a thought from another person without its being uttered or written, and without any ordinary sense indication. How that can be done we have no idea; but then we have not really any idea as to how it is done by ordinary methods. The main mystery lies in the connection between mind and brain. Human beings, like everything else, are connected with each other through the ether; and it has been guessed that perhaps a thought excites vibrations in the ether to which a distant brain can respond. If that is true, then there is a close analogy between

# BROADCAST NOTES.

FROM OUR BROADCASTING CORRESPONDENTS.

The Monopoly Challenge—Tennis Broadcasts—Summer Term Talks—De Vere Stacpoole—Henley Regatta, Too!—Surrey v. Hampshire—Return of Donald Calthrop—Morning Concert at Bournemouth—Prince Arthur of Connaught—Covent Garden Again—Wireless Band on View—A Great Cyclist to Talk—A Recent Success.

## The Monopoly Challenge.

THE various prospective challenges to the B.B.C. monopoly exclusively announced in POPULAR WIRELESS created a great stir in wireless, political, and newspaper circles. The Post Office are understood to have begun an exhaustive examination of the various proposals with a view to their suppression should they materialise.

The two great organisations of newspapers have been trying to find out what group from among their members was proposing to break away in order to provide the new broadcasting authority with racing information and other news at all times of the day and night. Members of Parliament, too, have been exercised over the possibilities. Most of the Liberals and a considerable section of Conservatives frankly welcome the idea and are hopeful of its maturity.

Labour, of course, is opposed for the reason that the only change it would make in the present broadcasting arrangements is to consolidate their State character in all directions. Thus, for instance, Labour would see to it that all B.B.C. publishing and printing were handled by the Stationery Office. Thus, on the whole, quite an interesting situation has developed out of the disclosures in POPULAR WIRELESS.

It is understood, however, that the earlier accounts of the experiments at Birchington with electric light wires were optimistic. Anyway, those representatives of the Press that were "told off" to interview Mr. Chisholm, the Managing Director of Secret Wireless, Ltd., have discovered that the secrecy of the activities of his company have been admirably applied to his own movements. He is determined not to talk for publication until he is quite ready.

## Tennis Broadcasts.

It is probable that the B.B.C. will give running narratives of some of the chief events in the Lawn Tennis Championships at Wimbledon this summer. The B.B.C. is now in touch with the All-England Lawn Tennis and Croquet Club with this end in view. The main difficulty appears to be that the whole of the available seating accommodation round the Centre Court is already disposed of. In the first place, the tennis authorities asked £1,000 for the broadcast; this the B.B.C. turned down. More reasonable terms were subsequently discussed.

## Summer Term Talks.

On April 20th there will be an S.B. Talk on Talks. This will deal with the syllabus for the months of May, June, and July. Names included in the new syllabus are Professor D'Arcy Thompson, Professor H. H. Turner, Professor Winnifred Cullis, Dr. Christon Millar, Professor George Gordon, Professor Lascelles Abercrombie, Mr. S. P. Ross, and Professor Barcroft.

There is understood to be some reduction in the talk time for these three months, but most listeners will be of opinion that the reduction is inadequate. Indeed, the B.B.C. will have some difficulty in avoiding a Press attack considerably more serious and general than any that have so far taken place. Fleet Street has not forgotten that by May the influence of the new Governors will have had a fair chance to make itself felt. And if in May there should not be much lighter programmes, then the storm will burst on all fronts.

## De Vere Stacpoole.

A talk of the kind listeners would not exclude is that to be given by Mr. H. de



The Covent Garden Octet, which will shortly be heard over the ether.

Vere Stacpoole when, on April 16th, he reads some of his own adventure stories of the South Seas, S.B. from London.

## Henley Regatta, Too!

Some of the most interesting events of the Henley Regatta in July will be broadcast generally.

## Surrey v. Hampshire.

There is to be a running narrative of Surrey v. Hampshire from Kennington Oval on Saturday, May 7th. The B.B.C. had better be careful about narratives of cricket matches. A little of this will go a long way with most listeners.

## Return of Donald Calthrop.

Donald Calthrop returns to the microphone on April 13th in the cast of "Yours to Hand," a humorous sketch of which

expectations are high. Since last heard by British listeners, Donald Calthrop has been round the world.

## Morning Concert at Bournemouth.

Bournemouth will give a special morning concert for the benefit of holiday-makers on Easter Monday. This is a practice which listeners elsewhere would like to see adopted. The music chosen by Bournemouth for the occasion will be uniformly light and attractive. Incidentally, the new octet at Bournemouth is winning golden opinions from local listeners.

## Prince Arthur of Connaught.

The speech of Prince Arthur of Connaught will be broadcast from the Royal Albert Hall on the occasion of his giving the inaugural address at the Boys' Brigade Rally on May 4th.

## Covent Garden Again.

Listeners will be delighted to learn that part of "Der Rosenkavalier," the opening event of the Covent Garden season, will be played between 8 and 9 p.m. on Monday, May 2nd.

## Wireless Band on View.

The augmented London wireless military band will be broadcast from the Embank-

ment Gardens on Saturday, May 7th. This should form an excellent precedent for other similar arrangements during the summer.

## A Great Cyclist to Talk.

Mr. W. J. Bailey, the great amateur cyclist, who has landed no less than four world championships as well as the Grand Prix de Paris, will broadcast S.B. from London on the pleasures of the racing track, on April 16th. On the previous day he will have competed at Heme Hill with the champions of Germany and of Holland.

## A Recent Success.

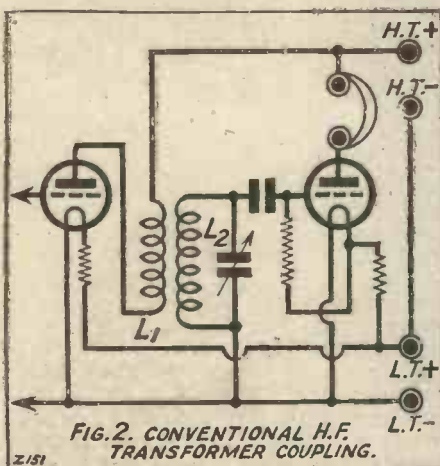
The "production" of Kismet by the B.B.C. last week was a great success, and, judging by the reports coming in, seems to have met with general approval.



## THE NEW LOFTIN-WHITE CIRCUIT.

(Continued from previous page.)

It is worth a few moments' consideration to see just where this variation of coupling affects our wireless receiver design. There are three points where it has an important effect. Firstly, there is our coupling from the aerial (if we use inductive coupling). Here coupling which is suitable for shorter waves is unsuitable for the longer waves; secondly, we have the coupling between valves where the same criticism applies; thirdly—and this is a very important point—we have reaction coupling. All experimenters who handle reaction circuits know that tighter reaction coupling is required to bring the set into oscillation on longer waves than on the shorter, and indeed the



constant resetting of the reaction control is quite a prolific source of the oscillation trouble against which the B.B.C., quite rightly, issues frequent warnings.

In a previous paragraph I have referred to the grid and plate circuits of the valve being in tune. This, of course, suggests the tuned anode type of circuit. If, however, we use as the coupling a transformer of which the secondary is tuned, there would, at first glance, appear to be no tuning of the plate circuit of the valve, and the troubles to which I have referred might seem inapplicable to the case. However, the effect of interaction of primary and secondary magnetic fields is such that if the coupling is tight the whole circuit acts as if the plate circuit were tuned, the grid and plate circuits behaving as one.

### Obtaining Constant Coupling.

As we loosen the coupling this tuned-anode effect is gradually reduced and a point can be reached in which the coupling is just sufficient to feed back enough energy to maintain the set in a state of oscillation. A reasonably efficient H.F. transformer can be designed to give this effect and the tuning thus obtained is very sharp, but we lose appreciably in signal strength, for when the coupling is weak enough to avoid the self-oscillation trouble it is not strong enough to give a highly efficient energy transfer.

It is thus evident that with these facts in mind many experimenters have en-

deavoured to overcome the difficulties referred to. One quite early method of compensating for the reduced efficiency on the longer waves was to arrange the coupling between the primary and the secondary of the H.F. transformer to be continuously variable as we increase the capacity in the tuning circuit. This was effected by connecting a rotor carrying a primary winding of an H.F. transformer to the shaft of the variable condenser used for tuning. I actually handled an American receiver (the "Zenith") incorporating this idea nearly two years ago, in the United States, and, as a matter of fact, gave a description of it in "Wireless" on my return from my American visit in 1925.

An interesting unit enabling the home constructor to utilise this variable coupling method was placed on the market in America last year under the name of the Karas Equamatic system. It has recently been copied here, under a different name.

Loftin and White, however, have tackled the matter from an entirely different viewpoint, and one which is so charmingly simple that it is strange that it has not occurred to any of us before. In the Loftin-White circuit, shown in Fig. 1, there are two distinct ideas of great interest—one dealing with the constancy of the coupling and the other with the feed-back.

Loftin and White worked on the lines that the voltage drop across a condenser decreases with frequency, whereas the transfer of energy between the primary and the secondary windings increases with frequency. By combining the two effects in their coupling they are able to get a substantially uniform transfer of energy on high or low frequencies, for as the efficiency of coupling by the inductive method increases as we get to the shorter waves, so

radio-frequency currents. Now, if you imagine  $L_1$  to be short-circuited, you will realise that the radio-frequency currents flowing through  $C_1$  in series with the tuning condenser  $C_2$  set up differences of voltage across it which will give quite effective coupling to the circuit  $C_2, L_2$  just as much as if the voltages were set up across a portion of the inductance  $L_2$ .

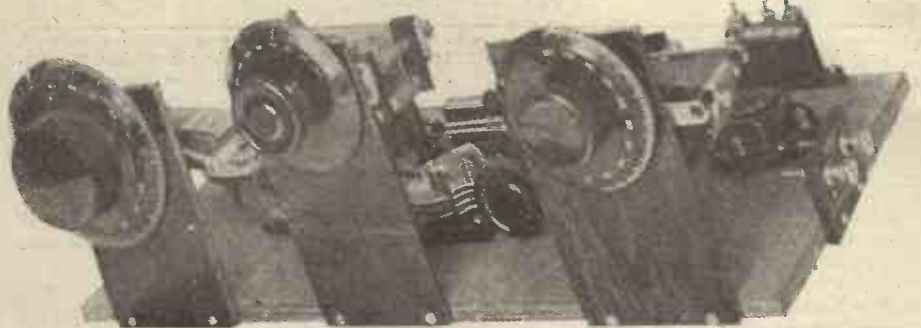
Now high frequencies pass easily through  $C_1$  and low frequencies with more difficulty. The easier the frequencies pass through  $C_1$  the smaller the voltage differences set up across it, and, as it is voltage difference we want for coupling, you will see that longer waves give greater voltage difference across  $C_1$  than the shorter ones.

### Preventing Feed-back Troubles.

Now come back to  $L_1$ . The radio-frequency current passing through  $L_1$  induces voltage into the winding  $L_2$ , and as the transfer of energy in this way decreases in efficiency as wave-length is increased, we can use the old phrase that "what we lose on the swings we gain on the roundabouts"—the swings being the inductive coupling and the roundabouts the capacity coupling.

So far, so good! We now come to the condenser  $C_1$ , which at first glance might be looked upon as a stopping condenser. In this case a stopping condenser is not needed as  $C_2$  serves the purpose.  $C_1$  has a special function which is not at all obvious on first examination.

In speaking of the valve feed-back which produces self-oscillation or other reaction effects, we have always assumed that the feed-back is "in phase." To use the old analogy of the child's swing in the garden, we have assumed that the pushes on the swing are timed just when the swing is moving away from us and not towards us.



Showing the simple nature of the experimental lay-out for Loftin-White circuit experiments.

correspondingly the efficiency of the capacitive coupling decreases. The correct choice of inductances and capacities enables a really constant coupling to be obtained. Fig. 1 shows the Loftin-White circuit for two valves (H.F. and detector without direct reaction). Ignoring the aerial coupling for the moment, the first valve is fed through a radio-frequency choke R.F.C. and is coupled to the next circuit through the condenser  $C_1$ , the inductance  $L_1$  and the capacity  $C_2$ . In the ordinary way the valve would be coupled through  $L_1$ , one side of which would be connected to the plate and the other to the H.T. battery, as shown in Fig. 2. In the Loftin-White circuit we place a capacity  $C_3$  between plate and  $L_1$  for a purpose I will explain later, and for this reason we must feed the valve through the radio-frequency choke. In the circuit comprising P,  $C_1, L_1, C_2$ , there flow only the

If such a swing is moving backwards and forwards sixty times a minute, and we give sixty impulses a minute to the swing at the right moment, then the oscillation of the swing can be built up steadily with each push. If, however, our sixty impulses a minute are wrongly timed in relation to the movement of the swing, then no building-up effect will be obtained. When our pushes come just at the right moment as well as at the right frequency, then our pushes are in phase with swing.

Similarly to get a valve feed-back effect it is necessary that the impulses should be fed back "in phase." The condenser  $C_1$ , in conjunction with the rest of the circuit, upsets the phasing of the feed-back, and so, when it is properly proportioned with the rest of the circuit, we can arrange that the feed-back voltages do not come at the

(Continued on page 283.)

# LANGENBERG.

The huge broadcasting station which is known to amateurs as "Germany's 5 X X."

(Above.) The main station building, showing one of the aerial towers. (Left.) A close view of one of the aerial towers, which is 315 feet in height.

(Right.) The control boards in the transmitting hall.

(Below.) The rectifier room. Note the number of large insulators used.

# GERMANY'S 5XX.

A description of Langenberg, the latest and largest German broadcasting station.

FROM A SPECIAL CORRESPONDENT.

THE race for the biggest high-power broadcasting station in Europe which began at Daventry was soon keenly entered into on the Continent. The Germans countered Daventry with Königswusterhausen, the Russians broke the German record at Moscow, and now the new Rhineland station at Langenberg has arisen, not only to break European records, but to claim the distinction of being the biggest in the world.

## Two Tremendous Masts.

It is erected in the most densely populated area in Germany, in a district which teems with vast manufactories and mines, and one of the first difficulties experienced by the engineers was to choose a spot in which the smoke screen from thousands of chimneys and furnaces would interfere as little as possible with reception. Before any decision was made, German scientists and engineers undertook with their usual thoroughness a very careful survey of the district.

At length a spot near the town of Langenberg, six miles north of Elberfeld and twenty-two miles from Cologne, was chosen, where the ground rises to a height of about 830 feet above sea level. Here the two tremendous masts, each about 315 ft. high, and 810 ft. apart, were erected.

Although the masts weigh more than 32 tons each, they are unsupported by any anchoring system. They are in the form of slim four-sided pyramids, and to make up for the absence of guys a great deal of attention had to be given to their foundation in gigantic concrete blocks. Each of the feet is also insulated in porcelain. The construction is of wide-mesh girders offering very little surface to wind pressure and allowing a considerable play in the whole mast.

## A Striking Feature.

For aerial a five-wire T-type was chosen, with the lead down to the station from a point near the centre. In order to be able to experiment freely for the best results when tests had begun, platforms with winding apparatus were erected on the masts about 100 feet above the earth. From these the aerial could be adjusted either in length or height.

An earthing system comprising eight miles of copper is one of the most striking features of the Langenberg station. It is claimed to be absolutely perfect in its results. The system, laid out in a great star formation on all sides of the station

building, consists of copper wires buried one metre below the surface and joined elliptically at their extremities by a wide band of copper. Every listener knows that it is impossible to take too much trouble with an earth, and it is probably true to say that the success now attending the results of transmissions from Langenberg is very largely due to the splendid system described above.

The new station has an input power of 60 kw. and an output of 25 kw. The necessary electric power for the station is taken from the overland system of the Berlin Electricity Works, and the pressure of the current is stepped up to 10,000 volts. The transmitting valves require a great volume of water (as much as 1,100 gallons per hour) to cool them, and this water is first softened by a special process to prevent the formation of "fur" in the water jackets.

Programmes are ordinarily supplied by land line from six different studios. The chief of these is at Cologne, and the others are at Elberfeld, Essen, Dusseldorf, Dortmund and Muenster. But transmission is also possible from any station in Germany, and the Berlin programme is sometimes taken over. Many difficulties had to be overcome by the engineers before these programmes could be employed.

## Range.

The most important achievement of the new station is its wide radius of reception. On a crystal set with an inside aerial Langenberg can be received within a 32-miles radius, and with an outdoor aerial within 64 miles. Under specially favourable conditions it was recorded that an adapted crystal set in Vienna received the programme. This is a distance of 830 miles. Complaints during the early days of the station that programmes were not well received in districts close to the

station were balanced by reports from a distance of 1,600 to over 2,000 miles stating that reception was perfect.

Herr Ernst Hardt, the station director under the control of the Westdeutsche Rundfunk Co., met at first with a good deal of criticism from listeners in the Ruhr area, who believed that he was going to neglect them. Hardt had stated that he attached great importance to the cultural mission of a station with such a vast influence, and that he would arrange for at least one opera and one drama a week. He had to speak at several protest meetings and assure the outraged Rhinelanders that he would care for local as well as general interests. He appears to be keeping his pledge.

Complaints have also been received from districts south of Cologne that reception there from Langenberg is poor. In order to cover the area in which this "blind spot" is centred it has been decided to erect a relay station.



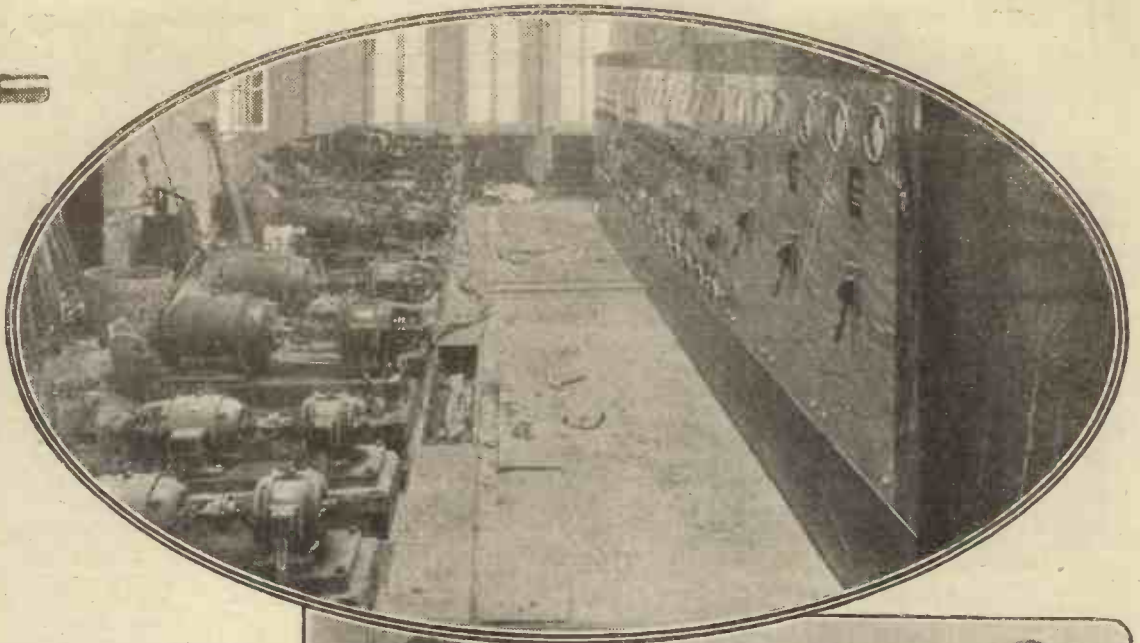
Another type of transmitting valve used at Langenberg.



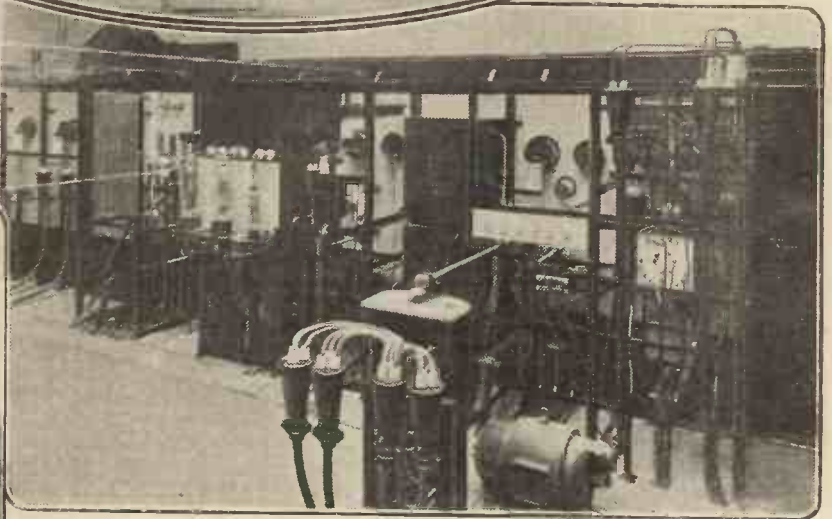
One of the transmitting valves used at Langenberg.



The exterior of the Potsdam Broadcasting Station in Berlin. A number of Langenberg station photographs are included in following page



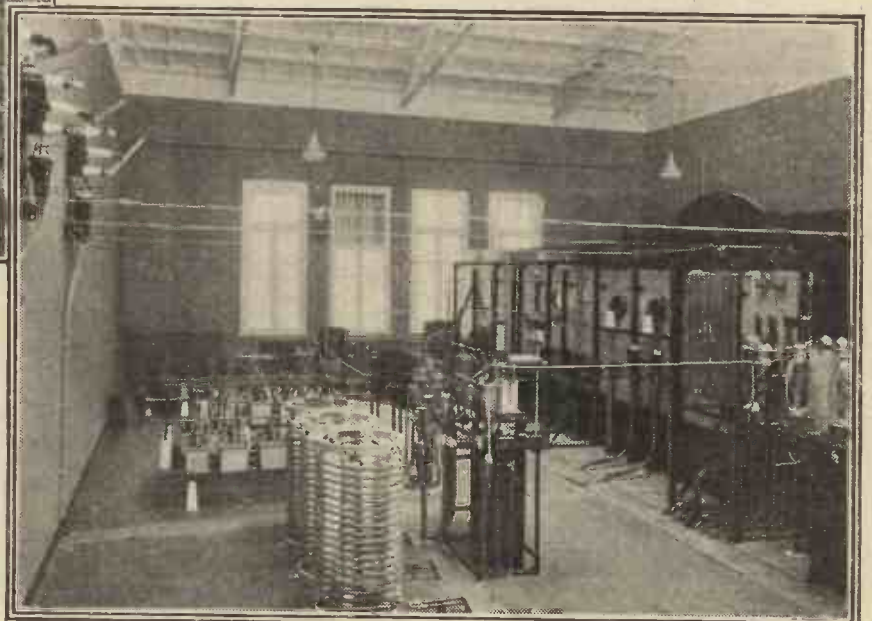
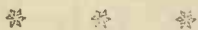
Above is shown, on the left, one of the modern high-power, water-cooled transmitting valves, and (right) the series of powerful generators and current converters used. The main power control switchboard is shown on the right.



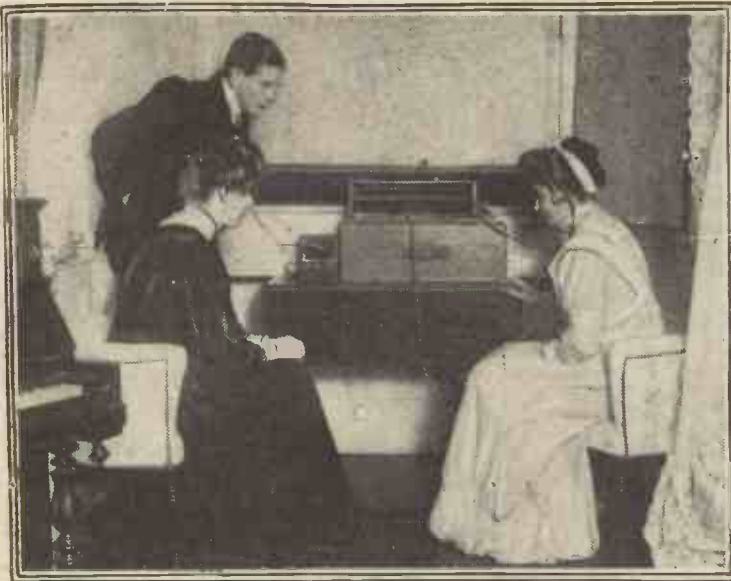
The above photograph gives a view of some of the transmitting apparatus.



(Above) Thick wires are buried in the above trenches. These form the extensive "earth" which covers a very large area. The base of one of the masts is also shown.



(Right) Another portion of the main transmitting apparatus. The wires running across operate the large switches which are mounted high up on the wall.



In 1910 great interest was displayed in the reception of Morse signals!

WHAT days they were! And what a little it took to please us! There was no oscillation, no bickering about programmes; we were just content to take what was going. I speak of somewhere round about 1910. Even then there was an enthusiastic little band of amateurs who sat up far into the night listening to the little sand-papery scratches given out by ships' sets.

It was by a mere chance I joined the happy band. Chancing to be up at Isleworth one day, I saw a company of Territorials marching through a gate to a small hut in a field. I found out they were going to a wireless demonstration, so I joined the party, and we were all, in turn, treated to a precious minute listening-in. When it was all over, I stayed behind, made friends with the operator, and came away with the diagram of a crystal circuit, a piece of galena, and instructions of how to wind some electric bell-wire round a cardboard tube. Some aerial wire and a pair of headphones would complete the set.

#### An All-night Vigil.

I went up home in the Midlands for the Easter holidays, and soon had up a magnificent aerial suspended from the top of a tall fir-tree, a four-wire fellow nearly 200 ft. long. In those days it was the fashion to connect together electrically the upper ends.

By ten o'clock one night all was ready for a test. Acting on the instructions of my friend, the set responded when the bell-push in the room was pressed, so all that remained was to drop on the wave-length of some station that might be going. This was a case of working in the dark, for I knew nothing about the wave-lengths of any station; and, to be on the safe side, I had wound tubes with wire totalling 4 ft. 6 in. in length. After prodding about on the bared wire in vain for three hours, things seemed pretty hopeless. Suddenly, however, a rich musical note boomed in at good strength. This, I found out later, was Poldhu giving out its nightly News Bulletin. Later on I dropped on the ship and coast stations. At 5 a.m. I turned in, pretty well pleased with the night's work.

Other popular stations that old-timers will remember were Nauen, with its coarse

deliberate (as I noted it in my log), also on 1,200 metres.

Scheveningen, T.C. (Calais), T.D. (Dunkirk), and the Batavier boats were others frequently heard.

#### Welcome Morse.

It seems difficult to believe in these days that friends considered it a great privilege to be asked to come in of an evening and listen to a couple of hours of Morse. If only some of us could but get away from it for all time! The great advantage of Morse in the presence of friends was that you could label it as you wished, and I'm afraid some of us put very distant labels on it, according to the company present.

At the same time, even then there were occasional plums to be picked from the ether. Every now and then a mild form of concert would burst in upon the listeners; rather a watery affair, it is true, but, nevertheless, an actual programme of unannounced but easily recognised items, and always finishing up in style with the

# Years Ago!

## A RADIO RETROSPECT.

Ry R. HUMFREY.

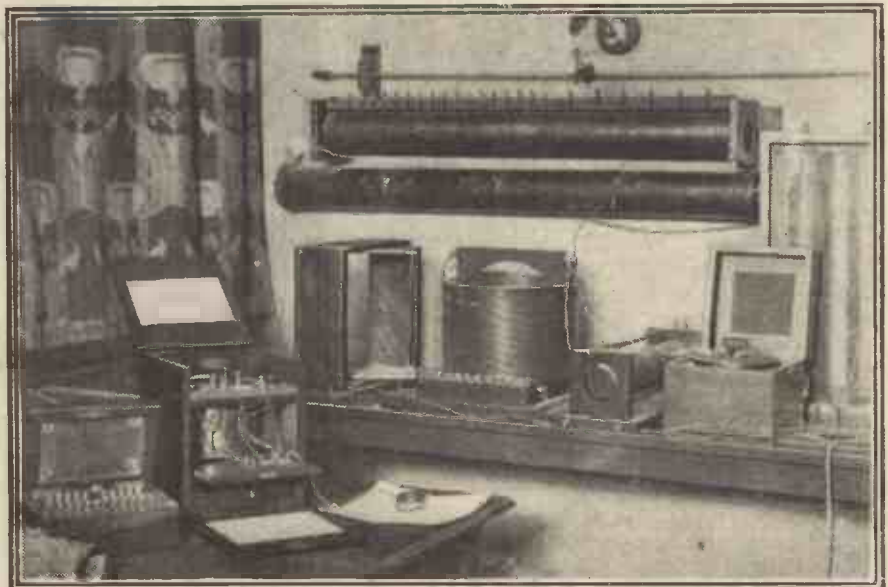
poppy note on 1,200 metres; Clifden, high and clearly defined on 4,000 metres; Eiffel Tower, loud and

National Anthem. These were given out by the Lepel experimental station at Slough, where a quenched spark system was in use. Herr Lepel was a genial Austrian with a taste for weird experiments, and had rigged up a small eight-fingered key board that controlled an inductance shunted round the arch which altered the pitch of the note and formed a scale. The items were mostly hymns, and sounded like a child playing on one note. Anyhow, they must rank as early examples of broadcast tunes. If, during one of these shows, another station chipped in with "There is a Happy Land," that would be the De Forest station at Cambridge having its own little joke. Another diversion for those who could read Morse was to listen to someone who repeatedly rapped out over the ether, "Smoke So-and-So's coarse-cut mixture." This gentleman did not give his call-sign on these occasions, but we knew him to be Cullercoats, where the Poulsen system was being tried out at that time. I often wondered if he worked on a commission basis.

#### Telephony Experiments.

The biggest surprise I ever had whilst listening-in was one Sunday morning in November, 1912. I could hardly believe my ears when I heard a couple talking to each other, and several times counting from one to twelve. The conversation finished with "Good-bye, Joe." (It wasn't "old man" in those days.)

This, I found out afterwards, was a conversation between two representatives of the Grindell-Matthews Syndicate, speaking respectively from Letchworth and Welwyn, a distance of 12 miles. They did better than they knew at the moment, for I was listening to them at a point near Banbury, over 50 miles away. When, a few days later, I put on the 'phones, a very clear voice repeated several times, "Experimenters of the British Isles, Signor Marconi greets you across the ether." That, however, was a young friend of mine with a keen sense of humour. He had cleverly connected up my set to a microphone, and was working his little stunt up in the attic no further than two floors up.



An amateur's receiving station in the year 1910. This set nowadays would be regarded as rather bulky for crystal work!



Some interesting short articles of an eminently practical nature.

# HINTS AND HOOKUPS.

## AERIAL INSULATION.

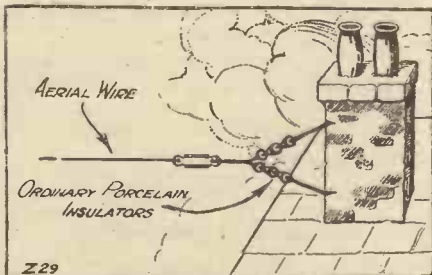
**A**N excellent method of providing a high degree of insulation for an aerial is the one illustrated in the accompanying diagram.

The method is particularly suitable in those cases in which the aerial is to be attached to a chimneystack, or to the end of a house. It is not so suitable for aerials which are secured to the ends of long thin masts, owing to the combined weight of the insulators employed.

As will be seen from the diagram, a chain of three insulators is attached to the upper part of the chimneystack, and about two feet below it is attached another chain of three insulators. These chains of insulators then converge to a single insulator, to which the aerial wire itself is attached.

Ordinary small porcelain insulators may be employed for the purpose, although, of course, it is desirable that the main insulator to which the aerial wire is attached should be of the most efficient pattern possible.

It is best to secure the insulators to the chimney-stack by means of rawlplugs, inserted in the brick of the stack—not in the mortar. The free ends of the wire



attached to the insulators should be fastened tightly to screws which are then inserted in the rawlplugs.

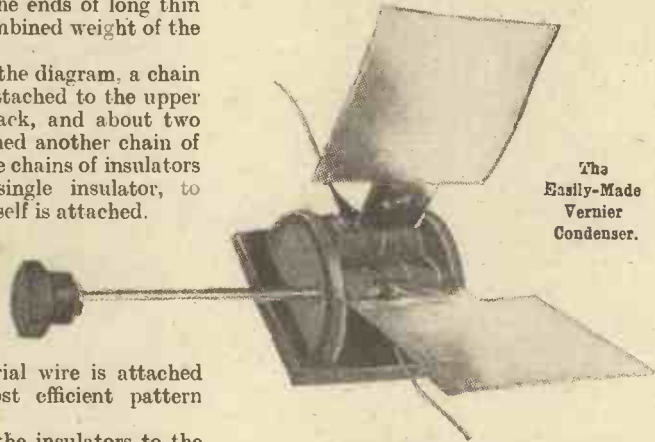
## AN IMPROVED VERNIER CONDENSER.

**I**T is often very convenient to have at hand a vernier condenser of a simple type in order to conduct rough experiments in the introduction of small amounts of capacity into one or more portions of a radio receiving circuit. The instrument here illustrated is capable of meeting this need in a very appropriate manner, and, as its construction is of the simplest nature, it will no doubt recommend itself to the attentions of wireless amateurs who do not wish to go to the expense of procuring a vernier condenser of the orthodox variety.

Procure two thin and perfectly flat pieces of cardboard. Place these in a warm oven until they are thoroughly dried, and then give them a coating of shellac varnish on both sides in order to render them moisture

proof. A convenient size for the cardboard is four inches by three inches.

Next, obtain two sheets of silver paper or tinfoil a little smaller in dimensions than the cardboard pieces. The "silver paper" on which cigarette manufacturers expend a small fraction of their surplus profits will come in very nicely for this need. Gum a sheet of silver paper or tinfoil on to each



cardboard piece, and from a projecting tag of tinfoil on each sheet take thin wire leads.

Now insert each cardboard piece having a sheet of tinfoil attached to it into the projecting plug of a two-coil holder. If the cardboard is thin, this wedging of it down the split portion of the plug will not injure the latter.

The condenser will now be complete, and its capacity is, of course, varied by moving the coil holder supporting the movable tinfoil sheet up against the stationary one, the closer together the two tinfoil sheets being, the greater the capacity set up by the condenser.

## LINKING-UP PANEL UNITS.

**A**N exceptionally neat and effective mode of connecting up panel units which I saw in use the other day is well worthy of a description in these columns.

By the use of this method, two separate panels can be connected together or disconnected in the absolute minimum of time, and without the necessity of employing wire or flex leads for the purpose.

The illustration below indicates clearly the means by which this is accomplished.

Suppose, for example, it is desired occasionally to connect up a single valve amplifying unit to an ordinary crystal set. On the side of the crystal set cabinet, just below the 'phone terminals, is placed an ordinary coil plug, and two short leads are taken from this to the 'phone terminals. A similar plug is attached to the side of the cabinet just below the input terminals of the amplifier, leads from the coil plug to the under sides of the input terminals being taken as before.

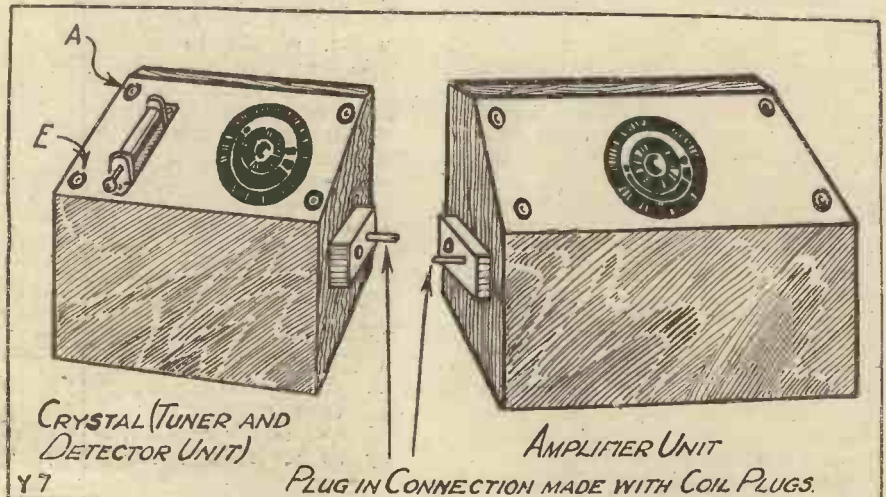
If due care is taken to fix the two coil plugs at exactly the same height from the bases of the cabinets, a ready means of linking up the two units will have been accomplished. Moreover, if at any time the use of the amplifier is not required, the latter can instantly be disconnected, and the 'phone leads secured to the crystal set 'phone terminals in the usual manner.

The method can, of course, be extended to the connecting up of many other varying types of panel units.

## A NOTE FOR REACTION USERS.

**I** WONDER how many reaction enthusiasts have noticed the apparent fact that if the reaction coil is wound with thinner wire than the aerial coil, a considerable improvement in reception results. Not only does the actual signal strength under

(Continued on next page.)



## HINTS AND HOOKUPS.

(Continued from previous page.)

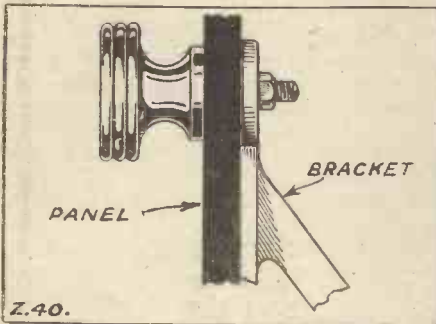
any given set of conditions increase, but the set tends to become more selective, and reaction noises are much more readily eliminated, or, at least, kept under control.

For instance, if the reaction coil of an ordinary valve set is wound with No. 24 wire, it is very advantageous to have the aerial coil constructed with No. 20, or even No. 18 wire. The efficiency thus obtained is very considerably greater than would be the case if both coils were wound with the same gauge of wire. Such, at any rate, has been my experience, and I am confident that other amateurs will reach the same conclusion if they take the trouble to put this note to an actual test.

### A NOVEL PANEL FIXTURE.

ONE usually finds the knob of a variable condenser much too handy when pulling out the panel in the American type of cabinet, and this has consequently the effect of causing the vanes to rub, so here is a hint which will be of use in this matter.

The panel is always fixed to the baseboard brackets by means of two bolts and nuts, but I substitute these for two small cabinet door handles. (Handicrafts, Ltd. supply them for a few pence.) These handles are fitted with a threaded rod and nut, and can be fixed in the same way as previously done



(see sketch). Being made in mahogany or black erinoid they will match both kinds of panels, and not only do they look neat, but they prove invaluable when pulling out the panel.

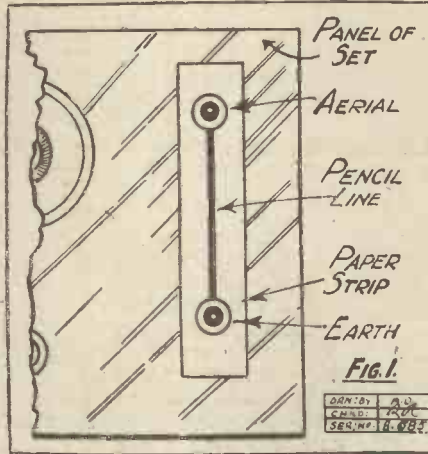
### A STATIC REDUCING NOTION.

AMATEURS who are persistently troubled by static interference in their reception, including not merely atmospheres of the natural variety, but also all kinds of other interference, such as those due to the presence of electrical generators in the neighbourhood of the receiving aerial, may like to experiment with the following means of effecting, at the very least, some amelioration of the trouble.

Remove the aerial and earth terminals from the panel of the set, and then cut a strip of good white paper of such a size that it will reach across the panel from the aerial to the earth terminal. A pencil line is then drawn down the middle of the paper strip, after which the terminals are replaced, as shown in the diagram, Fig. 1.

In carrying out the above operation, it is necessary to make sure that the under-sides of the terminals make good electrical contact with the pencil line. In order to ensure this, it is advisable to clean up the under parts of the terminals with a little sandpaper, as these portions are often covered with lacquer.

In many cases this very simple treatment will result in a complete cessation of the interference trouble. If the trouble still persists, make the pencil line on the strip of paper between the two terminals



thicker, and, if necessary, draw two or more such lines on the paper strip.

This device works, of course, by providing a very high resistance path for the disturbing currents. These are shorted to earth, while the majority of the transmitted waves pass on to the set.

Another variation of this basic idea is to soak the paper strip in Indian ink (ink of the ordinary blue-black variety will not do), and then, after allowing it to dry, to secure the paper strip in the above fashion. In this case the device works in the same way as the pencil line strip. Indian ink contains carbon, and this presents a high resistance leakage path to the interfering impulses.

It should be understood, of course, that these suggestions are not put forward as an absolute cure of interference troubles in every single case. Nevertheless, the above means are very often successful, and as they are simple to carry out in practice, it will be well worth the while of any radio set owner who is troubled by static interference to carry out a few experiments with their use. Finally, if the experiments are a complete success, a thin layer of shellac wax over the paper strip will keep the pencil line intact and prevent it from being rubbed away.

### A NEAT DIAL INDICATOR.

A NEAT dial indicator, which will help one to a more accurate reading of condenser scales, may be made in a few moments out of a brass terminal strip from an old

flash-lamp battery, by cutting one end to a point and bending the strip to the required shape. This may be affixed to the panel by means of Chatterton's compound, or by a small nut and bolt, and can easily be arranged so that the distance between the point of the brass strip and the dial scale is very small. Such indicators are more attractive in appearance than the usual "transfer" arrow, and do not look at all "makeshift." The brass can, of course, be cut with an ordinary pair of scissors.

### RESTORING OLD PANELS.

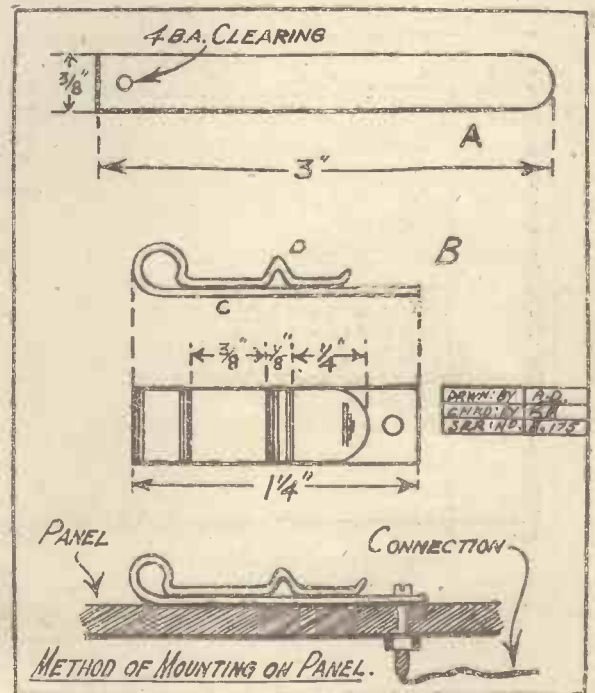
THE materials required are: (1) A sheet of fine emery cloth, grade 0 or 00, (2) A sheet of Blue-back emery paper, grade 00, (3) linseed or olive oil, and (4) pumice powder.

Knock some small nails or brads into the bench round the edges of the panel so that both hands may be used. Fold a strip of the emery cloth round a block of wood or cork, which fits nicely into the palm of the hand, then with a smooth circular motion rub evenly over the whole surface of the panel.

In a short time the emery cloth will be worn down; a fresh strip should be substituted and the work continued. A considerable amount of ebonite dust will have accumulated, and this must be brushed off and the panel examined to see that the whole surface is receiving the same treatment.

When the panel presents an even, dull appearance, and no trace of the old polish remains, brush off the dust clinging to the panel and replace the emery cloth with a strip of the Blue-back paper. This should be used in the same manner as the cloth, and until the rather deep scratches caused by the previous operation have all been removed. A little linseed oil and pumice powder on a piece of soft rag will finish off the process as far as the "matting" is concerned, and the surplus oil should be wiped off with a clean duster.

The resulting surface will not change colour and will last indefinitely.





# WHOSE TURN?

WRITERS of constructional articles in the radio journals keep one eye on the advertisement columns. Advertisers naturally expect their products to be used and mentioned in turn by these writers. So when you see certain makes of components definitely specified, remember that they are not necessarily the best. Users now know that they can replace every part named in any published circuit with the corresponding part in the LISSEN range. You will use all the energy available if you build with LISSEN parts and get louder, clearer signals from near and far in consequence.

## SAVES H.T.

You should put a LISSEN 2 mfd. Mansbridge Type Condenser across your H.T. Battery (1 mfd. will do, although a larger size is preferable), and so lengthen its life by 10 per cent.

These fine-quality condensers are totally enclosed by a moulded solid insulating case. This is a great protection, especially when the condensers are of large capacity and are used in eliminator circuits. The condenser cannot short-circuit on to its case.



LISSEN Mansbridge Type Condensers  
2 mfd. 4/8. 1 mfd. 3/10.

Other capacities :

'01 .. .. 2/4	'25 .. .. 3/-
'05 .. .. 2/4	'1 .. .. 2/6
'025 .. .. 2/4	'5 .. .. 3/4

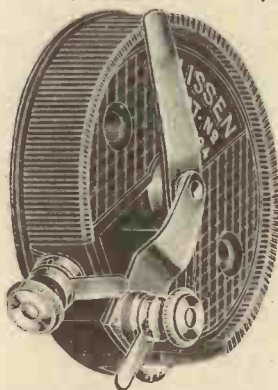
## LISSEN FIXED CONDENSERS

These are the condensers you should use for resistance-capacity units. They are absolutely leak-proof; they deliver all their stored-up energy, and they never vary. Guaranteed accurate to within 5 per cent of marked capacities. Notice the new improved case which enables condenser to be mounted upright or flat. A pair of grid-leak clips is included free with every grid condenser.



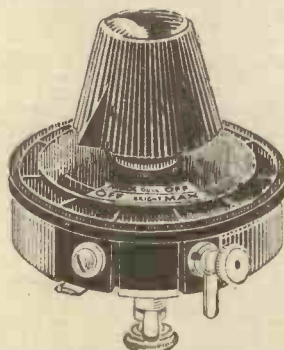
LISSEN Fixed Mica Condensers  
'0001 to '001, 1/- each (much reduced)  
'002 to '006, 1/6 " " "

## NOW ONLY 1/6



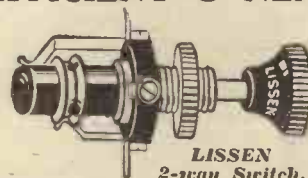
The baseboard type of LISSEN Resistor is now reduced from 2/6 to 1/6. This type has, of course, no knob, dial or pointer, but is provided with 2 holes for screwing to baseboard. 7 and 35 ohms Rheostats: 400 ohms Potentiometer, each 1/6 (Previously 2/6)

## PANEL RHEOSTATS



The wires do not loosen, the arm keeps in perfect contact—nothing ever goes wrong with this Rheostat.  
Rheostats, 7 and 35 ohms .. 2/6 (Previously 4/-)  
Potentiometer 400 ohms.. .. 2/6 (Previously 4/6)  
Dual Rheostat, 35 ohms ... .. 4/6 (Previously 8/-)

## EFFICIENT & NEAT



Energy often leaks away at the switch points. But not if the efficient LISSEN switches are used. There is a LISSEN switch for every switching need. Each one is very neat and fixed by the one-hole method. Tinned tags enable connexion to be made easily.

- NOW  
LISSEN TWO-WAY SWITCH 1/6 (Previously 2/8)  
LISSEN KEY SWITCH .. .. 1/6 (Previously 2/6)  
LISSEN REVERSING SWITCH 2/6 (Previously 4/-)  
LISSEN SERIES PARALLEL SWITCH .. .. 2/6 (Previously 3/6)  
LISSEN FIVE-POINT SWITCH 2/6 (Previously 4/-)  
LISSEN D.P.D.T. SWITCH .. 2/6 (Previously 4/-)

## SCOOPED OUT



There is not a square inch of superfluous ebonite in this LISSEN Valve Holder. That means low capacity and low loss, and therefore stronger, clearer signals. Shown ready for baseboard mounting, but can also be used for panel mounting by bending springs straight. Patented. Previously 1/8. NOW 1/-

## LISSEN GRID LEAKS

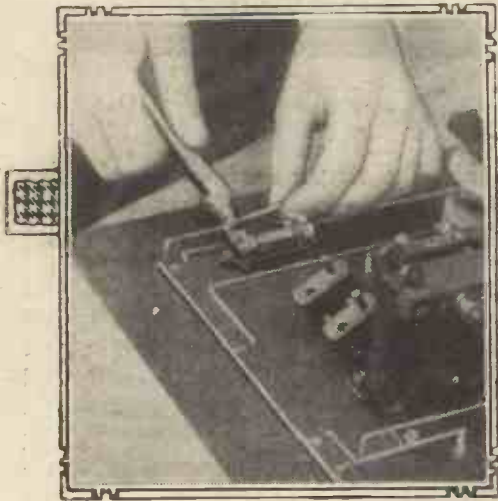


LISSEN Leaks are absolutely silent in use; their resistances never alter. This was proved some time ago by exposing them to the rain and sun on our factory roof. All resistances. Previously 1/3. NOW 1/-

LISSEN LTD., 8-16, FRIARS LANE, RICHMOND, SURREY

Managing Director: THOMAS N. COLE.

# Minute Defects of Contact



\*  
 An article of interest to all readers, whether they be owners of super-hets. or of the more popular crystal set, and especially valuable to those who go in for long-distance reception.  
 \*  
 By JAMES SCOTT, M.S.C.I., M.E.H.A., M.A.C.S.  
 \*

**M**OST wireless amateurs are, I fear, quite ignorant of the highly important rôle that common dust, grease from one's fingers, and kindred grime fulfil in the direction of effecting injury. On this particular occasion I will confine my attention to the possibilities relative to metallic contacts when they are influenced by the presence of specks of grime of any description.

Bear in mind that there is no means of overcoming these particular defects—not at the present time, at any rate.

### Building-Up Effect.

Suppose we are "listening in" to stations which are not very far away from our set. In such a case it does not matter seriously if the metallic contacts are of a comparatively poor character; for no great effort is needed on the respective parts of the apparatus to surmount any poorness of condition.

In the event, however, of our desiring to hear what distant stations are transmitting, the matter is in another category altogether. If we wish to secure a satisfactory response therefrom, a very small E.M.F. is sufficient, provided all fittings are in proper order. Necessary accuracy depends on the response beginning with tiny impulses of the correct

frequency; so that they may be gradually worked up to suitable pitch.

A little comparison will emphasise my meaning. We are confronted, say, with a huge rock balanced on a small projection. It is too large to lift, or to shift in the ordinary way. If, however, we give it a gentle push (the effect of which is too insignificant to be seen), then wait for a short interval of time and repeat the push with slightly stronger vigour, following this up with a third, fourth, and so on jerk, each succeeding one being stronger than the preceding shove, we may within half an hour or so find that the great mass is rocking noticeably to and fro; and can eventually be given a powerful thrust capable of causing it to tumble right over off the pinnacle upon which it has for so long been standing quite firmly and apparently immovable.

### Process of Tuning.

The whole subject of tuning depends on the success with which the force is worked up from a minute action, or impulse, to one of a bold, energetic kind, becoming, in due course, one of great magnitude or volume.

But, if the preliminary tiny disturbance cannot happen as it should do, there will be no response such as is required. When handling a very small E.M.F., perfect contact between the numerous metallic connections is absolutely necessary. An electric pressure of several volts or so are usually necessary to break down even a thin insulating film, but such voltages are rarely found on the H.F. side of a wireless receiver.

A coat of oxide, for instance, which is so thin as to be scarcely perceptible, while being all right for currents derived in other forms of electrical apparatus, can be so seriously upsetting as to render a "wireless" set useless for desired action.

An E.M.F. of 100 volts can spring across a minute space if the insulating film has been disturbed in the manner suggested; while one of 3,000 volts is capable of yielding a spark of a millimetre dimension, and jump across a space about equal to its own

size or, of course, of any lesser width, thereby demonstrating the fact that a distinct loss of current may be involved by even the least noticeable of gaps in an insulating film.

### Exceedingly Small Impulses.

If, on the other hand, we manipulate one-hundredth of a volt, or one-thousandth, or one-millionth, no such phenomenon occurs. Yet, as Sir Oliver Lodge points out so strikingly, the initial surgings upon which success in listening-in from very distant stations depends cannot begin at much over one-millionth of a volt. Hence, it only needs the very slightest defect to interfere with the beginning of the process, and consequently tuning cannot be effected as it should be.

In attempting to discover explanations for these phenomena, many patient and clever experiments have repeatedly been undertaken, and the outcome of these is to establish the truth that some electrons are evidently free from their atoms, and can be controlled by the merest electric force which remains, as it were, intact.

Just a slight digression will be advisable here. According to the old theory—not ancient, but not so modern as the study of electricity, matter consisted of combinations of atoms and molecules, the former (when alone) comprising the elements—iron, gold, silver, copper, oxygen, hydrogen, nitrogen, etc.—which could not be changed into anything else.

(Continued on page 261.)

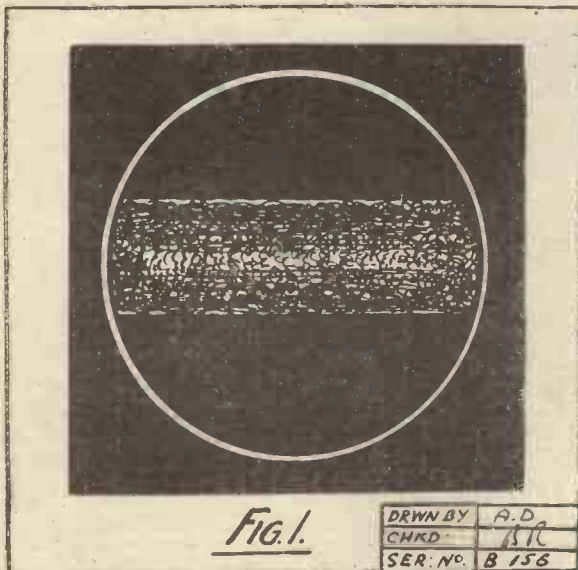


Fig. 1. An ordinary piece of wire, showing the oxide coating.



Fig. 2. Particles of dust, from various sources, as they appear through the microscope.



# The Crystal Gazer sees the condenser of the future

The Condenser of the future is evolved on the logarithmic principle—thus avoiding in the only possible manner the defects inherent in both Square Law and Straight Line Frequency types. Only by designing a condenser on the "log" principle is it possible to spread stations really satisfactorily over the whole dial, without any falling out of step at the beginning and the end. By using individual "log" condensers in multi-tuned circuits remember that all dial readings are the same. Thus tuning is an extremely simple matter.

In time all condensers sold will be designed on the "log" principle, but so far CYLDON Log Mid-line Condensers—just placed on the market—are the first log principle condensers to be made in this country.

And just as CYLDON Condensers, of whatever type, are reckoned in very highest class of all, so CYLDON "Log Mid-line Condensers" are not only the first out, but will remain the best. Prices:

·001 - 21/-  
 ·0005 - 17/6  
 ·0003 - 16/6

·00025 - 16/-  
 ·0002 - 15/6

Prices include 4" Knob dial. If dial is not required, deduct 2/-.

This new condenser is such a great improvement that in future all our gang condensers will be built up with Log Mid-Line Units. If you are building a receiver using gang control, bear in mind that the CYLDON Log Mid-Line is the only correct condenser. Prices:

2-GANG £2-10-0. 3-GANG £3-10-0. 4-GANG £4-10-0.

## LOG **CYLDON** MID-LINE

CYLDON Temprytes, the best means of valve control, are guaranteed to function perfectly with any type of valve. Comprehensive valve chart, showing correct Tempryle for every valve, free on application to your dealer.

CYLDON TEMPRYTES, 2/6 each.

HOLDER MOUNTINGS, 1/6 each.

If unable to obtain CYLDON products locally, write direct to

**SYDNEY S. BIRD & SONS,**

CYLDON WORKS, SARNESFIELD ROAD, ENFIELD TOWN, MIDDX.

Telephone: Enfield 0672.



# NOTICE

TO ALL  
**BENNETT COLLEGE**  
**STUDENTS**  
 PAST OR PRESENT.

To-day I received a letter from an old student who for private reasons did not complete his course although he had paid his fees. This was three or four years ago. He writes to ask if he is at liberty to complete his course.

This notice is to inform all Bennett College students, past or present, if for any reason whatever they have not completed their course, no matter how long ago it may have been, their names are still kept and they are at liberty to resume their studies until their course is completed, in fact, we shall welcome them back.

Some students who may have taken up a technical course may prefer to transfer to a commercial course or vice versa. We teach all the technical trades and all the commercial professions by post, in all parts of the world, and we specialise in all the examinations in connection with them. If any student has joined for a course that does not suit him he is at liberty to transfer. We hope all Bennett College students will make this known to their friends.

If you want any advice write to me at this address, The Bennett College, Dept. 106, Sheffield.

F.R.S.A., M.I.Mar.E., A.I.Struct.E., etc.,

Governor of  
**THE BENNETT COLLEGE,**  
**SHEFFIELD.**

## Don't Despair

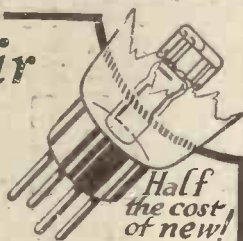
We will make your broken or burnt out valve as good as new. Simply pack it up and send it to us together with your name and address and remittance.

ALL TYPES OF VALVES REPAIRED  
 AT HALF LIST PRICES.  
 (Minimum charge 5/-).

Weco, S.P.'s and low capacity types not repairable.  
 Minimum D.E. current 0.15 amp. when repaired.

SATISFACTION GUARANTEED OR MONEY REFUNDED.  
**VALCO LTD., Dept. P.W., Tabor Grove,**  
**WIMBLEDON, S.W.19.**

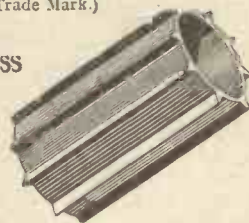
**VALCO will mend it!**



Half  
 the cost  
 of new!

The panel is an important unit in any radio receiver particularly in super hets and other sensitive circuits and where dignity and beauty are sought in the assembled cabinet.

REDFERN'S  
**Ebonart**  
 NON-METALLIC SURFACE  
**RADIO PANELS**  
 (Registered Trade Mark.)

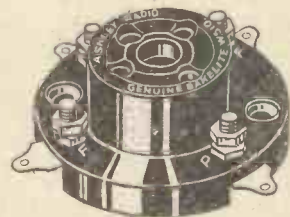


REDFERN'S LOW LOSS  
 COIL FORMERS  
 made in four sizes.

- Size A. 2 in. 1/6 each.
- .. B. 2 1/2 in. 1/9 each.
- .. C. 3 in. 2/1 each.
- .. D. 3 1/2 in. 2/3 each.

REDFERN'S RUBBER WORKS LTD.,  
 HYDE, CHESHIRE.

## Save One and Sixpence per Valve



Beyond the Detector stage, to pay more than 1/3 for the valve holders is extravagance. The belief that "shock absorbing" devices are necessary in every stage is a definitely exploded fallacy. For H.F. and L.F. stages there is nothing better than the new Ashley Valve Holder. Constructed throughout of genuine bakelite and non-oxxydising metal, the valve sockets are surrounded by air throughout 90% of their length. Sockets and connections are stamped complete out of one piece, provision being made for wiring to terminals or soldering to tags. Moreover, a special safety groove is provided to ensure the valve legs engaging with the corresponding sockets.

**PRICE 1/3 each**

## STANDARD VALUE RESISTANCES



**PRICE 2/6 each**  
 (with clips)

50,000 ohms to 1 megohm.

Exhaustive tests by the National Physical and other world famous laboratories have produced highly satisfactory reports. Each Resistance on completion is subjected to a prolonged ordeal during which it is under pressure at a minimum of 230 volts.

Guaranteed accurate within ten per cent. Superior to wire wound. Differs in construction from all others.

If your dealer cannot supply we send post free.

*Ashley Radio*

Ashley Wireless Telephone Co. (1925) Ltd.  
 Finch Place, London Road, Liverpool

# OBTAINING ACCURATE TUNING.

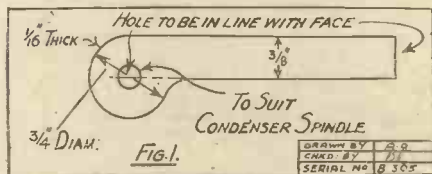
BY A. E. HALL.

CONTROL dials are perforce handled considerably, and consequently the marking often gets dirty, indistinct, and sometimes entirely removed. These can usually be made equal to new by carefully scraping away the old filling from the

to dry, any that has strayed from its course may be removed with a sharp knife. Should this filling become dirty it can be cleaned with a damp cloth.

A condenser dial used for DX work must have the reading clear and distinct, and should it be dirty it may be treated as above. For critical tuning the indicators used by many amateurs are not at all suitable. (Ivoryine arrows, saw slots in screws, etc.) These should be discarded and a new register made by scratching a fine line on the panel with a scribe or strong needle and filling with wax.

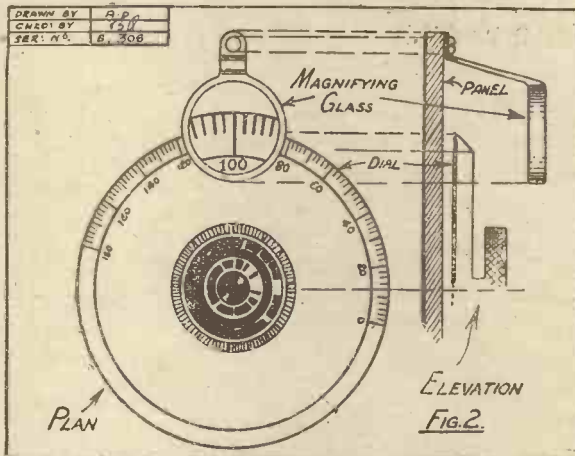
A template could be made in a few minutes to do this line and keep it straight (Fig. 1). The line should extend under the edge of the



marking niches and refilling with white sealing-wax.

This is prepared by breaking into small pieces a quantity of white sealing-wax, and having put the bits in a small bottle they should be covered with alcohol (methylated spirits). The wax quickly dissolves, and may be applied with a small artist's painting brush. When the filling has been allowed

dial, and when filled may be trimmed with a knife, as before. Close tuning can be made very simple by fixing a small magnifying glass over the register or pointer, as shown in Fig. 2. A suitable glass can be purchased for a few coppers. Care should be taken in soldering the arm (if necessary). Some are made with the glass sliding in a sheath, with this removed a small screw passed through the swivel hole can be used for fixing.



# MINUTE DEFECTS OF CONTACT.

(Continued from page 253.)

Other substances were the atoms of the elements remodelled, so to speak, in such a way as to produce compounds—i.e., iron-oxide, gold-chloride, silver nitrate, copper-sulphate, oxide of hydrogen (water), nitrate of soda, and so on. But the more recent theories conclude that the actual basis of all matter, whether the particles are elemental or compounds, is electrical, and composed of electrons and protons.

There is no need to go deeper into the very technical phases of this subject in order to understand sufficiently the purport of my words. Simply bear in mind that everything in the world—solids, liquids and gases—is made up of particles of electricity, known as electrons, which we may regard as particles of energy,

## The "Critical Force."

Now we will return to the topic under treatment. It is really surprising that a conductor can carry such infinitesimal quantities of current as it does—but there is the fact!

Electrons could not, however, obey Ohm's law if the minute E.M.F. did not yield a corresponding amount of current. In other words, a current, too insignificant for detection by ordinary means, can produce a tiny proportional result on the electrons, and so start the surgings which necessarily grow, so to express it, gradually until they become so voluminous as to be extremely clear, distinct, and accurate.

When an insulating medium has been broken down it serves then as a conductor. It is really ionized; or has its electrons duly liberated. It does not signify whether it consists of oxide, grease, or anything else which

is used to keep the current travelling along its desired course—it easily conducts.

What is known as a "critical force" is necessary to break them down. It is in this direction that the action of dust, perspiration from one's fingers, globules from vapour, etc., produces risk of destruction in small scattered areas. And, moreover, such effects cannot be prevented by any known methods: anything and everything which is exposed to the air is liable to this description of fault. Even the breath can be responsible for it; so that it will be at once apparent how significant it is from the point of view of "wireless" performance. If the interrupting surface is scraped off it speedily reappears, as is obvious, since no one can prevent dust from falling.

Metals may secure complete contact through the scraping action of loose fittings. But if such a junction should receive a shock, even of slight extent, such as a jolt or shake, it may be rebroken, and thus cause the familiar troubles, which consist of several indefinable noises, and odd behaviour of all kinds. The actual causes of these defects are generally so small that it is extremely difficult to trace them, and it is much better to endeavour to prevent them altogether.

For satisfactory tuning, all parts of an aerial must be well joined up; and in instances where sliding contacts are used the binding, or other form of holding, should be staid and capable of resisting chance shifting from any cause. It is for this reason that soldered contacts are safest and most suitable. Sliding contacts are unreliable.

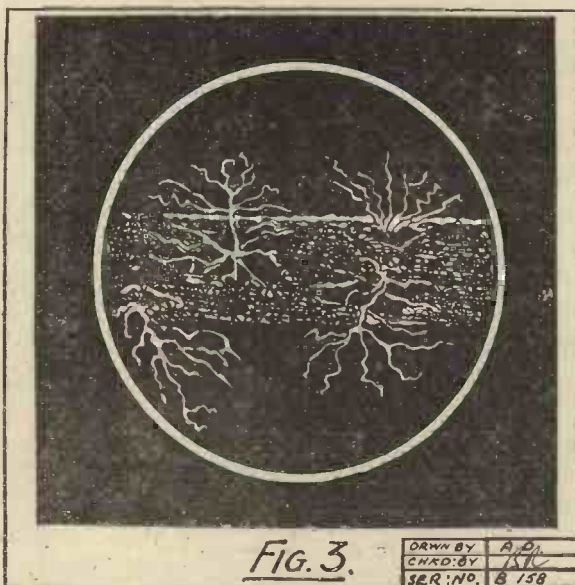
The illustrations may afford some enlightenment in these affairs, although they must be regarded as merely typical, because every case has its own individual items or troublesome formation, etc.

## Minute Details.

In Fig. 1 we see an intact wire, and all metal surfaces covered with oxide are similar in granular texture to this structure.

In Fig. 2 are several grains of dust, etc., recognisable through the microscope as emanating from fabrics, timber, stones, road grit, and so forth.

In Fig. 3 are shown several leakages of current, to which so many of the unfavourable incidents described are directly traceable, although they may not be observable to the naked eye.



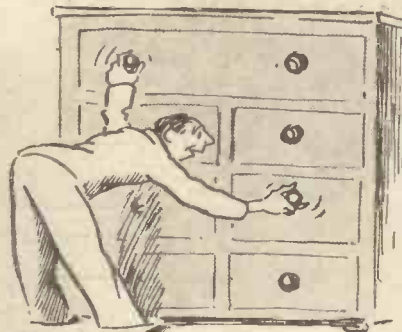
Leakage of current, though invisible to the naked eye, due to faulty insulation.

# THE REACTION!

WE FEEL SORRY FOR SYMPTON WHO IS ONE OF THOSE INOFFENSIVE CHAPS WHO IS SATISFIED WITH THE LOCAL STATION AND ALLOWS HIS SET TO "STAY PUT" FOR MONTHS ON END.



ENTER THE VILLAIN TIMSON THE ASS-CILLATOR WHOSE CHIEF JOY IN LIFE SEEMS TO BE



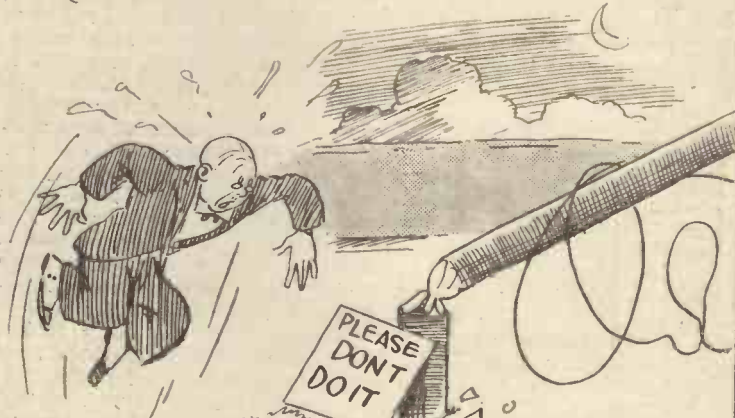
THE TWIDDLING OF KNOBS.



- HE INVITES HIMSELF TO DEMONSTRATE THE POSSIBILITIES OF A 2 VALVE SET -



- OTHER LISTENERS IN THE VICINITY "ENJOY" THE DEMONSTRATION AS MUCH (OR AS LITTLE) AS POOR OLD SYMPTON -



- BUT AS WE SAID AT THE BEGINNING - WE FEEL SORRY FOR HIM - BECAUSE HE HAS BEEN

THE VICTIM OF A GROSS MISARRIAGE OF JUSTICE!

*Ben Saw.*



# The "R.7" Crystal Set



An efficient set for reception of either the local station or 5 X X. Designed, Built and Described  
By R. BREWSTER.

THIS crystal set has been called the "R.7" because it gives nice loud signals. Although the "R" code is not used by broadcast listeners very much, it is a very useful one, for it immediately indicates a definite volume. "Good telephone strength," "fair loud speaker," etc., are all very well, but this haphazard method is not a very definite means of classifying

ubiquitous loading coil. The circuit is interesting, as the diagram on this page will show. Two closely coupled coils are used, and these are joined directly together at one end and by means of a .001 mfd. fixed condenser at the other. A very fair degree of selectivity results although the two coils do not form completely separate circuits.

### An Interesting Point.

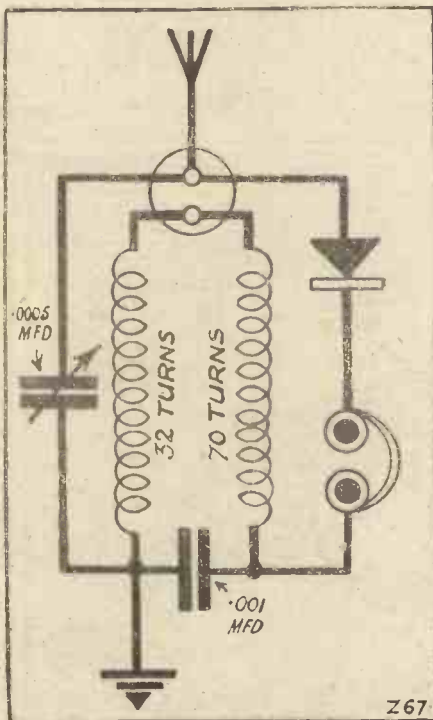
It is probable that it would be more correct to regard both the coils and the .001 mfd. fixed condenser as forming, as it were, one unit in the aerial circuit which has the .0005 mfd. variable condenser to tune it. Nevertheless the efficiency of the circuit appears to be relatively greater on the lower wave-length stations than on Daventry, although it brings in this station as well as most crystal receivers. The significance of this will be obvious, inasmuch as the use of a large loading coil such as is required

for Daventry would tend to make the other coils assume comparatively unimportant positions.

But there is one point well worth bringing forward, and that is that by varying the turns on the coils a little one way or another

### PARTS REQUIRED.

- 1 Ebonite panel, 8 in. by 8 in.
- 1 Case to fit.
- 1 .0005 mfd. variable condenser (any good make).
- 1 Panel mounting crystal detector.
- 1 Panel mounting single-way coil holder.
- 1 .001 mfd. fixed condenser.
- 4 Terminals.
- 1 Piece of Pirtoid tubing of dimensions detailed in text. (H. Clarke & Co.).
- Quantity of wire, etc. (See text.)

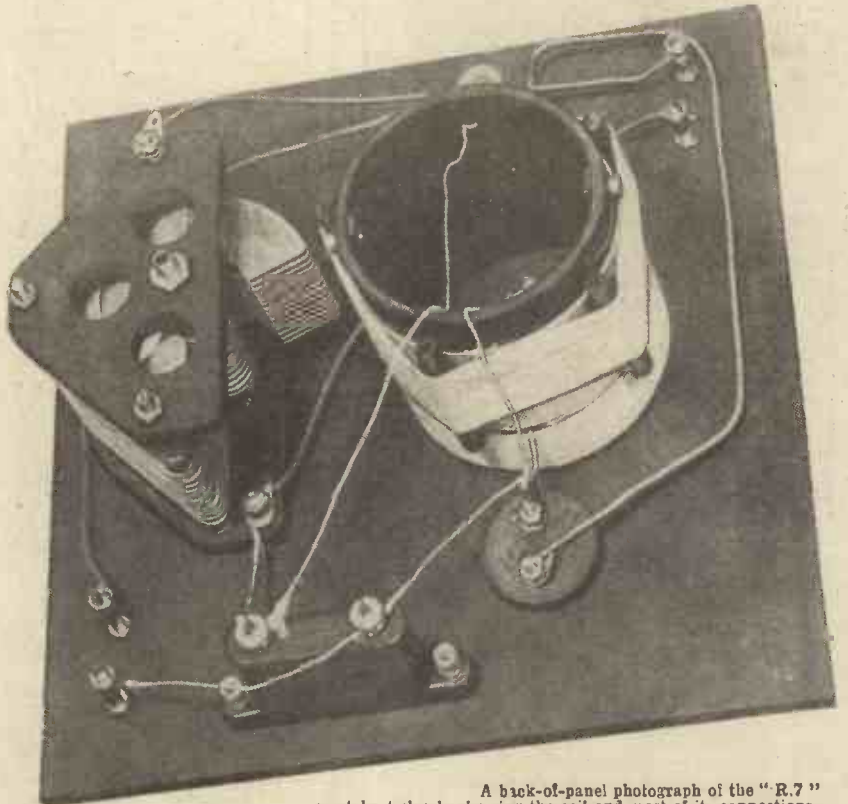


it is possible to increase the efficiency of the set by making it "balance" more accurately on individual aerial systems. The balancing refers more to the aerial or smaller coil, and means but two or three turns more or less. There will, however, be more to say about this when we get to the  
(Continued on next page.)

strength of reception. The "R" system at once suggests a graduation. It is used by all the service stations. The "R" merely stands for "Reception," while the numbers range from 1 up to 9. The latter number represents very loud signals indeed, while 1 would only be applied to signals that were practically inaudible on the most sensitive telephone receivers.

### Will! Bring in 5 X X.

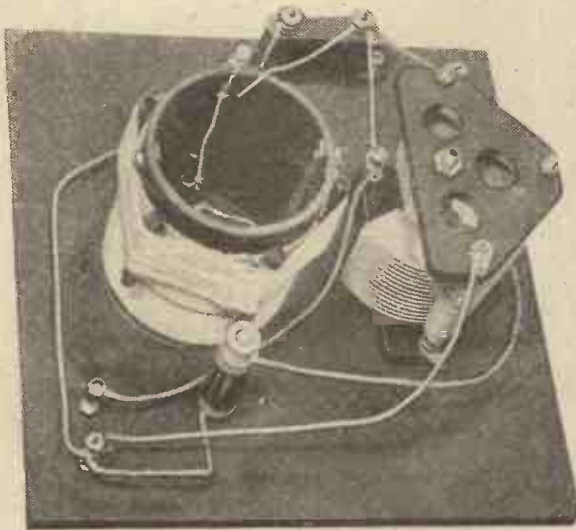
There is nothing particularly original about the "R.7" crystal set, and it is quite a simple sort of set to construct and to handle. It will, of course, tune up to Daventry with the assistance of the



A back-of-panel photograph of the "R.7" crystal set clearly showing the coil and most of its connections.

**THE  
"R.7" CRYSTAL SET.**  
*(Continued from previous page.)*

construction of the coil. Suffice it to say at this juncture that this "wangling" is by no means essential, and that good signals can be obtained on practically any fairly decent aerial with the set built exactly as described.



Note the five separators used to keep the coil windings apart.

Very little gear is required for this set. As it is the most important task, and perhaps the most tricky, it will be advisable to wind the coil first. For this about three ounces of 24 or 26 gauge wire will be required, although it will be safer to purchase a quarter of a pound. The insulation is not important, so that as cotton covered is the cheapest, this can be used. A former about 2½ in. in diameter and 3 or 40 in. in length must then be obtained. It should be of ebonite or "Pirtoid" for preference, although well waxed cardboard will do.

**Winding the Coil.**

About ¼ in. from one end two holes should be pierced and through this the wire threaded. Thirty-two turns should then be wound on and the last turn secured by threading the wire through two more small holes. Four or five inches should be left at each end for connecting purposes. Now we have a complete solenoid coil of thirty-two turns. The second coil should then be wound over these thirty-two turns, starting a little way from the beginning of these, so that they can be decreased if necessary. Five round pieces of hard dry wood can be used to separate the two windings, although it will not greatly affect results if the second coil is wound directly over the other.

For this second coil 70 complete turns should be wound, and when completed it will lap considerably over the first coil. The latter is referred to as the inside coil in the diagram. The coil unit completed, this can be laid aside and the task of drilling the panel commenced. This is quite straightforward, as the appropriate diagram shows. Any type of crystal detector can be used, so that should one be purchased which

requires more than one hole with which to mount it on the panel, then the measurement given for a crystal detector mounting hole should be ignored and others drilled accordingly.

The author has used both a "Gripheo" and an "R.I." detector in this set, and both gave excellent results. Mounting the coil unit is rather a tricky job, but there are several methods by which this can be carried out. Two small angle brackets can be fashioned and secured to the former by means of small nuts and screws. The unit can then be held to the panel by means of these brackets. Another way is to shape a piece of wood to fit into the former across its diameter. This can be fastened with screws. One or two screws can then be passed through the panel into this wood.

**The Terminals.**

The variable condenser need not be one of ultra efficiency. As a matter of fact an S.L.F. fine-tuning, low loss variable would be rather wasted in a crystal receiver. It is advantageous to have a square law condenser, and as long as its movement is fairly smooth and its construction robust, this is all that really matters. A .001 mfd. fixed condenser of any type of make can be employed. This also applies to the loading coil holder.

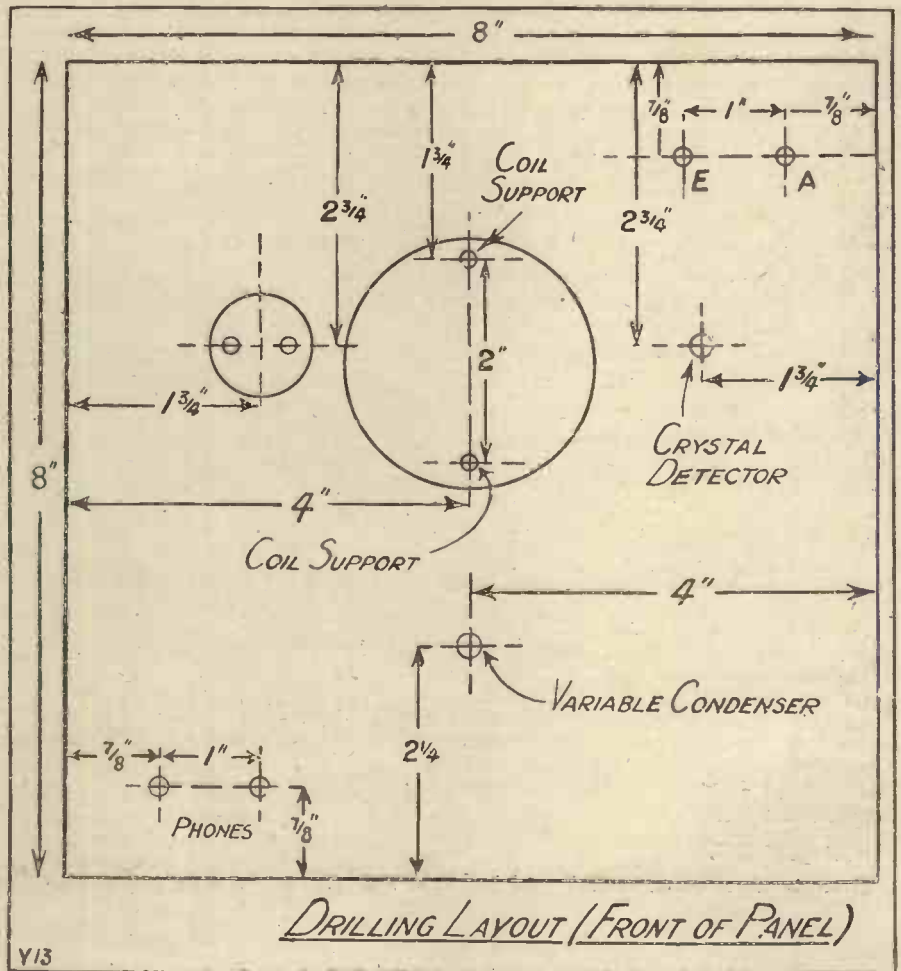
When all the components are mounted they can be wired up. But before we proceed with this I would like to draw constructors' attention to the disposition of the four terminals, which is nothing if not a novel one. It will be noticed that the 'phone terminals are placed to the left of the panel. The reason for this is so that the telephone cords do not foul the right hand when this member is performing the actions of tuning-in by adjusting the condenser and detector. By having the terminals to the left the hand does not pass over the cords at all, except in the case of left-handed persons who, after all, are in the minority.

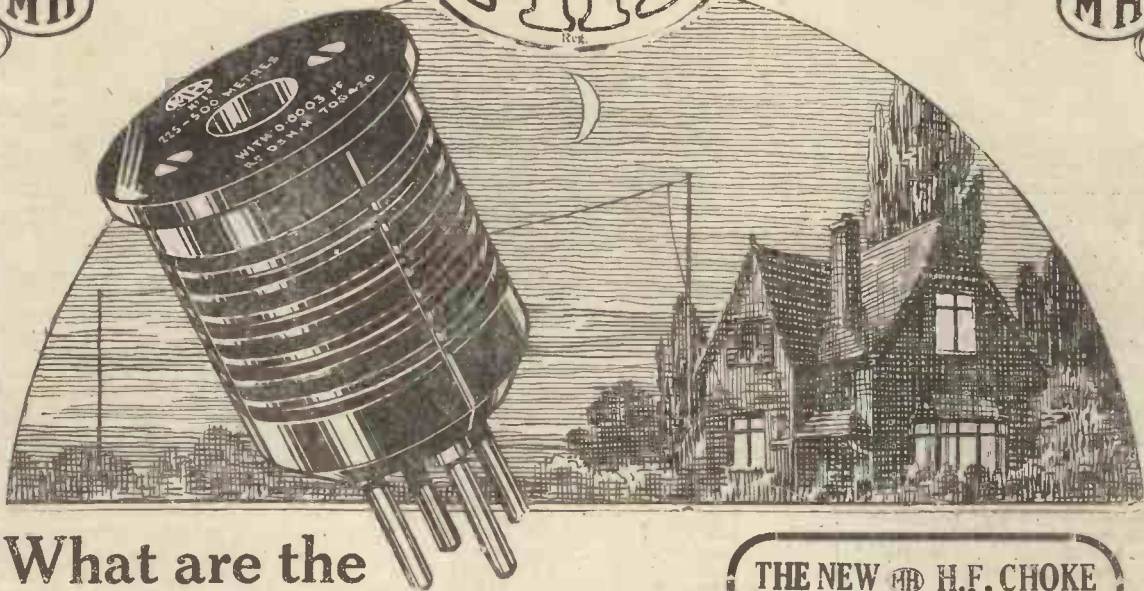
**The Wiring Connections.**

On my crystal sets I always place the earth terminal a trifle lower than the aerial terminal—just a fraction of an inch. I do this on valve sets too, when the aerial and earth terminals are in line as in the case of the crystal set under discussion. Even in my most distracted moments I never connect up the aerial and earth terminals round the wrong way, because subconsciously I always think of the earth as being lower! This practice may not appeal to all constructors as it is not a tidy one in point of the appearance of the set!

The wiring must be carried out carefully, as it is very easy to make a mistake when four connections to one coil unit have to be dealt with. I must confess that I did not do much soldering for I used Belling-Lee "sub-connectors." These are little fittings which screw on to the shanks of the

*(Continued on page 267.)*





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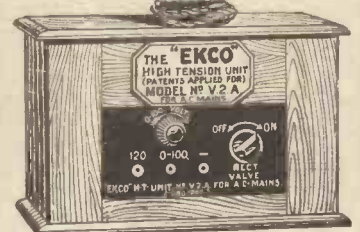
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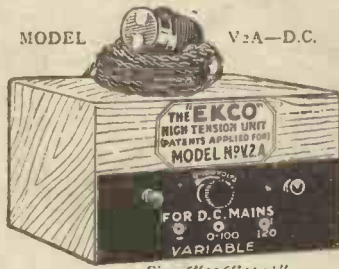
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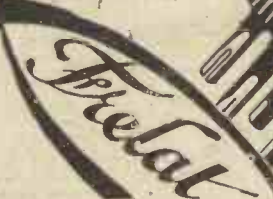
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## THE "R.7" CRYSTAL SET.

(Continued from page 264.)

terminals. They make very secure contacts and as they will take several leads at once, they are very handy when a set which includes a fair amount of wiring is being made.

The wiring concluded, the panel can be fitted to a cabinet which can be home made if the constructor desires, or purchased quite cheaply from any radio store. It is a standard size, so that little difficulty should be experienced in obtaining one.

### A "Building-up" Effect.

No trouble should be met with in tuning in the local station, although you should not forget to have a shorting plug in the loading coil holder when this is not in use. If the set is working properly the greatest volume should be obtained only over a degree or two of the condenser dial. A building-up effect will be noticed as this point is

### THE WIRING.

Connect aerial terminal to one side of loading-coil holder and to one side of crystal detector and to one side of variable condenser.

Connect earth terminal to remaining side of variable condenser, taking this lead on to one side of .001 mfd. fixed condenser and to top end of inside coil.

Connect remaining side of crystal detector to one 'phone terminal.

Connect other 'phone terminal to remaining side of .001 mfd. fixed condenser, taking this lead on to bottom end of outside coil.

Connect remaining side of loading-coil holder to bottom end of inside coil and to top end of outside coil.

reached. This will be quite different from an ordinary increase in strength. The tone of the signals seem to change from a weak, thin, tinny kind of note to the round, undistorted reproduction characteristic of a crystal set. I have not noticed this effect with any other crystal set, although it is frequently met with in valve sets.

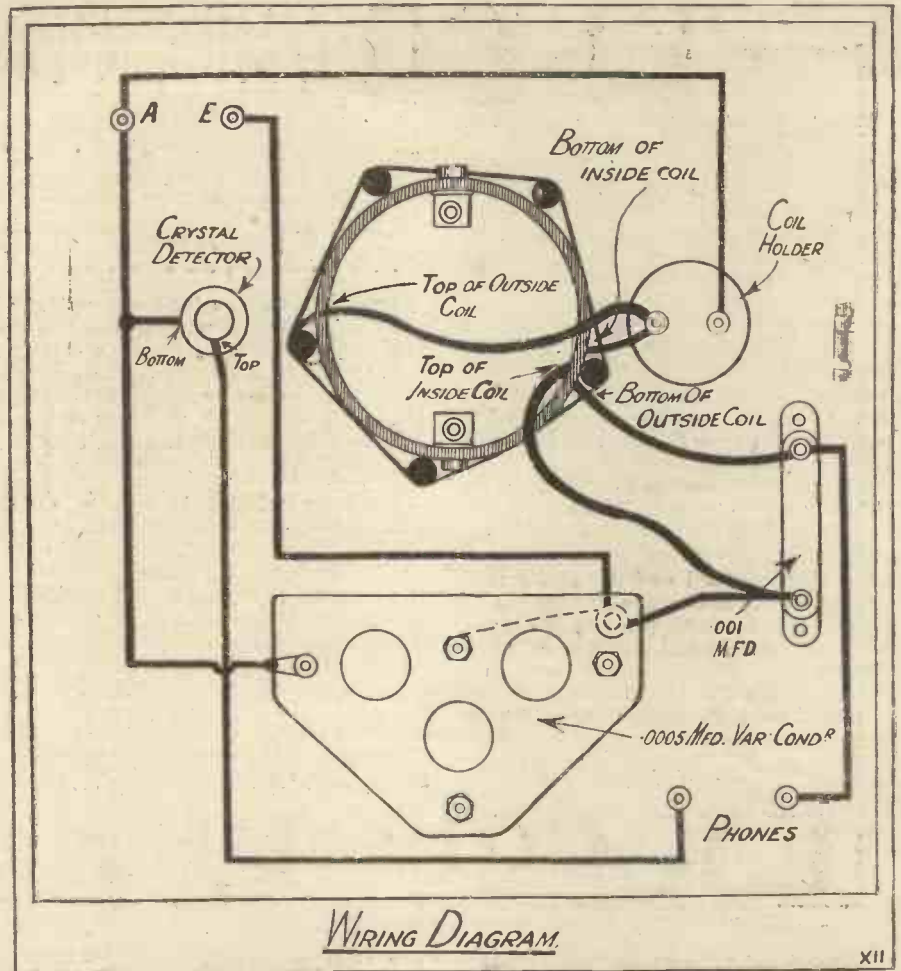
Now, as mentioned earlier in this article, it may happen that even better results than the set will in the ordinary way give may be obtained by varying the coil turns slightly to suit individual aerials. This adjustment will be quite a refinement, and in very many cases may not provide greater volume.

In any case only the outside coil need be varied, and at the most it will mean but four or five turns one way or the other.

For Daventry, a 150-turn coil must be plugged into the loading coil socket.

### Some Results Obtained.

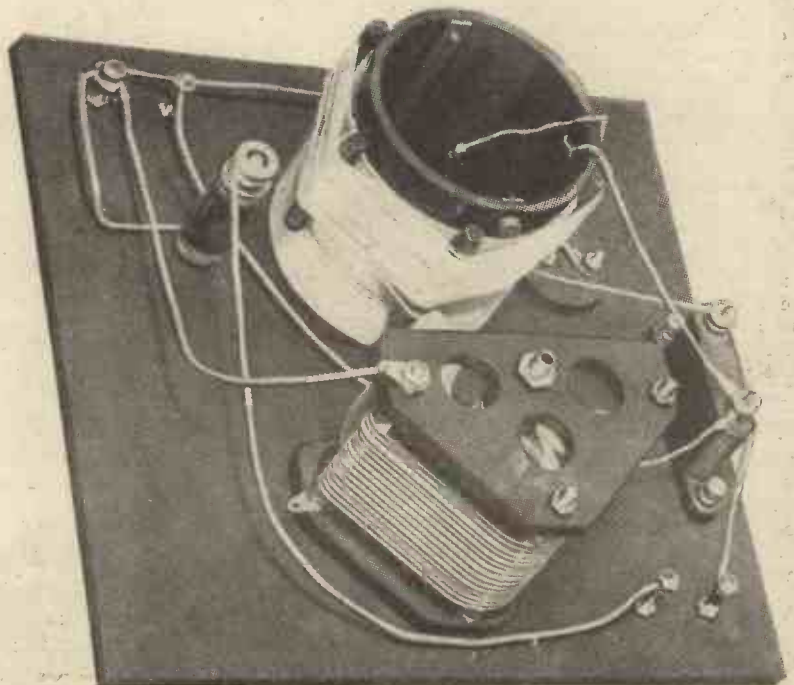
In conclusion I trust every "P.W." reader who builds this set will obtain as good results as is given by my set; results which are so good that I gave the name "R.7" to the receiver. My aerial and earth are good, and I am not very far away from a main station; but even so, the fact that my set will just operate a loud speaker



sufficiently well for it to be heard at the other side of the room when all is quiet does, I think, justify my claim!

Daventry I seldom receive well on any crystal set, but this station comes in fairly well on the "R.7" crystal receiver. Of course, in an instrument of this nature the

crystal detector is all important, and more really depends upon this component than anything else. The best crystal receiver in existence will give poor results if the detector is insensitive, while an efficient, carefully adjusted detector invariably means good results.



This photograph can be compared with the wiring diagram above.

It is always interesting when the writers of wireless semi-technical articles in the newspapers start to air their opinions as to the efficacy of home-made receivers. Many of them seek safety in the glib and sometimes parrot-like statement that "straight circuits are always the best."

We noticed recently in a Sunday paper that the wireless correspondent of that journal stated he had received a letter from a Manchester reader asking whether he did not think more harm was done to the cause of radio in general and pure reproduction in particular, by the continued outpourings of "stunt" circuits in the semi-technical press than by the pirate home constructor. This Manchester reader wanted to know "whether it is not possible, in the light of present knowledge, to lay down a specification for a standard receiver to work a loud speaker?"

The writer of the wireless notes comments on this, and he says he is quite sure his Manchester friend is voicing the opinion of very many who have been "lured" to depart from the simple and perfectly satisfactory straight circuit, than which nothing can be better [sic]. Since his personal opinion is asked, he says, he will say right out that the man who wants the best in the way of reproduction, either from his local station or a number of distant stations, will keep right away from any of the circuits with "fancy names." At the same time, he comes to the conclusion that in the majority of cases both time and money will be saved if a good commercial set is bought and no attempt made to build one at home!

#### A Few Facts.

Of course, the writer of the above sentiments is obviously out of touch with the amateur movement in this country, and would seem to have very little sympathy with the home constructor. Curiously enough, he seems to forget that quite a number of the more popular commercial sets on the market to-day have circuits basically founded on circuits which first saw the light of day in the wireless periodicals of this country; and, furthermore, a very large number of the more popular sets on the market are far from being "straight" circuit receivers.

Inasmuch as we publish from time to time in POPULAR WIRELESS, "The Wireless Constructor," and "Modern Wireless," details about a large number of sets which have what we suppose our friend the critic in the Sunday paper would call "fancy names," we feel it necessary to bring a few facts to his notice. Names are given to wireless sets these days because it is much better than giving them purely technical labels.

Just as the valve manufacturers would popularise certain types of valves more efficiently if they would adopt a more simplified system of nomenclature.

#### The "Black Prince"—and Others.

By the naming of wireless receivers, the amateur constructor is enabled to differentiate between their merits with greater ease and to remember the various points in their favour, etc., more easily than if the sets were described simply as "An H.F., Det. and 2 L.F. receiver," etc.

The writer in the Sunday paper we have referred to goes on to give his views with regard to a standard circuit which he thinks one of the very best. He thinks

## CURRENT TOPICS.

By THE EDITOR.

Circuits with Fancy Names—An "Ideal" Set—The Experimenter's Point of View.

the circuit should be for the operation of a loud speaker. Four valves should be used. One efficient stage of neutralised H.F. amplification transformer coupled to a high magnification anode bend detector; this to be followed by two stages of resistance capacity note magnification coupling.

#### A Standard Set?

The valves should be of the 6-volt class, the output valve being capable of handling a grid swing of at least 20 volts. That is to say, the grid bias on the last valve should be about 20 volts negative. The output of the L.F. stage through a choke capacity filter circuit, and the main voltage on the last valve, should be 120, the power supply being derived from the H.T. accumulator or from a good "mains unit" capable of delivering at least 20 milliamperes of current. No switching arrangements to cut out any valves should

receivers because they have names and because they are frequently dealt with in the technical press is not only misleading but silly, and, in any case, to lay down a standard specification for a valve set would have little or no appeal to the vast majority of people who are interested in the technique of wireless.

However, for the man who, similar to the Manchester reader we have mentioned, lacks obviously the elementary knowledge to operate a receiver, the only alternative is undoubtedly to buy a straightforward commercial set.

#### Delights of Circuit-Changes.

He probably finds many of the sets to which are given "fancy names" "delusions and snares" because he lacks the knowledge wherewith to operate them correctly. He is not really an amateur, but a listener, and, as a listener, he should not criticise things which he knows nothing about.

He is quite right when he says that these sets are good for trade, but he is quite wrong when he says people buy a large quantity of components which they quickly discard. That is just what the real amateur does not do. He obtains a varied collection of components, but because he builds one set and scraps it the next week, he does not necessarily scrap all his components. He uses them time after time in various



The studio of one of Germany's largest broadcasting stations, in Potsdamerstrasse, Berlin.

be tolerated. There should be a good volume control which can be had by dimming the filament of the last valve. In the anode circuit of the last valve a milli-ampere metre should be provided. Not more than two tuning dials are necessary. Used with the correct valves, such a receiver will give astonishingly good results."

This advice is curiously at variance with his other remarks. Undoubtedly his suggestions above are excellent, and nobody will quarrel with them.

The only point we criticise is that we think the grid bias of 20 volts rather excessive. Thirteen and a half to fourteen should be ample. The receiver outlined above is very similar, by the way, to "The Black Prince," fully described in the April issue of "Modern Wireless" by Mr. Percy W. Harris.

But dogmatic assertions condemning

circuits and so continues to enjoy an almost unlimited variety in the way of circuit experiments.

The same applies to the man who is "lured to depart from the simple and perfectly satisfactory straight circuit."

There are many types of "straight" circuits which, in the hands of the inexperienced amateur, very easily cause interference due to oscillation. It is possible, however, that the writer in the Sunday paper is a little confused in his own mind as to what is meant by a "straight" circuit, and he certainly betrays a lack of knowledge of the many types of receivers on the market which owe their design to circuits which first appeared in the technical and semi-technical press, and also a lack of knowledge regarding the sets described in the wireless papers and the popularity of the hobby of home construction.

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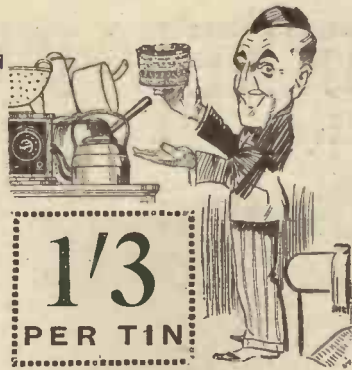
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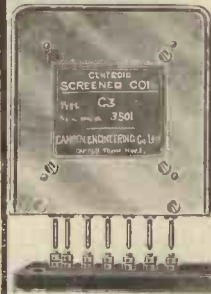
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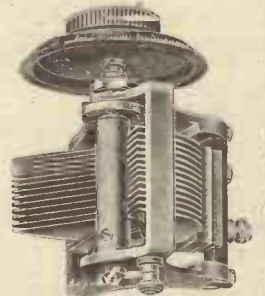
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Edited by PERCY W. HARRIS, M.I.R.E.

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**Visible Wave-length Indicator.**

REFERRING to the matter of the quartz-crystal wave-length control which I mentioned recently, an interesting development of this system arises from the discovery that if a quartz crystal be suitably mounted between two wire electrodes within a glass bulb, containing a mixture of helium and neon at a low pressure, it will glow when connected to a circuit which is oscillating at or near its fundamental frequency. The glow is very much more pronounced when the applied electrical oscillations are of the same frequency as the natural frequency of oscillation of the crystal.

This glow is presumed to be due to some discharge effect which is influenced by the actual mechanical vibrations of the crystal.

An application of this discovery which has already been made, is to provide a visible indication of the variation of a wave-length of a transmitter. A set of three of these quartz crystals, mounted up within their exhausted bulb, is provided and the crystals differ slightly in natural frequency. The centre crystal is arranged to have a natural frequency equal to that of the transmitting station whose output is to be observed and controlled. If the set of quartz oscillators is kept under observation in a darkened room or at night-time, it will be found that the centre crystal glows most brightly when the transmitter is working on its proper wave-length, whilst if the transmitter goes a little off its wave-length, one or other of the outer crystals will begin to glow more brightly, the glow of the centre crystal diminishing. The effect may be compared—although it is not optically similar—to the shining of a beam of light upon the centre crystal, this beam shifting to the right or to the left according as the wave-length goes up or down. I have not actually seen this system in operation, but I am told, after a very little practice in observing it, it is possible for the operator to know immediately what the transmitter wave-length is "doing." If this is so, it is evidently a very neat and useful appliance.

**Aerial Corrosion.**

Many beginners in wireless are often puzzled as to whether they should use bare or insulated wire for their aerial. One frequently sees advice given to amateurs on this point, sometimes in favour of the bare wire, sometimes in favour of the insulated wire, and no doubt the confusion in the mind of the reader arises from the fact that the explanation for the advice is usually an incomplete one.

It is true that insulated—more particularly enamelled—wire has certain advantages, and it is true also that bare wire may in some cases be fairly satisfactory. The insulated wire has the advantage that the insulation, particularly if rubber or enamel, acts as a protective covering for the wire and prevents, or, at any rate, retards, the corrosion which comes from exposure to the "elements." It is sometimes thought that the insulation prevents the access of the electro-magnetic or wireless waves, just as it would prevent electric current from entering the wire if it were placed in contact with an electrified conductor. There is, however, a fundamental difference between the method of electric current production in the aerial by the incidence of electro-magnetic waves and the method of pro-

**TECHNICAL NOTES.**  
A Weekly Feature  
Conducted by  
**Dr. J. H. T. ROBERTS, F.Inst.P.**  
(Staff Consultant.)

duction of the electric current which would be produced in it by connecting, for example, to a battery.

**Shaking-Up Electrons.**

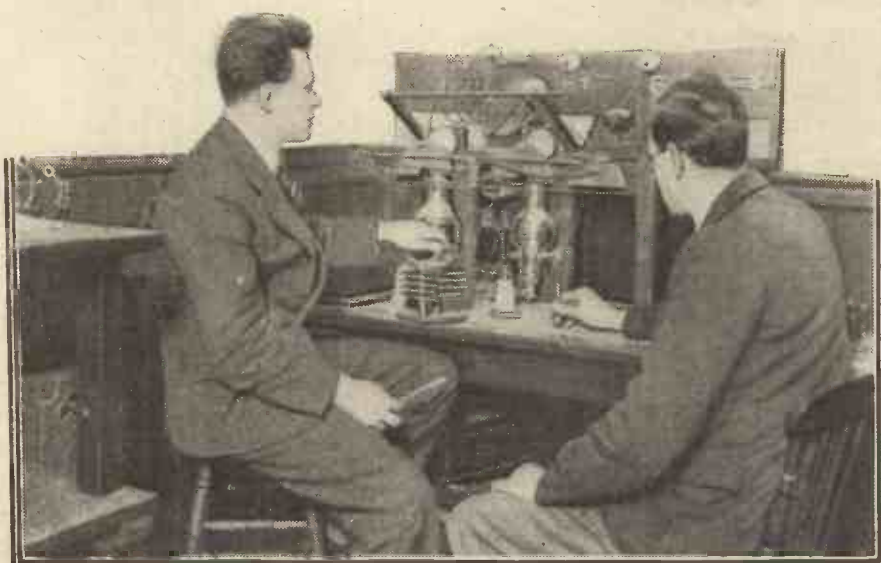
In the first place the electro-magnetic waves do not introduce any electrons into the aerial at all, and therefore the insulating covering of the aerial does not interfere. The electro-magnetic waves merely have the effect of "shaking up" the electrons which are already in the wire, and the waves are able to pass perfectly well through the insulator.

If bare wire be used, this after a time becomes corroded at its surface and a layer

their enthusiasm for the later achievement, have made in some cases rather unjust comparisons between the wireless telephony service and the longer-established cable service, and in one case it was stated by a contributor (I understand, a contributor to this journal) that "it takes some hours before a reply to a cable you send to America can reach you."

Messrs. The Western Union Telegraph Company, who own and operate the largest telegraph and cable system in the world, have asked me to point out, through the medium of "Technical Notes," that replies to messages sent from Great Britain to America are regularly received over their lines in the ordinary course of business in from two to five minutes, a statement which may be corroborated by the many business houses who make extensive use of this service. They go on to say, "Whilst we do not suggest that such an exchange of telegrams can entirely take the place of a conversation on the telephone, we think you will agree that the experience of our clients is quite different from that indicated by the quotation referred to."

I had not seen the statement mentioned by the Western Union Telegraph Company, nor do I know by whom it was made or in



Students at the Marconi College, Chelmsford, undergoing a special training course to enable them to become operators on the new air liners.

of semi-conducting material is formed. It is sometimes stated that, owing to the fact that the high-frequency currents tend to travel more in the surface of the wire than throughout the body of it, this corroded surface acts as a high resistance. It should be remembered, however, that it is still "open" to the electricity to travel in the surface of the wire beneath the corrosion and to treat the corroded covering as though it were an insulator. This does not quite accurately represent the true state of affairs, but it is sufficiently near the truth for purposes of general explanation. I think from this you will see that the corroded wire is equivalent to a wire of less diameter than the original.

**Cable v. Phone.**

In view of the developments of transatlantic wireless telephony some writers and correspondents of different papers, in

what connection, but I am very pleased to take the opportunity of giving the facts of the case as put forward above.

**Permalloy.**

At the same time the Western Union send me a full technical description explaining the improved methods which have enabled such a rapid exchange of telegrams to be possible. Apparently much has been accomplished by the use of "permalloy" cables, one of which was laid between New York and the Azores in 1924, and the second between New York and Penzance in 1926. The latter cable is capable of transmitting 2,500 letters per minute—a capacity equivalent to that of no less than four of the older type of cables. It was designed jointly by the engineers of the Western Electric Company, the Western Union Telegraph Company, and the Telegraph (Continued on page 284.)

Mr. SCOTT-TAGGART'S Further Comments on Dynamic Curves.

The Editor, POPULAR WIRELESS.

Sir.—My attention has been drawn to your issue of February 12th in which appears a further letter from Mr. Royds, of Reigate, and an article by Capt. H. J. Round. The editorial heading "Are Dynamic Curves Misleading?" is good journalism, but rather suggests the answer "Yes," whereas, from my personal knowledge of him, Capt. Round is certainly not like the old lady from the country who on being shown, at the Zoo, the unbelievable sight of a giraffe, exclaimed: "There's no such animal." I have no comments whatever to make on Capt. Round's article. Although he is in a rival camp, there is nothing controversial in his remarks. He has, however, obtained, or been given, the impression that my article on "What Dynamic Curves Mean" was a battle-cry for a change-over from static to dynamic curves, and he says there is no case for such a change. I agree entirely. There is not a single word in my article suggesting the change. For the fourth time and I hope the last, I wish to say that my article was one explaining why a given static curve, if taken as representing what happened in practice, was "utterly fallacious." This is no reflection on an innocent useful static curve, pathetic as it is when away from its "family." It is the person who does not understand about dynamic curves, who makes the "utterly fallacious," "unreliable," "useless" deductions.

"In Good Company."

Capt. Round says: "The expert will be able to prophesy" what the dynamic curve will be like. Mr. Royds says: "Anyone pretending to any knowledge of dynamic curves" can imagine the dynamic curve from the static group. My article, however, was not meant for experts, prophets, and pretenders.

Mr. Royds' letter is in a very different class altogether. He continues to stress the elliptical nature of dynamic curves with such a ruthless determination to show my article was "inaccurate," that I almost wonder what his object is in writing. I am in good company, however, for Capt. Round, as I will show, made similar "inaccurate" statements. First of all, I should like to say that dynamic curves can be dead straight lines, curved lines, long thin ellipses to all intents and purposes straight lines, ellipses of varying sizes, lines of other shape. If I did not mention ellipses it must have been for one of the following reasons.

(a) I did not know what I was talking about and was ignorant of dynamic ellipses.  
(b) If I had heard of such ellipses, their omission was a definite inaccuracy and perfectly unjustifiable.  
(c) The consideration of elliptical dynamic curves would have very greatly complicated and confused a simple explanation which was being given for the first time and was written for those with no knowledge of the subject.

Regarding (a), elliptical curves were, I believe, given in Major Stanley's book on Valves published in 1919, and which I was commissioned to review for the leading electrical journal in this country. I also published in "Modern Wireless" (March, 1925) an article by Capt. Round on "Choke and Transformer Amplifiers," which, while not an article explaining dynamic curves, gave a very able and detailed account of how and when elliptical dynamic curves are obtained.

Mr. Royds would have shown himself more generous if he had given me credit for a desire to present what he himself calls "a difficult subject" in as simple a manner as possible in the case of a first article written for those with no knowledge of the subject. Although my article was of considerable length, the only point capable of any criticism was the association of the straight curve with the loud-speaker example. As, in a wireless receiver, the dynamic curves of many of the valves in operation are often straight, I felt and still feel perfectly justified, under the circumstances, in regarding the loud-speaker case as if it were not elliptical.

"Inaccurate Simplicity."

As a matter of fact, Mr. Royds' cheap sneer about "inaccurate simplicity" could equally have been levelled at Capt. Round, who in an article published in "Wireless Weekly," of October 29th, 1924, treats a choke coupled amplifier in the same way as one using resistance coupling, making his 100,000 ohm impedance choke give a dead straight line dynamic curve (see his Fig. 10). I do not recollect Mr. Royds writing to me as editor to complain of Capt. Round's "simple inaccuracy," or "inaccurate simplicity." As a matter of fact, history is repeating itself. Capt. Round's simplification of 1924 (in a distinctly technical article) was justified, and so is mine. Six months later ("Modern Wireless," March, 1925) Capt. Round explained: "In that article (the one in which he gave a straight line curve for a choke) to prevent complicating it, I slurred over the calculation of the choke amplifier. I drew a line for a choke and actually, in that case, it was roughly correct, but the full solution is so interesting that I am now going to give it."  
"In a resistance R, if we impress a voltage  $V$  across it, and  $V$  is a sine wave form, we can write:

$$V = V_0 \sin 2\pi nt \quad (1)$$

and the current by Ohm's law is

$$I = \frac{V_0}{R} \sin 2\pi nt \quad (2)$$

## 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.

the current is in phase with the voltage ( $\nu$  is the frequency).

In a choke coil  $L$ —

$$i f V = V_0 \sin 2\pi nt \quad (3)$$

the current is:

$$I = \frac{V_0}{2\pi nL} \sin \left( 2\pi nt - \frac{\pi}{2} \right) \quad (4)$$

it is lagging  $90^\circ$  behind the voltage.

"If we plot out 1 and 2 we shall obtain our straight line, but if we plot out 3 and 4 we shall get in nearly all cases an ellipse."

A further paragraph from Capt. Round's article reads:

"Remember  $V$ , is arbitrary after we have settled the shape of our ellipse.  $V_0$  settles the size of it. Increasing  $L$  or  $n$  makes the ellipse shallower until with  $L$  or  $n$  extremely large the choke acts like an infinite resistance as far as the alternating current is concerned. If  $n$  or  $L$  are small the ellipse extends vertically. If at any place the ellipse runs into the curve,  $V_0 = 0$ ; or into the axis,  $I = 0$ , then we get distortion."



Adjusting one of the loud speakers used on the latest and largest motor liner, the s.s. "Alcantara."

Further on Capt. Round deals with cases where resonance and partial resonance in connection with a choke will produce a straight line or an ellipse so thin as to be virtually a straight line.

Capt. Round's 1925 article is a distinctly "heavy" one technically, and the moment I introduced ellipses I should have had to introduce similar matter, no doubt to the confusion of many readers. I therefore did what Capt. Round did in his first article.

From Mr. Royds' first letter many readers may have got the impression that dynamic curves are elliptical instead of straight as I showed one of them. It will do no harm, therefore, to say that while a reactive apparatus (e.g., a choke) may produce an ellipse, yet a straight line dynamic curve is obtainable:

- (1) In tuned H.F. amplifier circuits.
- (2) In untuned H.F. amplifier circuits.
- (3) Where an ellipse is so thin and long that it is to all intents and purposes a straight line.
- (4) Where a choke of certain characteristics is in the anode circuit of a valve.
- (5) In resistance coupled L.F. amplifiers.

The curve of Fig. 3 of my article was taken with a 20,000 ohm resistance in the anode circuit, and is an actual laboratory measured dynamic curve. As I indicated 20,000 ohms impedance, different other curves could be produced if further details of different output circuits were given. Mr. Royds' ellipse apparently is one of these, but since the reactive and resistance components of the impedance were not given, they must have been assumed by him. I chose a resistance of 20,000 ohms because the curve is then independent of changes in frequency. Mr. Royds says that "with every note uttered a different dynamic curve is obtainable." This does not apply where, for example, the anode circuit contains a plain resistance. Moreover, since I was discussing a "line" dynamic curve, I explained that a dead straight line was required if distortion was to be avoided.

Mr. Royds' curious assumption that he shares with Heaven an exclusive monopoly of interpretation of parts of my article is in keeping with the tone of his criticism. The dynamic curve I gave was not below the static curve but crossed it in the usual way.

It would have been below if the anode (not H.T.) voltages had not been made to correspond under static conditions of non-reception of signals.

Mr. Royds flatters himself in heavy type that "we have now agreed that ordinary static curves are both reliable and useful."

I am very patient, but I am getting a trifle tired of pointing out that nothing I wrote suggested anything else, and to read my article again would do everyone who has read this correspondence a lot of good.

This correspondence has reached an unprofitable stage. My only regret is that I have learnt nothing from Mr. Royds or others about dynamic curves which has not been published in my own former journals, and I have certainly learnt nothing new about writing a simple explanatory wireless article.

Yours faithfully,  
JOHN SCOTT-TAGGART.

### ANOTHER FILADYNE SUCCESS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Although in the midst of constructing an elaborate long-distance 5-valve I was so attracted by the description of the "Spider" and its principle, that I immediately made one up and took the description literally by knocking it up in the rough.

Without paying any attention to the selection of the correct transformer ratio for the L.F. stage, I tried it out on telephones.

So far, I have recorded 35 stations on headphones (about 8 of these would be loud-speaker strength) which are beautifully clear and others which are faint and inferior I have excluded from my list.

Of these 35 I have so far only definitely identified 15, as the remainder, although excellent in volume and quality, rarely gave their call sign, but having plotted a curve of my log I have a good idea who most of them are.

The above results have fostered considerably my interest in the principle, and I shall as time permits experiment on some of Mr. English's refinements of the "Filadyne."

For an enjoyable trip round Europe with the greatest of ease in tuning I can thoroughly recommend the "Spider," which is the most fascinating receiver I have yet constructed, having built several—amongst them being multi-stage H.F. amplifiers.

I am now converting the above "knock-up" into a respectable lay-out from which I hope even more fun will be obtained.

Looking forward to "more about the Filadyne" and wishing "P.W." continued success.

Yours faithfully,  
T. L. ANTHONY.  
5, Queen's Gate,  
Southsea.

### PERFECT REPRODUCTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—Some of your correspondents seem to be very set against the L.F. transformer. I admit that it is capable of destroying the quality of music and speech if it is badly designed. Some of the things I have had said about my receiver seem to point to the fact that some transformers must give almost perfect reproduction. The transformer that I used at the time was an Igranite (ratio 5:1).

Resistance capacity-coupling falls short, in my opinion, because the impedance of the anode resistance varies as the frequency varies. This is most noticeable with cheap wire-wound resistances, which are inductive to a considerable extent.

I have noticed that some transformers make the piano sound tinny and not at all natural.

Wishing POPULAR WIRELESS every success in the future.

Yours faithfully,  
HASTINGS F. MIDDLETON.  
Eton College,  
Windsor.

### AN L.F. TRANSFORMER'S PERFORMANCE.

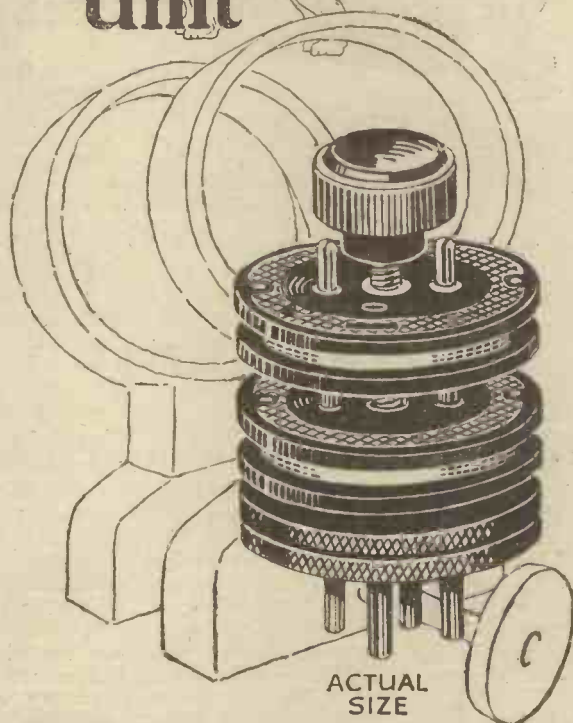
The Editor, POPULAR WIRELESS.

Dear Sir,—I am somewhat diffident about joining in the correspondence now running in your paper on the subject of Transformer v. R.C. coupling, as I have had no experience of the latter. My object in writing is in order to set up a definitive standard obtainable with transformer coupling; perhaps the advocates of R.C. coupling would then tell us how their reception compares with the following:

I have identified every note on the piano from the highest to the lowest—i.e., frequencies from about 30 to over 4,000. In addition I have received organ notes considerably lower than this, but as I cannot play this instrument, I cannot put a name or frequency to the notes. So far for range; now for what one might term sensitivity to the finest shades. When the B.B.C. put on "records," I can always hear the needle being placed on the record, the grinding of it during the duration of the piece, and finally the needle being lifted off at the end with a characteristic little scrape. The other day a piano solo was being played, and the piano was quite obviously one which I call "the world's-worst" (those who are concert-goers will know which I mean). The tone was quite unmistakable; I subsequently verified my impression. Every instrument in a band or orchestra preserves its individuality and can be identified, including the various drums; one can distinctly differentiate between the up-strokes and down-strokes of a violin bow.

(Continued on page 282.)

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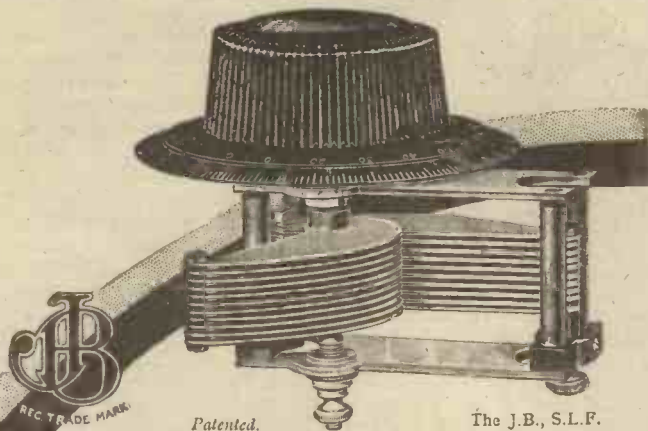
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# Apparatus Tested

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.

### MESSRS. J. HYATT & CO., LTD.

IN a recent report we printed the name of the above firm as J. Wyatt & Co., Ltd. Readers should note that the makers of the cheap wireless cabinets with which the report dealt, are Messrs. J. Hyatt & Co., Ltd., Ento Works, De Beauvoir Road, London, N.1.

### THE "MICROFIX" VERNIER DIAL.

This is the latest production of Messrs. Harlie Bros., of 36, Wilton Road, Dalston, London, E.8. The unique feature of this component, which can be fitted to practically any variable, is that there is practically no metal in its construction. The movement is quite an original one, too, and allows a very smooth and fine adjustment to be made. The gearing is 1-120, a ratio that should satisfy the keenest DX enthusiast. The normal "rough" tuning can, of course, be carried out in addition to the vernier

adjustment. The dial measures 4 in. in diameter over all, while the fine tuning is accomplished on a large control knob, which carries separate indication markings. The whole thing is very well designed and constructed, and is cheap at 5s. 9d.

### B.T.H. HOME CONSTRUCTORS' BOOK.

The British Thomson-Houston Co., Ltd., has issued an interesting book describing the construction of a number of most interesting receivers. Full details are given and the text is accompanied by diagrams and photographs. In two of the sets a novel form of reaction control is introduced. This is accomplished by means of a variable coupling resistance which operates in conjunction with a capacity feedback. The various receivers are styled "Resistors." Thus we have the "Resistor 2," the "Resistor 3," and so on.

We must admit that "Resistor 5"

excites our curiosity. Here we have a five-valve receiver employing a special reaction stage, three stages of resistance coupled L.F. amplification and reaction! Now Messrs. B.T.H. hint that the degree of amplification per stage will be equal to that obtainable with transformers, and this we do not doubt if the B.8's advised be used for these valves have "mu's" of 50. But a B.8 has a limited grid swing and it would seem impossible to us that the B.4 in the fifth stage would have its work cut, for although the B.4 is a jolly good power-valve it is not a super-power-valve.

However, it is dangerous to be too dogmatic about anything radio; during the next week or so we will run up the "Resistor 5" if we have an hour or two to spare and give it a practical test. Anyway, the B.T.H. book is very well produced and should prove of interest to all constructors.

### A USEFUL BOOK.

Messrs. Rudge-Whitworth, Ltd., recently sent us a copy of "The Rudge Book of the Road," which formed the subject of a full-page advertisement in this journal a week or two ago. With a substantial artificial leather cover having a snap fastener, it contains 31 pages of excellent maps and many items of value and interest to the road tourist. It is well worth the 2s. 6d., at which it is marked, but it can be obtained free of charge on application to authenticated Rudge dealers.

(Continued on page 276.)



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BRIGHTON: Carter's Stores, Western Rd.  
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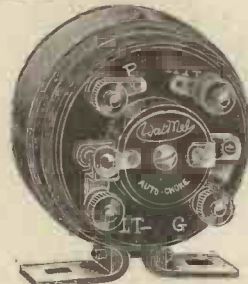
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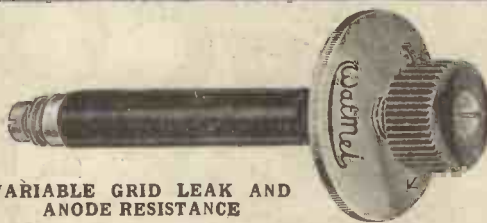


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**APPARATUS TESTED.**

(Continued from page 274.)

**K.L.I. VALVES.**

The Marconiphone Co., Ltd., has issued a booklet giving information of value to those desirous of converting existing sets for use with the new K.L.I. valves. The price of this booklet is 6d.

**A FERRANTI BOOKLET.**

The manufacturers of that efficient and popular L.F. transformer, the Ferranti, have published a booklet entitled "The Way To True Radio Reproduction." It costs 1/- and can be obtained through Messrs. W. H. Smith and Son's bookstalls, wireless dealers, or direct from Messrs. Ferranti.

**A NEW AMPLION LOUD SPEAKER.**

Messrs. Graham Amplion, Ltd., recently sent us one of their new A.R.65.0 loud speakers to test. It is an improved and enlarged version of their popular "Junior-de-Luxe," which was withdrawn some time ago. In general design it follows closely on the lines of the modern Amplion "Dragon" types and has a Jacobean oak flare identical in construction and appearance to the famous A.R.19. The heavy, curved sound conduit has the familiar chocolate crystalline finish and the base is of oxidised copper.

Altogether it is a very handsome instrument and, in our opinion, its appearance is distinctly more attractive than many of the

hornless speakers that are on the market. Its performance is good, too. Amplion speakers always are good—the brand is as dependable as anything in radio can be. Some Amplions are naturally better than others, but we have yet to meet one that would fail to satisfy the average amateur. An Amplion can be tacked on to any average sort of set with the assurance that whatever the quality of input, it will make the best possible job of the reproduction within the

limits of its capabilities. The new A.R.65.0, for instance, cannot handle the very low notes like a cone type speaker, but it can reproduce the high notes most faithfully. And in the majority of transmissions the higher notes are the most important. The average man will lose drums with equanimity, but if violin solos sound thin or strident he will hunger for the comfortable mellowness of an Amplion. We feel quite safe in recommending this new Amplion loud speaker to all but the hypercritical—these we would advise to try the effect of pairing an Amplion with a cone in a suitably balanced circuit; they would then have those "very low notes" together with a most pleasing reproduction of the rest of the scale. The price of the A.R.65.0 is £3 18s. 6d., at which figure it represents excellent value for money.



Large Amplion loud speakers used at the Highbury football ground in connection with the community singing movement.

**LAMPLUGH MICRO STATION SELECTOR.**

Messrs. S. A. Lamplugh, Ltd., of King's Road, Tyseley, Birmingham, have sent us a sample of their new and improved Micro Station Selector. This fine-tuning variable condenser dial was formerly known as the Cleartron, although we are given to understand that it is a Lamplugh patent, and has been manufactured by the patentees since its inception and that hereafter it will be marketed solely as a Lamplugh product.

It is a very excellent dial both in appearance and in operation. The gear ratio of approximately 13 to 1 is a convenient one and the movement is perfectly smooth. A knife edged pointer and a very clearly defined scale make it possible to obtain precise readings.

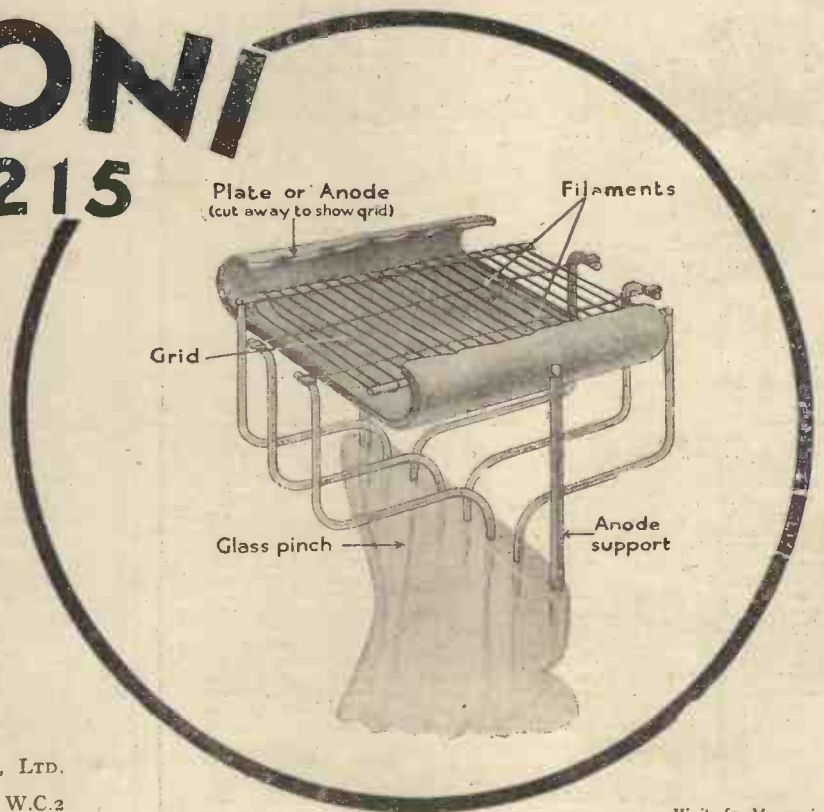
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# RADIOTORIAL

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

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

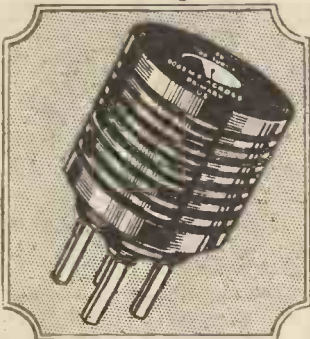
As much of the information given in the columns of this paper concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees 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

### TRANSFORMER OR RESISTANCE.

R. T. (Andover, Hants).—"I am going to build a 3-valve set for use in a country village, miles away from anywhere, and I want to  
(Continued on next page.)"



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NELSON STREET WORKS, MORNINGTON CRESCENT, N.W.1



## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

keep the battery requirements as low as possible. I understand that transformer sets take less H.T. volts than resistance-capacity sets, but that purity is not half so good. Do you think that, in the circumstances, I should do better to risk the distortion and build a transformer set, or ought I to use the resistance method?"

You have been mis-informed regarding the comparative results, for it is quite wrong to suppose that transformer-coupling is "not half so good." As a matter of fact, a well-designed transformer-coupled set gives practically perfect reproduction, and only an expert ear can detect imperfections in the results obtainable. In the circumstances outlined we should certainly choose the transformer-coupled method on account of the lower voltage necessary with the type of coupling.

### WHY VALVES BURN OUT.

C. J. (Burnham, Bucks.).—"Will you kindly tell me through 'P.W.' how valves can be destroyed by H.T. voltage? I have had three

## THE TECHNICAL QUERY DEPARTMENT

### Is Your Set "Going Good"?

Perhaps some mysterious noise has appeared and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

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

Full details, including a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," Fleetway House, Farringdon Street, London, E.C.4.

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

burnt out, and this is what the makers tell me has happened."

It is the filament of your valves that has been destroyed by the H.T. voltage. This filament is a fine wire which when heated by the application of 2, 4, or 6 volts (as the case may be) from the L.T. battery, emits the electrons upon which the action of the valve depends. With one class of valve (the "2-volt" class) the filaments get sufficiently hot for this to occur when only 2 volts are applied across the filament-pins of the valve; others require 4 volts or so and others about 6 volts, but no ordinary filament will stand more than its correct 2, 4, or 6 volts. If a greater pressure is applied the valve "burns out."

In addition to the necessary 2, 4, or 6 volts applied to the filament, each valve requires a certain high voltage applied to its plate. This is supplied by the H.T. battery, but on no account must this H.T. voltage be permitted to reach the filament connections. If one of the H.T. wires touches a filament lead even for a moment the filament gets white hot and burns out.

Great care, therefore, is necessary in wiring the set, so that H.T. and L.T. wires are kept apart. And on no account must the valve itself be inserted carelessly into its valve holder, for it is very easy to touch one of its filament legs upon an H.T. wire or socket, and sometimes the merest touch is sufficient to destroy the filament.

If you have been rather careless in plugging-in or taking out the valves, or in joining up the battery leads, this will explain your burn-out.

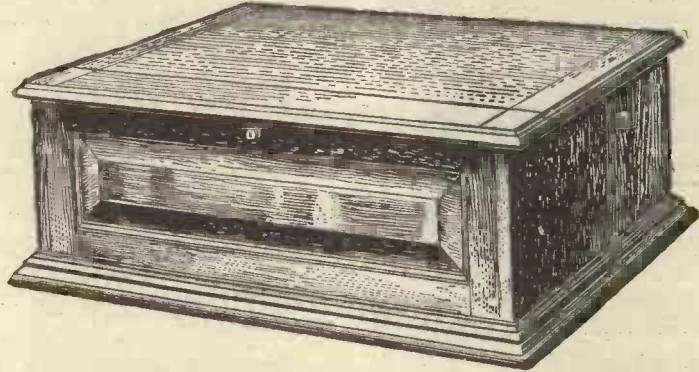
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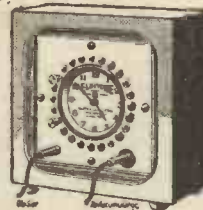
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**RADIOTORIAL QUESTIONS AND ANSWERS**

(Continued from previous page.)

If, however, the valve burns out when left alone in its valve holder, you have a fault in the sets' insulation—probably two wires touching that should be separated—and this is the cause of the trouble.

**BROADCASTING FROM NEXT DOOR.**

P. S. E. (Richmond, Surrey).—"Last week, during an interval in the programme, I heard voices, and then somebody said 'Well, good-night, Jack!' Thinking I recognised the voice, I went round to my neighbour's and found that I was picking up conversations from his house through our crystal sets!

"Both of us use simple crystal sets, and although it won't always do it, we can often hear words quite plainly. If the set is altered in any way the talk disappears, so there is no doubt that it is coming through the sets. Our aerials run close together, but even so I can't understand how we can hear when neither of us uses any battery or valve. How is it done?"

Such freak transmission and reception has often occurred before, and it is probably due to re-radiation. When your aerial is accurately tuned to 2 L O, it is energised by the carrier wave from that station; and this energy not only oscillates backwards and forwards in your aerial, but some of it is actually re-radiated—i.e. sent out again.

The same applies to your neighbour's aerial, and if they are quite close to each other there will be a certain interaction and linkage between them.

If you speak close up against your telephones the diaphragms of these will vibrate in sympathy with the sound waves, and these vibrations will affect not only the 'phones, but the whole circuit of which these form only a part.

The exact actions and reactions are somewhat complicated, but the effect is to alter the value of the re-radiated energy from the aerial in accordance with the sound-waves striking the telephone diaphragm. In other words, the telephones act like a microphone and the "transmission" is "modulated."

As your neighbour's aerial is receiving some of this modulated transmission, and as he has a sensitive crystal and 'phones in circuit, he can hear this in just the same way that he hears, with the same apparatus, the modulated transmission from 2 L O.

**"P.W." ULTRA CRYSTAL SET.**

J. S. A. (Northampton).—"How many turns were there on the coil for the original 'P.W.' Ultra Crystal Set?"

The original coil was wound upon a 4-inch former, 4 inches long, and had a total number of 60 turns, the aerial and earth leads being connected to the 20th turn and 40th turn tapings.

**A BUILT-UP HOWL.**

P. E. S. (Becontree, Essex).—"A very curious fault has recently been spoiling our reception, and if you can tell me what it is I shall be very glad, because nothing I do seems to stop it. The set is a two-valve (Det. and L.F.), and the H.T. comes from the mains. To get good loud-speaker results I have to use about 100 volts H.T., and employing 2-volt valves the loud-speaker results are then very good indeed, but for the fact that sooner or later the set begins to hum to itself. At first this noise is quite a modest one, but it slowly gets louder and louder until the programme is nowhere in it! To describe the din it causes is rather difficult, but it always begins very slyly, and slowly builds itself up into a roar.

"The first valve is for resistance-capacity coupling (high-amplification factor), and the second valve a power valve. Actually I am not using resistance coupling, but I employ a transformer, the makers of which inform me that the valves I am working are quite O.K. for use with their transformer.

"What is the cause of this steadily increasing howl? When I turn the set off it stops, but sooner or later during the evening it starts off again, and some evenings I have to

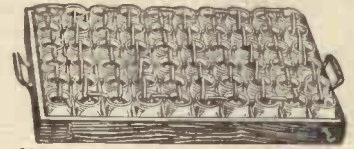
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**NEW FACTS REGARDING STANDARD WET H.T. BATTERIES (LECLANCHE TYPE)**

**Result of Recent Tests**

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Jars	Price-Per doz.	Rubber bands for insulating 12 No. 1
Sacs No. 1	- - 1/3	Sacs - - 6d. box
Sacs No. 1 (with terminals) - - 2/3	- - 1/6	Ditto, No. 2 Sacs
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Send 1/4d. stamp for new illustrated list giving full details, price of batteries for various voltages, maintenance hints, and useful information.

Special Note—The NEW ZINC is designed so that Standard wander plugs can be inserted in every cell.

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No.	25	35	50	75	100	125
Price.	1/8	1/8	1/8	1/8	2/-	2/3
No.	150	175	200	250	300	
Price	2/6	2/8	3/-	3/3	3/6	

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**VALVE REPAIRS**  
 as good 5/- Postage Power 7/- as new 3d. extra Valves 7/-  
 For 5/- your burnt-out or broken valves will be repaired by our established process. Satisfaction guaranteed or money refunded. When sending valves, state fil. volts and amps. required.  
**MARCONI, COSSOR, EDISWAN, MULLARD, B.T.H.**  
 We have in stock for sale, repaired and GUARANTEED Valves of the above, also other makes, at 5/- each, plus postage 6d.  
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**LUMOCRAFTS, Ltd.,**  
 64a, Mill Hill Road, Acton, W.3

## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

switch off seven or eight times, or close down altogether."

The trouble in your case is almost certainly due to the situation of the loud speaker. Probably you will be able to cure it by placing the loud speaker right away from the set, in another corner of the room; or if it at present stands on or quite near to the set, try moving it as far as the lead will allow, and turn the horn away from the set.

This latter is most important, because the usual reason for a howl such as this is a "singing round the ring" effect, in which the trouble arises in the first place from the sound waves issuing from the loud speaker.

When this is directed straight at the set, or when the set stands on the same table as the loud speaker, any powerful note broadcast is liable to impart a slight vibration to the valves. This is purely a mechanical vibration, but as the filaments are probably "sprung" they shake slightly, and this shaking sets up more sound-waves of the same frequency, which then makes them shake still more! There is, in fact, a sort of "reaction" effect, though the build up in this case is not electrical; but is merely due to the loud speaker's sound-waves shaking the filament, causing this to vibrate and set up more corresponding sound-waves, which accentuate the trouble. It should vanish altogether when you find a more suitable position for the loud speaker.

### WHICH CRYSTAL DETECTOR?

"CAT'S-MOUSTACHE" (Bolton).—"Is the permanent or the adjustable-permanent class of crystal detector just as good as the old-fashioned cats'-whisker type?"

We are not quite clear as to exactly what you mean by "just as good." When they were originally introduced, the semi-permanent or permanent crystals had the reputation of being not quite so sensitive as the type of crystal on which finding the best spot depended upon the skill and patience of the person operating the set.

Whether this reputation was ever justified or no, it has certainly been getting less and less until now most owners of "permanent" crystals claim them to be quite as sensitive as any of the "cats'-whisker" type. This is stoutly denied by the "cats'-whisker" adherents, so the only satisfactory solution to the question is to assume that it is either a matter of opinion, or else that in some cases one type is better, and in other cases the reverse is true.

Probably much of the diversity of opinion is caused by the different conditions under which sets are used—different aerials, earths, distances from the local station, etc.—so that no definite rule can be laid down, and each individual case must be tested on its own merits.

### COMPONENTS FOR A GOOD THREE-VALVER.

"MAC" (St. Helen's, Lanes).—"What components are required to make a good, easily tuned three-valve set, consisting of one high-frequency amplifier, detector, and one low-frequency amplifier, and where can I get a description of a set of this kind? I should like to make it myself, as I made up a one-valver from 'P.W.' a year ago and it's still going fine, but I want to reach out a bit more now."

You evidently missed the description of the "H.D.L. Three," which appeared in "P.W." No. 248 (March 5th, 1927). This is just the kind of set you require, and with the aid of the photographs and diagrams given you should have no difficulty in construction.

The following components are necessary:  
Panel 21 by 7 by 4 in., and baseboard to suit cabinet; 1 retroactive tuner; 1 retroactive anode unit; 1 L.F. transformer; 1 .0005 variable condenser; 1 .0003 variable condenser; 2 S.P.D.T. push-pull switches; 2 .0002 fixed condensers; 1 2-megohm leak; 3 30-ohm rheostats; 3 valve holders; 1 3-terminal strip; 1 7-terminal strip; 2 grid-bias battery clips; 2 dial indicators; wire, screws, etc.

### READERS' ADDRESSES.

Will the following readers, who have sent in queries with insufficient addresses, please communicate again with the Query Department?

S. C. Stevens, S. D. Ashworth, F. Bayliss, J. Garside (Halifax), C. V. Preece, P. Flexen, S. Bryant, M. C. Ward, — Coldwell, H. C. Elliott, H. B. Dowell, C. Richards, T. R. Parry, J. S. Laker, M. J. Caton, A. E. Hart, A. Moore, G. D. Aldbury, H. M. Girling, and A. C. Smith.

ALL OTHER MAKER'S PLATES ARE MADE OF ANTIMONY AND LEAD

Are Electrically Seriously Inefficient. For the Indisputable Facts stated below

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Pure Lead Grid

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Pure Lead is the **ONLY** Metal that **PERFECTLY, RELIABLY AND EFFICIENTLY** Stores Electricity by Chemical Conversion

The basic principles upon which all Batteries work.

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The only use for Plates made of Lead and Antimony is to hold the Paste in position with the aid of Wood Separators and convey the current. Therefore all other Batteries (only exception Tungstone) are excessively weighted with a bulk of useless metal.

All the World's makers (except Tungstone) of present-day Car and Wireless High and Low Tension Portable Batteries make the Plate Grids entirely of an alloy of Lead and Antimony (Electrically an inert metal) which cannot store electricity Electro-chemically converted—hence the expense of constantly Re-charging and permanently adding to maintenance costs and giving a shortened life.

**TUNGSTONE** in addition to the practical working advantages derived from the use of **Pure Lead** offers many other exclusive features of exceptional commercial value.

Patented and Trade Mark Registered in the Chief Countries of the World.

**TUNGSTONE** High Tension 60 Volt Battery 3 a.h. is sold in the United Kingdom on monthly payments over extended period. Apply for particulars. Further interesting information on points of this advertisement are to be found on pages 58, 59, and 67 to 73 of the Illustrated Booklet "Photography tells the Story" which will be sent free on application to—

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**AMPLIFIERS: 1-VALVE, 19/-; 2-VALVE, 30/-**  
2-Valve All-Station Set, £4. Approval willingly. Wet H.T. Batteries—Jars, Zincs and Sacs complete, 3/6 per doz. (18 volts). Post 9d. extra. Sample 6d. 3 doz. upwards post free, in divided cartons.  
Bargain List Free.  
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ABSOLUTELY (Patent No. 265463) PERMANENT.  
I enclose P.O. value 1/-; please send me an N.M.C. Detector complete for easy panel mounting, with five years' guarantee. (See p. 1493 "P.W." No. 246)

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ADDRESS .....  
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Inches	Inches
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12 x 10.3/-	12 x 9.2/10
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16 x 8.3/2	3/4 in. thick
16 x 9.3/6	Post Free.

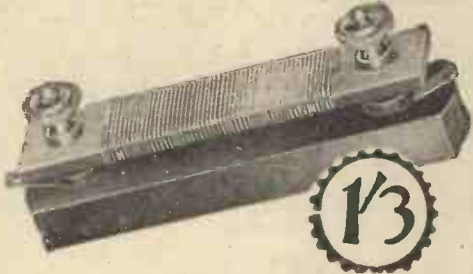
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1/3

## Efficient, Neat and Cheap

YOU CAN SEE from the illustration what a neat job this "Peerless" Fixed Resistor is. The Base is solid insulation and the former a strong impregnated material that atmospheric conditions will not affect. The wire is wound evenly and firmly and terminals and soldering tags are fitted. One hole fixing. A very thoroughly assembled and finely finished unit in all.

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From all good dealers or direct.

**BEDFORD ELECTRICAL & RADIO CO. LTD.**  
22 CAMPBELL RD. BEDFORD

## CORRESPONDENCE.

(Continued from page 272.)

My receiver is an All-British Six built by myself. I use three stages of H.F. (S.T. 61), 70 volts on the anode; detector (S.T. 61), anode potential, 90 volts; and one stage of L.F., Ferranti transformer, S.T. 63, anode potential, 128 volts; grid bias, 22½ volts; plate current, 61 milliamps, the latter practically steady, but very loud notes give it a kick up to 8 milliamps. G.E.Co. cone and C.A.V. cabinet loud speaker in parallel.

Yours faithfully,  
J. PUSINELLI.

The Little House,  
Horning, Norfolk.

### TRANSFORMER v. RESISTANCE COUPLING.

The Editor, POPULAR WIRELESS.  
Dear Sir,—With reference to the remarks in the latter portion of the letter by "Maltese Cross," in your issue for the 12th inst., I think that your correspondent is quite wrong, and I am under the impression that the published curve of the A.F.3 transformer represents within 5 per cent. the performance of any transformers of that type under normal working conditions—that is to say, with a plate current between 2 and 3 milliamps—in fact, they guarantee it.

Doubtless the makers will have something to say about the matter themselves, but it seems to me on the face of it that a firm of the standing of Ferranti, Ltd., in the engineering world, would hardly be likely to be guilty of the misrepresentation suggested.

Regarding N.P.L. curves, the writer is under the impression, but he is, of course, open to correction, that the N.P.L. is not in a position to take tests of audio-frequency about 4,000 or below 250 cycles, and that they do not guarantee the accuracy within quite large limits at the 250 period and 4,000 period points, so that to refer all matters to that body for settlement would seem to be quite misguided, although the limitations of that particular institution in this respect probably account for the fact that very few transformers or other amplification curves extend over a larger range of frequencies.

Yours faithfully,  
J. BAGGS.  
47, Northfield Road,  
New Moston, Manchester.

### EDITORIAL NOTE.

We publish Mr. Baggs' letter as it will undoubtedly be of interest to many of our readers who have gained a wrong impression from a recent letter from "Maltese Cross." We should like to point out that in our opinion "Maltese Cross" did not suggest that the firm of Ferranti, Ltd., had in any way been guilty of misrepresentation in their advertisements. The reputation of this firm is too high to permit of such an absurd suggestion. "Maltese Cross," however, did give his own opinion, based on the results he had obtained. It is, of course, also a matter of opinion as to whether or not "Maltese Cross's" results were accurate.

### FROM MR. G. M. PART.

The Editor, POPULAR WIRELESS.  
Dear Sir,—Gangway! Just a little space, please, as no fewer than three of your other correspondents have got on my tail in the great transformer controversy, now a highly diverting one, with "Maltese so very cross" again.

Mr. Wilson first—I have only replaced my transformer and the resistance-coupled stage—to quote a current advert—"makes the old set sing." The improvement is truly wonderful, and I have no regrets. I think the necessity for high anode potential is one of those popular superstitions which die hard, but as—following Captain Round's footsteps—I prefer to use anything up to 160 volts in any case, this consideration has hardly influenced me one way or the other.

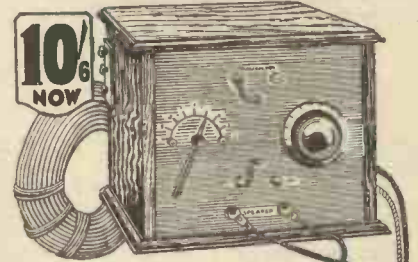
Mr. Baggs—I never suggested that the science museum set was a commercial proposition; it obviously isn't, but it seems to me somewhat significant that in producing a demonstration set the B.B.C. engineers, who do know their job, even if some of us have doubts about the programme compilers, used resistance coupling and an out-size in chokes and not transformers. In ordinary "commercial" sizes the choke method has, as Mr. Baggs implies, little advantage over transformers.

This gentleman assures us that the A.F.3 has no appreciable "cut off" as low as 50 cycles; "Maltese (very) Cross" assures us that under working conditions its curve is very different from what Mr. Baggs thinks it is; Mr. Bonavia Hunt on theoretical grounds deduces that no transformer made avoids a "nasty" cut-off below 200 cycles. I can't help thinking he is pretty right, and that if there is a snag anywhere it is in the transformer, though undoubtedly the A.F.3 under certain working conditions is a very fine instrument. Even resistance-capacity coupling is far from perfect, and just at present I am experimenting with battery-coupling which gets over the frequency variation of the coupling condensers in the former method. None of these methods are likely to be really "popular" in the way the transformer is. The latter has four terminals marked in Latin figures, gives no trouble, wants no adjustment, and works

(Continued on next page.)

# GRAVES

## 2-VALVE LOUD SPEAKER BARGAIN.



**10/6 NOW**

This highly efficient 2-Valve Loud-Speaker set is the finest wireless value ever offered.

It gives a volume and quality of tone unattained by any instrument of a similar price and is the essence of simplicity. Fitted with coils covering all the British wave-lengths, including Daventry

**THE CABINET** is of beautifully polished Oak, & all components are of the highest quality. Dull Emitter Valves with patent valve holders, &c.; H.T. Battery, 2-volt accumulator and complete Aerial Outlet. **LOUD SPEAKER** of exclusive design with unique magnetic system and improved mica diaphragm. Price **£7:17:6**

**TERMS:** Our Bargain Price is for deferred payments. Send 10/6 now, & complete purchase in 14 monthly payments of 10/6. If you wish to pay cash, 5 per cent discount is allowed. Catalogue Post Free. Up-to-date Crystal & Valve sets at keeneest prices. J. G. Graves Ltd. Sheffield

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SYN ZINCITE · TELLURIUM · SYN GALENA · OSC ZINCITE-MOUNTED CRYSTALS FOR DETECTORS · IRON PYRITES. IF ITS CRYSTALS - QUALITY PRICE IS RIGHT · N HEYWOOD 27 TRADE ENQUIRIES IS RIGHT · MOOR MEAD ROAD TWICKENHAM.

### WET H.T. POROUS POTS

Genuine miniature porous pots for Wet H.T. to fit 2 1/4 x 1 1/4 jar registering 1-4 volts: 3/- per doz. Non-conductive Glass jars, 1/4 doz. Waxed 1/3 per doz. Sacs, 1/8 doz. Zincs, 1/- doz. Send 1/4d. stamp for Price List and Instructions. Carriage and Packing extra.

Trade Inquiries:

THE ETON GLASS BATTERY CO., (Dept. P), 46, St. Mary's Road, E.10.

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Transformers, Phones, Loudspeakers, Rewound and Repaired to Maximum Efficiency. All One Price 4/- each. Don't discard if burnt out. All work guaranteed for 12 months. Write for trade terms. **TRANSFORM CO., 115, LINKS RD., TOOTING, LONDON, S.W. 17.**

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(RADIO COMPONENTS DEPT.)

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WHEN replying to advertisements please mention "Popular Wireless" to ensure prompt attention. THANKS!

### NON-CORROSIVE "HARTEL" WET H.T. BATTERIES

Super-Capacity Leclanché Type. As tested and recommended by Popular Wireless of January 22nd.

Ensure Low Upkeep and Perfect Reception. 30 Volts Battery in Case ... 13/0

60 " " " (4 tappings) ... 25/-

100 " " " (8 tappings) ... 42/-

Carriage 1/6, 2/-, 3/- respectively.

Jars, 2/-; Sacs, 2/-; Complete Cells, less Jars, 3/6 doz., with perm. separations. Send 3d. Stamp for Sample Cell. Manufactured solely by Yorkshire Ignition Co. Ltd., 1 & 4, Broomhall St., Sheffield

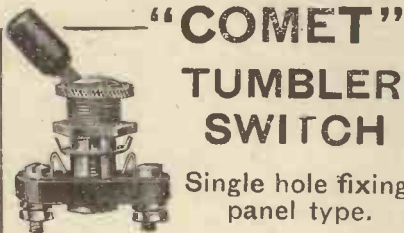


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4, Ludgate Circus, London, E.C.4

(Phone: City 7261.)

and NOT to the Editorial  
or Publishing Offices.

## TECHNICAL NOTES.

(Continued from page 271.)

Construction and Maintenance Company. "Permalloy" is an alloy with an extremely high magnetic permeability: the alloy consists of about 78 per cent. nickel and 22 per cent. iron. Its magnetic permeability at very low magnetising forces is 20 times as great as that of the best soft iron wire, which was the best loading material for cables previously obtainable.

### Valve "Disease."

Sir Oliver Lodge, who can always be relied upon to bring freshness and imagination to the consideration of a problem, made a very interesting suggestion at a recent meeting of the Royal Society of Arts in connection with the destruction of the filament of a wireless valve. It is known that if any oxygen be present in the valve (and oxygen may, of course, be present in the form of water-vapour which, in the immediate vicinity of the filament, may be decomposed into oxygen and hydrogen), the oxygen may act as a catalytic agent or a "carrier." It may enter into combination with the metal of the filament, producing a volatile oxide which subsequently decomposes, depositing the metal and releasing the oxygen: the oxygen is thus free to repeat its destructive attacks upon the filament. In this way a very small quantity of oxygen may, in course of time, bring about the removal from the filament of an amount of metal enormously greater than that which would be required to enter into combination with the oxygen present to form any known oxide of the metal.

Sir Oliver suggests that cancer, as it affects human beings and certain animals, may not be a microscopic growth, nor even a pathological growth, but may possibly be due to some "catalytic" action taking place in a way having a greater or lesser resemblance to that mentioned in the case of a valve filament. This is a very interesting suggestion.

### Filament Disintegration.

Perhaps I may be forgiven for mentioning that the discovery of the catalytic or "carrier" effect with oxygen and a heated metal filament in a partial vacuum was first made by the present writer, and is published in a paper entitled "The Disintegration of Metals at High Temperatures" in the Philosophical Magazine for February, 1913.

It is there shown that a very small trace of oxygen will continue to eat away the metal of the filament indefinitely.

I found that the oxide or oxides (for usually a mixture of different oxides is produced) are endothermic (that is, absorbing heat at their formation, the heat, of course, being provided by the hot filament). This endothermic compound, moreover, is volatile and, like most endothermic compounds, unstable when the temperature is lowered. The result is that when the oxygen is endothermically combined with the metal, the resulting compound, being volatile, escapes in a gaseous condition and, passing away from the hot region of the filament, its temperature falls and it dissociates, depositing the metal (usually in the form of a film) upon the glass bulb and releasing the oxygen, which is again available to take further part in the same type of action.

## The FUTURE of The Varley Bi-duplex winding

The success of the famous Varley Bi-duplex winding has been so marked that, in response to a general demand on the part of the public, we are adding new Bi-duplex wire-wound components to our existing range.

Just as in the electrical world proper, the Varley Bi-duplex winding has built up a reputation for real reliability, so in the radio industry to-day the name Varley stands for the really efficient wire-wound product. This is only the beginning of big developments of our wireless activities—activities which will mark a real advance in modern science and result in a vast improvement in existing radio reception.

Descriptive Leaflets with full particulars of Varley Bi-duplex wire-wound Anode Resistances—up to 500,000 ohms—Tapped Resistances and H.F. Chokes on application



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CABINETS

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Made on mass production lines, hence the low price. Provision is made to take panel, from 16 by 7 up to 30 by 18 in.

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## Right, First Turn

**T**HERE is no quicker or easier way of finding any station between 200 and 4,000 metres than with the R.I. Retroactive Tuner. Right, first turn, is the rule with this time-and-money saving instrument.

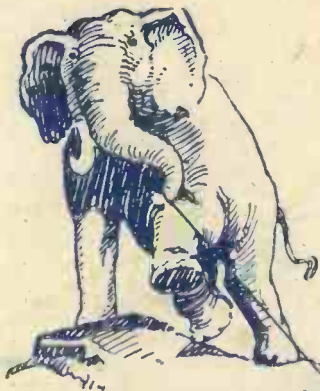
All bother with coils is eliminated and a greater efficiency is gained, for the R.I. Retroactive Tuner secures the correct aerial reaction over the whole range of wave-lengths covered. In addition this tuner costs appreciably less than a set of coils with coil holder to cover the same range.

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huge in proportions and gigantic in emission surface . . . tough and always ductile so that it may be tied in knots . . . proved by National Physical Laboratory Test to be constant and lasting . . . gives majestic volume free from microphonic noise . . . too economical even to glow . . . a wonderful filament . . . British made . . . secured by demanding Mullard P.M. Valves

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